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AUTHOR	Hample, Stephen R.
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ABSTRACT

Two allocation methods for studying costs per student credit hour at Montana State University are compared. Both a long method and a short method, using the same source of data, were proposed prior to the study. The long method required much more effort, in that it considers every individual faculty member's salary and, for each faculty member, requires a series of calculations to allocate salary costs based on the person's individual teaching load. These individual calculations are then added to determine salary costs by level for each department. The shorter method differs only in that total teaching loads for each department are used to allocate total department faculty salaries, thereby eliminating individual calculations and directly arriving at departmental salary costs distributed to levels of instruction. The rationale for use of the long method is examined. However, the university also maintained an additional worksheet so the short method could be used on exactly the same data. The comparison of the two methods shows not only that both methods produce similar results, but that the short method may even be more valid. (SW)

MONTANA STATE UNIVERSITY

Office of Institutional Research

COSTS PER STUDENT CREDIT HOUR
A COMPARISON OF TWO ALLOCATION METHODS

Report 80-03

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Prepared by: Stephen R. Hample

(406) 994-4361

Data Source: Statewide Cost Study
MSU Data

108 Montana Hall

Bozeman, Montana 59717

ABSTRACT

Montana State University recently expended some eleven person months of effort in responding to a statewide cost study. This paper documents the advantages, had a shorter method been permitted versus the disadvantages of the prescribed longer method.

Both long and short methods, using the same source of data, were proposed prior to the study. The long method required much more effort, in that it considered every individual faculty member's salary and, for each faculty member, required a series of calculations to allocate his or her salary costs based on that person's individual teaching load. These individual calculations were then added to determine salary costs by level for each department. The proposed shorter method differed only in that total teaching loads for each department were used to allocate total department faculty salaries, thereby eliminating individual calculations and directly arriving at departmental salary costs distributed to levels of instruction.

For reasons described herein, the use of the long method was required, but MSU also maintained an additional worksheet so the short method could be used on exactly the same set of data. This comparison of the two methods shows not only that both methods produce similar results, but that the short method may even be more valid!

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Background

During the past few months, Montana State University has been responding to requests for cost data from a statewide formula budget task force. The cost data include only expenditures from the instructional portion of the budget with the immediate results of showing cost per student credit hour by discipline and by level of instruction.

The assignment of faculty salary costs by level of instruction proved particularly difficult for MSU. The cost study directions specified that each faculty member's salary be allocated by that person's teaching load (adjusted for independent study courses, etc.). E.g., the salary of a person teaching 30% of his or her courses at the lower division level would be allocated 30% to lower division costs. Because the instructor's name is not generally carried on MSU registration records (because of team taught courses, multiple subsections of courses, independent study courses and other reasons) this office was faced with the chore of manually tabulating each faculty member's teaching load and allocating individual salaries accordingly. Faculty in several departments were hesitant to provide detailed teaching schedules which they felt might be misinterpreted by persons unfamiliar with the campus. For these reason, MSU administrators proposed an alternate, shorter method of calculating costs per student credit hour.

The Two Cost Allocation Methods

The "Long" Method

The cost study directions previously described (requiring a separate workload report for each faculty member and a separate allocation of each individual's salary) is henceforth referred to as the long method.

The "Short" Method

Rather than using individual workloads and salaries and summing these to obtain department totals, this method simply allocates the total faculty salaries expended in a department by the total courses taught. The same course adjustments or weighting factors used in the long method are followed; the only difference is in replacing a very large number of individual computations by one departmental calculation, essentially using a department average.

The Hypothesis Favoring the Long Method

Hypothesis: The use of the "short" method would appear to place a bias toward higher lower division and lower graduate division cost allocations. This is because low cost GTA's teach mainly in lower division and we expect graduate programs to be the domain of higher ranked and paid faculty.

The detailed matching of individual salries and workloads was therefore required by the state agencies directing the study.

Comparison of the Two Methods

In following the long method, this office also kept a list of departments' summary data. In this manner, exactly the same data were used to compare the results of the two methods.

College and University Summary Comparisons

Table 1 does show a slightly lower university wide graduate level cost per student credit hour using the short method. However, college summary costs are interesting; half of the colleges experienced a higher graduate cost under the short method. Thus, no consistent bias is apparent, the changes may be considered as "noise" in the system (the small numbers involved are easily affected), and the hypothesis appears to be false.

