

Revising course mix weight
methodology for the ‘Annual
national report’

NATIONAL CENTRE FOR VOCATIONAL
EDUCATION RESEARCH

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Publisher's note

Amendments were made to the following data on 18 May 2011:

- ✧ table 2, page 7: course mix weights by state/territory for total government expenditure scope for 2005 and 2006
- ✧ table B3, page 13: expenditure per FYTE and hour by state/territory for total government expenditure scope for 2005 and 2006.

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About the research



Revising course mix weight methodology for the 'Annual national report'

National Centre for Vocational Education Research

The calculation of expenditures per full-year training equivalent (FYTE) in the Department of Education, Employment and Workplace Relations's *Annual national report of the Australian vocational education and training system* to Parliament includes the application of cost weights. These 'course mix weights' account for the variation among states and territories in the relative mix of high- and low-cost programs and promote comparability of unit costs among jurisdictions. However, changes to the Australian Vocational Education and Training Management Information Statistical Standard (AVETMISS) mean that the methodology applied until 2008 can no longer be used.

The purpose of this paper is to explain the technical solution to this problem.

The paper explains how course mix weights are calculated using a new method based on a set of cost relativities by the subject field of education rather than the funding industry of the course. It also provides a comparison of the two methods.

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Introduction

The calculation of expenditures per full-year training equivalent (FYTE) in the Department of Education, Employment and Workplace Relations' *Annual national report of the Australian vocational education and training system* includes the application of cost weights ('course mix weights') to take account of the variation among states and territories in the relative mix of high- and low-cost programs.¹ This promotes comparability of unit costs among jurisdictions. However, changes to the Australian Vocational Education and Training Management Information Statistical Standard (AVETMISS) mean that the methodology applied until 2008 can no longer be used.

Starting with the 2009 VET Provider Collection, vocational education and training courses will no longer be matched to an occupational code based on the old Australian Bureau of Statistics' Australian Standard Classification of Occupations (ASCO; now the Australian and New Zealand Standard Classification of Occupations). This means that the 19 funding industry groups, which are derived from ASCO and are used in course mix weight calculations, will not be available.

This short paper explains the technical solution to this problem, specifically how course mix weights are calculated using a new method based on the subject field of education rather than the funding industry of the course. It also provides a comparison of the two methods.

The 'old method'

Under the old method, course mix weights are calculated using a set of cost relativities by funding industry (table 1). These 19 funding industry groups were developed in the early 1990s following consultations between the Australian National Training Authority (ANTA) and the states, resulting in a nationally agreed cost weight for each category.

Obtaining the final course mix weights for a particular year involves a simple calculation. First, the cost relativities are applied to a tabulation of annual hours by funding industry and state/territory. These weighted hours are summed by state/territory and then divided by the sum of the unweighted hours. Finally, the resultant ratios are indexed such that the reference value is 1.000 for Australia.² A weighting greater than 1.000 indicates that the state or territory is offering relatively more expensive programs compared with the national profile.

The calculations may be performed on different scopes for the annual hours, although in all cases the same cost relativities are used. Table 2 shows course mix weights for 2005–08 under scopes consistent with 'total expenditure', 'government recurrent expenditure' and 'total government expenditure'.

¹ Both expenditures per FYTE and annual hour are presented in the 'Annual national report'. Expenditure per FYTE is equal to the hour value multiplied by 720 (since one FYTE equals 720 hours). In the future, it is expected that only expenditures per FYTE will be presented.

² If H_i^* represents the sum of the weighted hours for state i and H_i represents the sum of the unweighted hours, then the indexed course mix weight for state i is given by $(H_i^*/H_i)(H/H^*)$, where H^* and H are the sums of the weighted and unweighted hours for Australia, respectively.

Table 1 Cost relativities by funding industry

	Cost relativities
1 - Arts entertainment sport and recreation	1.030
2 - Automotive	1.334
3 - Building and construction	1.159
4 - Community services health and education	0.910
5 - Finance banking and insurance	0.683
6 - Food processing	1.137
7 - Textiles, clothing and footwear, and furnishings	1.181
8 - Communications	1.157
9 - Engineering and mining	1.278
10 - Primary industry	1.119
11 - Process manufacturing	1.158
12 - Sales and personal services	0.936
13 - Tourism and hospitality	1.101
14 - Transport and storage	1.205
15 - Utilities	1.290
16 - Business and clerical	0.788
17 - Computing	0.844
18 - Science technical and training	1.055
19 - General education and training	0.847
Other	1.000

