

An evaluation of the impact of changes to the Metal Fabrication and Welding (Heavy) Trade Course in NSW

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Background

Every country in the world has some form of an educational system leading to a Vocational Education and Training system. Vocational training is normally post secondary education but in some countries it is initiated during the schooling years. Other developed countries such as the United Kingdom have similarities in their competency based education system to that of Australia (Gunning, 1993). The challenges facing vocational education and training in the United States of America from the mid to the late 1990's had parallel's with those changes occurring in New Zealand at that time, these challenges are now being confronted by the Australian Vocational Education System (O'Connor, 1993).

Technical Education in New South Wales (NSW) evolved from the privately funded Sydney Mechanic's School of Arts in 1833. The NSW State Government assumed control of this institution in 1883 resulting in the expansion of the Technical Education at a rapid rate, and has developed into what is now called a Vocational Education and Training (VET) system (Goozee, 1995).

This comparative study of the MF&W trade course in 2001 and the newly introduced MF&W trade courses in 2004, focuses on the data from the exit tests. The discussions and recommendations also focus on types of benefits or deficiencies this major change has had in the knowledge base of the current apprentices from the trade course.

From 1972 to 1990 the MF&W trade course had not changed a great deal in its delivery mode or subject matter. The introduction of the Competency Based Training (CBT) format into the MF&W area of training in 1991 changed it from a lock step method of delivery. Lock step method underpinned the knowledge of the task step by step form whereas the modular based delivery contains the competency required for the task. During the decade that followed, there have been three major reviews of the MF&W (Heavy) trade, which have impacted on delivery, what is taught and how it is taught.

1. Scott Report

The Scott Report (1990) indicated TAFE NSW could legitimately boast of some remarkable achievements. The report predicted that during the next decade (the 1990's) its potential and its national importance could become even greater. While the changes proposed for TAFE NSW were fundamental, the new structures introduced reduced the then existing 22 Institutes to 11 institutes by the mid 1990's. Due to the duplication of services this structure is currently under review again as it is becoming uneconomical. The newly formed institutes were expected to be autonomous and self funded.

2. Finn Report

The Minister of Education at the time requested that the Employment and Skills Formation Council (ESFC) should take into consideration the changes proposed in the Finn Report (1991) on post - compulsory education and training (Minister's Letter to Carmichael 1992).

The ESFC was able to propose a new entry training system with a range of quite advanced features. The system builds on the "Finn Committee" report on post-compulsory education and training. It further developed the means of meeting the growing convergence of work and learning and of general and vocational education.

The ESFC saw the fundamental task of devising a system that would extend structured entry level training for a large number of young people who did not have the opportunity to participate. At the same time the system needed to retain the good features of existing entry level training, particularly of apprenticeships. It also needed to ensure a real advance in access and equity.

The vocational certificate training system recommended by the ESFC met the requirements. It was capable of providing vocational education and training opportunities to the Australian Standards Framework (ASF) level 2 (or higher) for virtually all school leavers by:

- increasing the occupational and industrial areas covered by the articulated structured training arrangements;
- providing multiple flexible pathways to accommodate the needs and circumstances of most young people;
- contributing significantly to the task of producing a more skilled and productive work force and generating new employment opportunities in an internationally competitive market; and
- facilitating the articulation of the credentials held by young people with career paths established in most occupations and industries through the award restructuring process (Carmichael, 1992: v).

The ESFC's advice had been prepared in the light of extensive consultations and debate. The Council recognised that acceptance and implementation of its advice would require some fundamental institutional and cultural adjustments by sectors of the community.

The report outlined a staged strategy for meeting Australia's training needs for the future and was not a short term response to the current levels of unemployment, but an essential part of a broad structural reform. (Carmichael 1992: v-vi)

3 Schofield Report

In the “The Next Generation Report (2001)” (chaired by Kaye Schofield) five themes recur throughout the report of the TAFE NSW product processes and policies. These are outlined from the Overview of the Report.

The first of these was the need for the product system to support TAFE’s vision to become a catalyst for regional renewal and economic progress, equitably shared. As different communities, economies, industries, enterprises, occupations and learners respond in different ways to economic and social pressures, a “one-size-fits-all” model of training product is no longer viable. Product diversity, innovation and flexibility at a local level will be necessary.

The second was the *changing content* for vocational learning. New and shifting customer needs and expectations are evident everywhere. Change in the structure of industry is affecting product content and product mix. New technologies are impacting on the range of teaching and learning products and also on the way learning can be facilitated and managed. Competition is becoming ever more intensive. Shifts in the availability of resources are apparent. Change in government policy and regulations continue to impact strongly on all training organisations, including TAFE NSW. The report was of the opinion that any training organisation that fails to regularly adjust its strategy, systems and processes to changing circumstances will not have a secure future and those that continue with approaches tailored to outdated modes of operation will suffer most.