Table 1

Costs Per Student Credit Hour
Comparison of Two Allocation Methods
College Summary Costs

College	Lower Division		Upper Division		Graduate	
	Short	Long	Short	Long	Short	Long
Agriculture	$ 17.60	18.78	$ 38.60	37.93	$ 112.26	104.04
Arts & Architecture	29.75	29.49	48.26	49.94	170.90	158.59
Education	18.83	17.88	38.34	35.43	73.23	90.05
Engineering	27.78	27.81	43.68	43.85	148.11	145.22
Letters & Science	17.98	17.76	45.73	45.92	135.46	139.76
Business	17.61	18.20	28.18	27.36	83.80	83.80
Nursing	43.07	48.36	63.97	62.29	202.89	250.62
UNIVERSITY	$ 20.02	19.98	$ 43.66	43.11	$ 116.56	121.83

Nursing shows a large change in costs per SCH between the two methods, but this is caused in part by the small number of graduate students involved (25) and corresponding small number of student credit hours. The actual total dollar difference in graduate costs between the two methods is not large; when added to lower division and upper division levels, it only slightly changes these costs per SCH. The same logic applies to other colleges and the university totals, although these areas are not as dramatically affected. One benefit of this exercise is to remind us of the instability of cost figures based on small numbers of dollars and student credit hours.

Under both methods, the average cost for all levels for each department remains the same. The results differ only in the allocation of total costs among the three levels.

Variation within an Individual Department

The statistical "law of large numbers' holds that random variations are generally smoothed out as sample sizes or numbers increase. The converse is also true (small samples have relatively larger random variations) and departments with small enrollments were likely to show greater fluctuations between the two calculation methods. One such department (Modern Languages) showed a 26% change in upper division costs per SCH as shown in Table 2.

Table 2

Costs Per Student Credit Hour
Comparison of Two Allocation Methods
Variations within an Individual Department

	Lower Division		Upper Division		Graduate	
	Short	Long	Short	Long	Short	Long
(Modern Languages)	$ 36	$ 34	$ 96	$ 121	$ --	$ --

In reviewing the allocation of individual faculty salaries for this department, one item stood out; the salary of the department head as shown in Table 3.

Table 3

Sample Allocation of Individual Salaries
(Department of Modern Languages)

Faculty Member	Lower Division Salary	FTE	Upper Division Salary	FTE	Totals Salary	FTE
A	$ 1,956	.18	$ --	--	$ 1,956	.18
B	15,244	.83	3,056	.17	18,300	1.00
C	13,304	.77	3,996	.23	17,300	1.00
D	10,400	.80	2,600	.20	13,000	1.00
E	6,197	.33	→ 16,503 ←	.89	22,700	1.22
F	2,247	.21	1,689	.15	3,936	.36
G	9,535	.70	4,165	.30	13,700	1.00
H	890	.09	--	--	890	.89
I	10,037	.52	4,363	.23	14,400	.75
J	13,320	.90	1,480	.10	14,800	1.00
K	19,326	.99	274	.01	19,600	1.00
	$102,456 (73%)	6.32	$ 38,126 (27%)	2.28	$140,582 (100%)	8.60

Note the large amount ($16,503) appearing in the upper division cost column for professor "E". This person serves as the department head with a full time equivalent employment of 1.22 (including .22 summer) and a relatively high salary. While administering the department he taught a year's total of three courses, two at the upper division level and one at the lower. Thus, in accordance the long method, approximately two thirds of his salary was allocated to upper division costs. This is in contrast to the 27% upper division average for the department and ignores the fact that most of his time was actually spent on administrative matters probably at the lower division level where most of the department's teaching occurred. The short method assigns 20% of his salary to the upper division which seems much more reasonable than the 73% generated by the long method. Thus, the long method appears to be less valid than the short method.

The long method could be modified to treat department heads as a special case. Correcting this deficiency would cause the current small differences between the two methods to virtually disappear. The only remaining differences would be caused by the very weak effects of the hypothesis or by other instances in which non-average faculty salaries produce non-average teaching loads and

which do not counter balance each other. In the above example (modern languages) a reasonable modification would produce a 19% lower division, 81% upper division salary allocation very close to the 20%-80% short method allocation and would produce virtually the same costs per SCH when added to other costs.

The long method consumed a total of approximately 11 person months of effort with a total cost of about $21,000. The short method would have reduced this effort by an estimated six clerical and two professional person months. The savings (at an $8,000 clerical salary rate and a $17,000 professional/assistant average rate) for this campus of 10,000 students would be approximately $15,000 annually.

Conclusions and Caveats

The short method did not show the bias as hypothesized. The long method was found to generate what might be considered as a reporting method error. Thus the short method, requiring much less effort, may be more valid than the long method and is recommended for future use.

Caveats

The differences in effort required by the two methods may be unique to MSU whose courses could not be automatically linked via computer files to faculty salaries.

The detailed long method may give a greater appearance of accuracy and hence greater credibility. Whether increased accuracy actually exists is questionable and credibility may be conveyed through the use of audited departmental expenditure reports within the short method.