Table 2 Course mix weights by state/territory, 2005–08: the 'old method'

	NSW	Vic.	QLD	SA	WA	Tas.	NT	ACT	Aus.
Total expenditure scope									
2005	0.967	1.001	1.045	0.995	1.038	1.053	0.984	0.987	1.000
2006	0.971	1.000	1.038	0.997	1.035	1.039	0.997	0.981	1.000
2007	0.979	0.987	1.041	0.994	1.043	1.043	0.995	0.995	1.000
2008	0.981	0.982	1.043	0.998	1.046	1.045	0.980	0.983	1.000
Government recurrent expenditure scope									
2005	0.962	1.003	1.053	0.992	1.046	1.050	0.982	0.996	1.000
2006	0.964	1.003	1.045	0.994	1.046	1.038	1.001	0.985	1.000
2007	0.970	0.991	1.049	0.994	1.054	1.043	0.996	0.993	1.000
2008	0.971	0.987	1.053	0.997	1.054	1.050	0.985	0.983	1.000
Total government expenditure scope									
2005	0.963	1.004	1.055	0.994	1.042	1.052	0.985	0.992	1.000
2006	0.965	1.004	1.046	0.996	1.041	1.041	0.999	0.986	1.000
2007	0.972	0.991	1.050	0.995	1.043	1.046	0.994	0.997	1.000
2008	0.972	0.988	1.053	0.999	1.045	1.048	0.976	0.986	1.000

The ‘new method’

Under the new method, course mix weights are calculated using a set of cost relativities by subject field of education (table 3). These new cost relativities are derived from the old set shown in table 1 (the mathematical basis is provided in appendix A). In short, we attach the old cost relativity to every module to obtain the ‘weighted’ hours for that module. This enables us to tabulate the weighted hours according to any characteristic of the module. Specifically, we tabulate by field of education. Thus for each field of education we derive a table with the hours of all the modules in a particular field of education, and the weighted hours of the same modules. The ratio of these two elements gives us the cost relativity for the field of education. The scope of these calculations is ‘total government’.

Table 3 Cost relativities by subject field of education

	Cost relativities
01 - Natural and physical sciences	1.020
02 - Information technology	0.882
03 - Engineering and related technologies	1.235
04 - Architecture and building	1.154
05 - Agriculture, environmental and related studies	1.116
06 - Health	0.982
07 - Education	0.860
08 - Management and commerce	0.894
09 - Society and culture	0.890
10 - Creative arts	1.017
11 - Food, hospitality and personal services	1.042
12 - Mixed field programmes	0.921

These new cost relativities are then applied to tabulations of annual hours by subject field of education and state/territory for each year to obtain the final course mix weights. The calculations are performed on the three different scopes for the annual hours (table 4), but once again the same set of cost relativities are used in each case.

Table 4 Course mix weights by state/territory, 2008–09: the ‘new method’

	NSW	Vic.	QLD	SA	WA	Tas.	NT	ACT	Aus.
Total expenditure scope									
2008	0.994	0.996	1.014	0.994	1.014	1.012	1.012	0.976	1.000
2009	0.993	0.998	1.014	0.996	1.009	1.009	1.018	0.982	1.000
Government recurrent expenditure scope									
2008	0.988	0.998	1.021	0.997	1.018	1.013	1.013	0.979	1.000
2009	0.988	0.997	1.021	1.000	1.011	1.009	1.020	0.988	1.000
Total government expenditure scope									
2008	0.989	0.998	1.020	0.997	1.013	1.013	1.012	0.981	1.000
2009	0.988	1.000	1.021	0.999	1.009	1.004	1.019	0.986	1.000

Comparison of old and new methods

Table 5 provides a comparison of the old and new method course mix weights for 2008 for the different scopes. The discrepancies between old and new weights occur at the state/territory level not the national level (under both methods the reference value is 1.000 for Australia). Overall, the differences are greatest for Tasmania, the Northern Territory, Western Australia and Queensland; the old and new weights differ little for other states, especially South Australia and the Australian Capital Territory. Table 6 provides analogous calculations for the final expenditures per FYTE.