The third theme was *quality*. In a world where products and services are merging, a new teaching and learning model is taking shape. In this new model quality is less dependent on standardised products and centrally-determined policies and more dependent on the quality of teaching, learning and assessment of services actually delivered to customers. Teacher knowledge, skill and understanding and their perceptions of the different contexts in which they now work have become even more central to vocational learning and fundamentally affect its success. It is not that products are not important - just that teaching and learning processes and outcomes now matter more than ever before.

The fourth theme was *value*. Conceiving the TAFE product system not as a collection of documents, resources, policies, committees, guidelines, procedures and cost centres but as an integrated value chain has allowed the review to better identify where change is required and most likely to add value. Within this product value chain, there are four primary activities which are interdependent. These activities are:

- teaching, learning and assessment of resources;
- professional development;
- teaching, learning and assessment; and
- student support.

Together they provide end-to-end delivery of services. The way that any one of them is performing affects the efficiency and effectiveness of the others.

Innovation and responsiveness are created in the tension between the pull exerted on the one hand by customers and stakeholders and the push exerted on the other hand by product research, design and development processes. With this concept of the product consideration must be given to the linkages these have downstream with professional development and teaching, learning and assessment.

Finally, the fifth theme was *the change process* itself. The review has chosen an approach to change based on building links, networks and relationships that allow creativity and adaptability to emerge, and on weeding out those blocking processes that are often found in functionally-split bureaucracies. It has not advocated for long-term product planning because this forces organisations to make wild guesses about what customers might want in the future. It has not advocated significant structural change because this can yield its own dysfunctions. Rather, the report's focus has been on helping TAFE NSW to evolve and adapt continuously to new circumstances.

Aims of the study

An evaluation of the changes in course delivery was undertaken by comparing the results from an exit test taken by stage III MF&W (Heavy) apprentices in the Hunter Institute of TAFE in 2001, under the old course, and in 2004, under the new course. The results from the same exit tests for stage III MF&W (Heavy) apprentices across New South Wales (NSW) in 2004 were also obtained to evaluate the exit knowledge. Information from teachers about the course changes and reactions to Competency Based Training (CBT), method of delivery and the changes to on-the-job training was also obtained through phone interviews conducted in 2005.

The specific questions addressed by the study were:

- Was there an improvement in the exit knowledge of the apprentices who completed between 2001 and 2004 and those who completed the trade course stage III at TAFE NSW, after the introduction of the new courses?
- What were the differences, if any, in the knowledge base of MF&W (Heavy) apprentices between the TAFE NSW institutes in 2004?
- What were the differences in the results of the exit tests undertaken between 2001 and 2004 and what were the differences between the old course and the new course at the Institute where the study was undertaken in 2001?
- In the opinion of the MF&W (Heavy) teachers in NSW does the current MF&W (Heavy) course meet industry needs?
- What, if any, components of the course need improvements?

- Which is the preferred teaching delivery technique used by MF&W (Heavy) teachers in TAFE NSW?
- In the opinion of the MF&W (Heavy) teachers in NSW to what extent do employers take on-the-job training of apprentices as an important component of the course?
- In the opinion of the MF&W (Heavy) teachers in NSW did the changes implemented in the new course improve the knowledge base of the apprentices who were completing the stage III of the course?

Procedure

The study comprised of three stages of data collection.

First, Institutes, Campuses and MF&W (Heavy) Sections in TAFE NSW were approached to encourage their participation in the study, to gain consent and to establish the research relationship.

In phase one of the study, an exit test was designed around the stage III final tests carried out in 1980's (which were the validating test for the course at the time) using material from the trade modules that the apprentices had been taught. The test was made up of multiple choice, short answer, calculative and development questions. A pilot test was carried out in a section environment after being scrutinized by the Institute's MF&W (Heavy) teachers. As a result of the pilot some changes to exit knowledge of the students had occurred and required further investigation.

In phase two of the study in 2004, exit tests were conducted across five TAFE NSW Institutes which involved nine participating MF&W (Heavy) sections with 98 out of a possible 229 apprentices taking part. This sample was bench marked against a sample of similar tests carried out in 2001 at the Hunter Institute of TAFE across five campuses with 56 out of 64 apprentices participating.

In phase three of the study in 2005, involved phone interviews with Teachers of MF&W (Heavy) across a total of 10 Institutes of TAFE NSW. Within the eight TAFE NSW Institutes, 24 campuses which offered MF&W (Heavy) trade course agreed to participate in the interviews. These campuses comprised of 17 from rural areas and seven from urban areas. Of those Institutes that participated, 61 teachers out of a total of 105 agreed to participate in the interviews. The phone interview schedule comprised of two sections:

- Section 1. included six open ended and closed questions relating to general information about location, teaching experience and age.
- Section 2. included eleven open ended and closed questions relating to trade courses delivery and employers on-the-job attitudes.