This report points out a problem (department head salaries) with the long method relative to the short method. Perhaps an entirely different approach would be better than either method, but none (retaining practicality) has yet been found.

COST PER STUDENT CREDIT HOUR

Comparison of Two Calculation Methods

Department	Lower Division		Upper Division		Graduate		ALL LEVELS
	Short	Long	Short	Long	Short	Long	Either Method
Agric Econ & Econ	13.62	14.10	33.93	31.14	133.06	167.73	21.84
Agric & Indus Educ	21.75	23.93	49.53	46.77	107.30	116.11	38.04
Animal & Range Sci	32.04	30.57	41.73	43.98	134.75	130.36	40.15
Plant Pathology	N/T*	N/T	25.22	26.77	92.27	91.23	65.27
Plant & Soil	11.60	18.17	37.27	34.78	97.48	77.79	31.20
Veterinary Sci	N/T	N/T	37.57	58.94	129.97	66.57	60.87
COLLEGE OF AGRIC	17.60	18.78	38.60	37.93	112.26	104.04	30.42
Architecture	26.71	25.62	26.50	29.63	218.76	209.67	43.20
Art	21.01	21.70	48.03	49.18	98.07	67.64	30.63
Film & TV	31.80	32.71	64.95	63.41	N/T	N/T	44.08
Music	42.11	40.22	53.59	57.20	96.63	112.17	46.20
Theater Arts	43.58	42.60	91.81	93.37	N/T	N/T	62.27
COLLEGE OF A & A	29.75	29.49	48.26	49.94	170.90	158.59	40.44
Educational Svcs	N/T	N/T	39.30	34.50	85.28	86.00	79.28
Elementary Educ	N/T	N/T	37.27	35.85	56.93	69.48	40.69
Home Economics	15.11	15.18	49.67	44.36	148.70	273.73	23.59
Hlth, PE & Rec	21.23	19.24	29.30	28.67	84.96	131.14	25.23
Secondary Educ	32.16	39.73	39.16	34.75	49.96	73.09	40.08
COLLEGE OF EDUC	18.83	17.88	38.34	35.43	73.23	90.05	32.16
Agricultural Educ	34.17	29.52	48.16	52.08	8.35	8.35	41.54
Chemical Engr	47.42	48.26	41.72	41.75	199.32	195.61	53.86
Civil Engr & EnMch	22.83	23.75	47.14	44.98	141.15	118.12	38.58
Electrical Engr	35.20	35.84	47.82	47.18	165.57	170.15	48.73
Indus Engr/Comp Sci	23.71	24.45	35.65	34.22	120.75	143.24	31.84
Mechanical Engr	28.31	26.60	45.83	48.03	94.18	79.42	38.72
COLLEGE OF ENGR	27.78	27.81	43.68	43.85	148.11	145.22	40.36
Biology	14.09	15.39	56.25	56.66	129.21	112.90	32.13
Chemistry	26.73	28.70	57.33	49.22	143.29	120.65	34.65
Earth Science	15.57	15.49	56.35	56.74	49.00	48.34	25.17
English	25.22	24.39	34.59	38.32	N/T	N/T	26.89
History & Phil	15.45	16.38	36.69	34.75	172.44	163.68	23.39
Mathematics	13.39	12.51	64.30	57.17	159.73	257.78	17.33

Department	Lower Division		Upper Division		Graduate		ALL LEVELS
	Short	Long	Short	Long	Short	Long	Either Method
Medical Science	N/T	N/T	N/T	N/T	141.01	141.01	141.01
Microbiology	46.46	38.21	93.75	100.14	154.22	216.21	65.84
Modern Languages	35.93	33.58	96.19	121.38	N/T	N/T	41.03
Native Amer Stu	35.65	24.50	76.27	89.50	N/T	N/T	54.26
Physics	17.63	17.67	81.30	83.78	187.31	180.02	30.12
Political Science	12.92	12.79	39.75	38.76	80.28	87.39	25.82
Psychology	8.00	9.46	31.05	28.27	98.50	111.19	18.09
Sociology	12.21	12.02	35.62	36.59	175.68	123.11	19.49
Speech Comm	18.22	17.42	22.23	23.73	174.41	243.44	19.69
Military Sci	24.80	24.77	24.73	24.76	N/T	N/T	24.76
COLLEGE OF L & S	17.98	17.76	45.73	45.92	135.46	139.76	27.08
School of Business	17.61	18.20	28.18	27.36	83.80	83.80	22.62
School of Nursing	43.07	48.36	63.97	62.29	202.89	250.62	61.69
MSU TOTAL	20.02	19.98	43.66	43.11	116.56	121.83	31.59

* N/T - None Taught