Table 5 Comparison of old and new method course mix weights by state/territory, 2008

	NSW	Vic.	QLD	SA	WA	Tas.	NT	ACT	Aus.
Total expenditure scope									
Old 2008	0.981	0.982	1.043	0.998	1.046	1.045	0.980	0.983	1.000
New 2008	0.994	0.996	1.014	0.994	1.014	1.012	1.012	0.976	1.000
% change	1.3	1.4	-2.8	-0.5	-3.0	-3.1	3.3	-0.6	0.0
Government recurrent expenditure scope									
Old 2008	0.971	0.987	1.053	0.997	1.054	1.050	0.985	0.983	1.000
New 2008	0.988	0.998	1.021	0.997	1.018	1.013	1.013	0.979	1.000
% change	1.8	1.1	-3.1	0.0	-3.4	-3.6	2.8	-0.4	0.0
Total government expenditure scope									
Old 2008	0.972	0.988	1.053	0.999	1.045	1.048	0.976	0.986	1.000
New 2008	0.989	0.998	1.020	0.997	1.013	1.013	1.012	0.981	1.000
% change	1.7	1.1	-3.1	-0.2	-3.0	-3.3	3.7	-0.6	0.0

Table 6 Comparison of old and new method expenditure per FYTE by state/territory, 2008

	NSW	Vic.	QLD	SA	WA	Tas.	NT	ACT	Aus.
Total expenditure scope									
Old 2008	10975	10502	11705	12632	11159	10717	24417	15164	11264
New 2008	10834	10354	12049	12692	11506	11064	23631	15263	11264
% change	-1.3	-1.4	2.9	0.5	3.1	3.2	-3.2	0.6	0.0
Government recurrent expenditure scope									
Old 2008	9440	9072	11194	10493	9758	10654	16412	12042	9874
New 2008	9275	8976	11547	10493	10101	11048	15962	12091	9874
% change	-1.8	-1.1	3.2	0.0	3.5	3.7	-2.7	0.4	0.0
Total government expenditure scope									
Old 2008	9085	8819	11399	10153	9032	10345	20502	11889	9649
New 2008	8929	8726	11761	10171	9316	10700	19777	11960	9649
% change	-1.7	-1.0	3.2	0.2	3.1	3.4	-3.5	0.6	0.0

Discussion

The reason for the discrepancies above is that although the new and old cost relativities are 'aligned' at the national level, the distribution of annual hours by subject field of education is different to the distribution by funding industry for each state/territory, and hence the final course mix weights differ for each jurisdiction.

The discrepancies between old and new course mix weights are virtually the same when the different scopes for annual hours are used to initially align the cost relativities.

It may be possible to obtain a new set of cost relativities which give exactly the same final course mix weight for each state/territory as under the old method. However, this requires solving for twelve variables from eight simultaneous equations. There are an infinite number of solutions but there is no guarantee that the resultant cost relativities are in an acceptable range. That is, there is no guarantee the cost relativities are sensible rather than just allow for the mathematical equations to be solved.

In light of the discrepancies between old and new method course mix weights, the National Training Statistics Committee (NTSC) and NCVET decided to present two time series in the efficiency tables of the *Annual national report of the Australian vocational education and training system*. For 2005–08, course mix weights calculated using the old method are applied to expenditures per FYTE and hour. For 2008–09, course mix weights calculated from the new method are used. That is, 2008 is provided as a common year to show the discrepancies which result at the state/territory level. The final tables are presented in appendix B.

Appendix A: mathematical model

The derivation of new cost relativities by subject field of education is as follows.

The total hours of activity can be partitioned into 19 funding industry groups (plus an unknown category) and 12 fields of education (FoE). For convenience, define the following quantities:

H_{ij} hours of activity for funding industry group i and FoE j , where $H = \sum \sum H_{ij}$, $i = 1 \dots 20$, $j = 1 \dots 12$, $H_i = \sum_j H_{ij}$ and $H_j = \sum_i H_{ij}$
 w_i the cost relativity that is applied to each H_i (the hours of activity for each funding industry group i).

Further define:

$$H_{ij}^* = w_i H_{ij}$$

Therefore,

$$H_j^* = \sum_i w_i H_{ij}$$

Define $v_j = H_j^* / H_j$

These are the new field of education cost relativities. Thus we have defined the new cost relativities by simply projecting the old cost relativities on to fields of education. It is shown that $\sum_i w_i H_i = \sum_j v_j H_j = H^*$, the total weighted hours.