Results

From the information gathered from the exit tests and phone interviews the following findings are presented. First the result on the exit tests are detailed by the sections of the tests and then by the location of the TAFE campuses.

Exit Test Results

Of the total scores on the exit tests gathered in 2001 there was a statistically significant difference, in Parts A and C of the test with the mean scores being higher. There were no statistically significant differences in Parts B and D of the exit test between 2001 and 2004. In the case of Part B which was the short answer section, the performances were uniformly higher representing about 90% of marks for this section. In the case of Part D, the developmental section, the performance was lower representing about 40% of marks available.

The results in Table 1 show the Hunter Institute was similar to those throughout NSW. Students in 2001 managed a pass mark of 70% but in 2004 this mean mark fell by about 5 marks in, indicating a decline in performances over that period of time.

**Table 1. A Comparison of the Exit Test Results in the Hunter Institute.
2001 with 2004**

Test Part	Year	Mean	Standard Deviation	T	P Less than 0.05
A	2001	40.7	7.23	3.820	Significant
	2004	36.0	5.36		
B	2001	16.6	2.37	0.822	Not Significant
	2004	16.3	1.46		
C	2001	8.5	2.72	2.945	Significant
	2004	7.0	2.64		
D	2001	4.0	3.13	1.348	Not Significant
	2004	4.9	3.41		
Total	2001	70.0	10.08	3.187	Significant
	2004	64.5	9.17		

In Parts A, B and the total test score at the Hunter Institute was significantly different in 2001 when compared to 2004, and in each case the mean scores were

higher in 2001. Overall, there was a decline in exit knowledge when compared to 2001 results because the results in 2004 were lower than 2001. In the case of Part B, the short answer section, the performance was uniformly high representing about 90% of marks for this section. In the case of Part D which was the developmental section, the performance was low compared to the rest of the results from the other sections.

In a comparison of the results for the Hunter Institute's with other Institutes in TAFE NSW results the apprentices in 2001 have obtained a pass mark of 70% whereas it fell below this mean mark by about five marks in 2004 indicating a relative decline over that period of time.

There were no significant differences in 2004 between the Hunter Institute's results and those of other Institutes of NSW, reflecting a common standard across the Metal Fabrication and Welding Trade training system in that period.

As shown in Table 2, there were no significant differences in 2004 results between the Hunter Institute and other institutes of NSW. This reflects the common standard across the Metal Fabrication and Welding Trade training system.

Table 2. A Comparison of Exit Test Results between the Hunter Institute and other Institutes in TAFE NSW 2004

Test Part	Institute	Mean	Standard Deviation	T	P Less than 0.05
A	Other	37.2	6.64	0.462	Not Significant
	Hunter	37.8	8.11		
B	Other	15.9	1.79	0.110	Not Significant
	Hunter	16.0	3.23		
C	Other	7.3	3.18	0.312	Not Significant
	Hunter	7.1	3.24		
D	Other	4.6	3.30	0.414	Not Significant
	Hunter	4.4	3.24		
Total	Other	65.0	11.23	0.162	Not Significant
	Hunter	65.3	13.47		

Urban and Rural Exit Test Results

There was no significant difference in Parts A, B, C and D of the **urban campuses** results completing the exit test between 2001 and 2004. In the case of

Part A, B, and C of the urban mean marks the performance was higher in 2001 than 2004 with Part D 2001 being lower than 2004 marks. (refer Table 3)

In the **rural** results, Part A of the **rural** apprentices was significantly different between 2001 and 2004, with the mean score being higher in 2001. For this section, made up of multiple choice items, the performance was uniformly high representing about 70% of marks in 2001 compared to 2004 as shown in Table 4. There was no significant difference for Parts B, C and D for the rural mean scores of the exit test between 2001 and 2004.

In Part A, there was a significant difference between the rural apprentices in 2001 and 2004, and in this case the mean score was higher in 2001. There was no significant difference for Parts B, C and D of the rural mean scores of the exit test in 2001 and 2004.

In the case of Part A, the multiple choice section, the performance was uniformly high, representing about 70% of marks for this section in 2001 compared to 2004.