Appendix B: supporting tables

Table B1 Expenditure per FYTE and hour by state/territory, 2005–09: total expenditure scope

	With old method course mix weights				With new method course mix weights	
	2005	2006	2007	2008	2008	2009
Expenditure per FYTE						
New South Wales	12646	12344	11759	10975	10834	10161
Victoria	11092	10913	10093	10502	10354	9673
Queensland	11887	11338	11979	11705	12049	11500
South Australia	14462	14276	13180	12632	12692	12035
Western Australia	12407	11549	11586	11159	11506	10919
Tasmania	12266	12141	11065	10717	11064	12816
Northern Territory	24363	22961	24259	24417	23631	22360
Australian Capital Territory	15063	14286	14689	15164	15263	14585
Australia	12328	11945	11524	11264	11264	10677
Expenditure per hour						
New South Wales	17.56	17.14	16.33	15.24	15.05	14.11
Victoria	15.41	15.16	14.02	14.59	14.38	13.43
Queensland	16.51	15.75	16.64	16.26	16.73	15.97
South Australia	20.09	19.83	18.31	17.54	17.63	16.71
Western Australia	17.23	16.04	16.09	15.50	15.98	15.17
Tasmania	17.04	16.86	15.37	14.88	15.37	17.80
Northern Territory	33.84	31.89	33.69	33.91	32.82	31.06
Australian Capital Territory	20.92	19.84	20.40	21.06	21.20	20.26
Australia	17.12	16.59	16.01	15.65	15.65	14.83

Table B2 Expenditure per FYTE and hour by state/territory, 2005–09: government recurrent expenditure scope

	With old method course mix weights				With new method course mix weights	
	2005	2006	2007	2008	2008	2009
Expenditure per FYTE						
New South Wales	10536	10565	9913	9440	9275	9049
Victoria	9839	9702	9148	9072	8976	8519
Queensland	11244	10380	11218	11194	11547	11624
South Australia	11744	12242	11659	10493	10493	10720
Western Australia	11876	11165	10813	9758	10101	9753
Tasmania	11394	11232	11029	10654	11048	11830
Northern Territory	20046	16677	15916	16412	15962	15084
Australian Capital Territory	12603	11761	11600	12042	12091	11053
Australia	10851	10588	10248	9874	9874	9663
Expenditure per hour						
New South Wales	14.63	14.67	13.77	13.11	12.88	12.57
Victoria	13.67	13.48	12.71	12.60	12.47	11.83
Queensland	15.62	14.42	15.58	15.55	16.04	16.14
South Australia	16.31	17.00	16.19	14.57	14.57	14.89
Western Australia	16.49	15.51	15.02	13.55	14.03	13.55
Tasmania	15.82	15.60	15.32	14.80	15.34	16.43
Northern Territory	27.84	23.16	22.10	22.79	22.17	20.95
Australian Capital Territory	17.50	16.33	16.11	16.72	16.79	15.35
Australia	15.07	14.71	14.23	13.71	13.71	13.42

Table B3 Expenditure per FYTE and hour by state/territory, 2005–09: total government expenditure scope

	With old method course mix weights				With new method course mix weights	
	2005	2006	2007	2008	2008	2009
Expenditure per FYTE						
New South Wales	9966	10049	9588	9085	8929	8697
Victoria	9684	9548	8903	8819	8726	8610
Queensland	11637	10662	11520	11399	11761	11919
South Australia	11813	12242	11367	10153	10171	10224
Western Australia	11563	10820	10017	9032	9316	9633
Tasmania	11386	11237	10936	10345	10700	11115
Northern Territory	20483	19380	18845	20502	19777	18217
Australian Capital Territory	12171	11430	11515	11889	11960	10851
Australia	10644	10402	10045	9649	9649	9583
Expenditure per hour						
New South Wales	13.84	13.96	13.32	12.62	12.40	12.08
Victoria	13.45	13.26	12.37	12.25	12.12	11.96
Queensland	16.16	14.81	16.00	15.83	16.33	16.55
South Australia	16.41	17.00	15.79	14.10	14.13	14.20
Western Australia	16.06	15.03	13.91	12.54	12.94	13.38
Tasmania	15.81	15.61	15.19	14.37	14.86	15.44
Northern Territory	28.45	26.92	26.17	28.47	27.47	25.30
Australian Capital Territory	16.90	15.87	15.99	16.51	16.61	15.07
Australia	14.78	14.45	13.95	13.40	13.40	13.31