Table 3 A Comparison of Urban to Rural Exit Test Results in 2001 with 2004

N2001=56 N2004=104

Part	Location	Year	Mean	Standard Deviation	T	P Less than 0.05
A	Urban	2001	38.4	5.28	1.888	Not Significant
		2004	35.1	6.51		
	Rural	2001	42.0	7.84	3.497	Significant
		2004	37.2	5.71		
B	Urban	2001	16.6	1.34	1.948	Not Significant
		2004	15.9	1.18		
	Rural	2001	16.6	2.77	0.785	Not Significant
		2004	16.2	1.79		
C	Urban	2001	8.6	2.83	2.080	Not Significant
		2004	6.8	3.36		
	Rural	2001	8.4	2.70	2.077	Not Significant
		2004	7.2	2.70		

D	Urban	2001	4.1	3.24	0.260	Not Significant
		2004	4.3	3.54		
	Rural	2001	4.0	3.12	1.423	Not Significant
2004		4.9	3.26			

Phone Interviews

Of the 61 MF&W (Heavy) Teachers who responded at the interviews, 60 were males while there was only one female. Of these male teachers 57 were employed on a full time basis while the other three were employed on part time basis and 83.6% had more than 15 years of trade teaching experience, 31% had more than 15 years experience of teaching stage III apprentices. Forty four percent of respondents held a Metal Fabrication and Welding (Heavy) Trade Certificate, Category Four Workplace Assessing Certificate and a Diploma of Teaching qualification.

Of the MF&W (Heavy) Teachers interviewed, 59% suggested that the course did not meet industry needs. The teachers expressed the opinion that the welding component was reasonable in its outcomes but felt that the fabrication part of the course lacked substance in the drawing interpretation, calculations and the computer aided drawing components of the course. As shown in tables 1,2,3&4 - section C & D results.

These teachers preferred the previous method of teaching of lock-step delivery over competency based training method, citing that the old method was a better delivery learning mode for apprentices than the CBT method and that no improvement in the learning outcomes of apprentices was apparent. The majority of teachers commented that the lock-step method enabled the apprentices to understand better because of the under pinning knowledge aspect of the method. However 41% of teachers were happy with the new changes with CBT.

From the results of the interviews it would appear that the on-the-job assessment of the apprentice's training was in large part ineffective due to the attitudes of the employers reluctant to participate in the system. The teachers interviewed commented that they felt this was due to the fact that employers saw their role as providing employment while the TAFE's role is provision of training. This has resulted in a 'tick and flick' (where the competency is passed in the workplace without obtaining the competency required) attitude of doing the assessments.

A large majority of teachers interviewed indicated that the changes that occurred to the course had not resulted in any improvement in the knowledge base of apprentices and furthermore they explained that in their opinions the changes had a deskilling effect on the trade.

Summary and conclusions

When comparing the data collected from the stage III Metal Fabrication and Welding (Heavy) apprentices who completed the exit tests in 2001 to those who completed the exit tests in 2004 at TAFE NSW which was brought about by the changes to on-the-job training of the course structure, there was a decline in exit knowledge in the mean scores of the apprentices. In the Hunter Institute the same pattern occurred, when comparing 2001 to 2004 results, which was lower in exit knowledge score.

There were no significant differences between the different NSW Institute's results in 2004 which indicate that the level of material taught and learned on-the-job and off-the-job did not differ across the state.

At the interviews with the MF&W (Heavy) Teachers a majority indicated that the course did not meet industry needs except in the case of the welding component. They also felt that the fabrication part of the course lacked substance in the drawing interpretation, trade calculations and the computer aided drawing components of the course.

The teachers interviewed preferred the old method of teaching that of lock-step delivery over competency based training method and vast majority indicated that the CBT method had not improved the learning outcomes of apprentices since the changes that occurred in 1991.

The findings indicate that on-the-job assessment of the apprentice's training was in large measure ineffective due to the attitudes of the employers who were reluctant to participate in the system.

Based on the above findings, the study makes the following recommendations:

- There should be better communication and involvement between the employers and the organisation implementing the changes to the courses at all levels.
- More structured drawing interpretation material should be included in the trade course incorporating computer aided drafting techniques with the changes.
- Calculations relating to the trade be integrated through out the training package to enhance the competencies in the existing trade calculations.
- Due to the lack of underpinning knowledge when entering this area of the trade, the engineering drawing subject should be made compulsory for year 9 and 10 high school students before entering the trade course.

- The methods used in delivering the educational subject matter in the vocational education and training area should be reviewed.
- With the introduction of a new training package to the MF&W (Heavy) trade course in 2007, further research should be undertaken to evaluate the impact of the changes to the trade course. (Lidbury, 2007)

The Metal Fabrication and Welding (Heavy) training has come a long way since Federation in 1901, with minor but important changes occurring up to the 1990's. With the global market becoming a major factor in the manufacturing industry in Australia rapid changes had to be affected in Australia to keep pace with the market (Campbell, 2003). The continuing evaluation of changes and impacts on the trade and on industry and its training needs for the future should be a priority to determine the extent to which changing needs are met by training.

The introduction of changes in vocational education area of NSW in 2008 with the 21st Century project it has parallels with the Scott Report of 1990. Even though 18 years have passed, current thinking appears to be the same. What should have been said in 1990 "if it is not broken, there is a need to fix it".

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