Over recent years competency-based training and assessment have gained the attention of teachers and trainers. National competency standards for the teaching profession were the focus of an Australian Teacher Education symposium at which Leo Bartlett and Glen Evans were main contributors (Cairns, 1992). Later, the Australian College of Education published a collection of articles on the competency debate in Australian education and training (Collins, 1993). The most recent issue of The Australian Educational Researcher, a publication of the Australian Association for Research in Education, contains a discussion on the application of national standards for beginning teachers to initial teacher education (Preston & Kennedy, 1995). As the authors state the "development and application of competency standards in Australia have their recent origins in attempts to solve particular economic, industrial relations, labour market, and vocational education and training problems" (p.28). It is to competency-based training and assessment in vocational education and training that we now turn.

Competency-based training and assessment in the vocational education and training sector have been the focus of national and international conferences. The most prominent include "What Future for Technical and Vocational Education and Training?" (NCVER, 1992) and "Testing Times" (NCVER, 1993) sponsored by the National Centre for Vocational Education Research, and the "National Assessment Research Forum" (VEETAC, 1993a, 1992b, 1993c) managed by NSW TAFE Commission under the guidance of the Assessment Steering Group of the Vocational Education, Employment and Training Advisory Committee CBT Working Party. It is largely from these conferences that Hall (1994) draws examples in his review of research into competency-based training and assessment. From this review he found that "research into competency-based training and assessment is very thin indeed" (p.6) and that "policy decisions may have been made on flimsy, or non-existent, or negative research evidence" (p.20). The four main issues that arise from his research review concern transferability of skills, practicability and cost of a competency-based system, competency-based assessment, and learning improvement as a consequence of competency-based training. More recently, researchers from the University of South Australia and the National Centre for Vocational Education Research suggested that six features of competency-based training and assessment require consideration. These concern the implementation of the system; the notion of competence and the development of competency standards; the
development of national curricula in a competency-based mode; the
assessment of learning; and the provision of fair participation in a
competency-based education and training system (Harris, Guthrie, Hobart
& Lundberg, 1995).

Today I would like to share with you two studies undertaken within the
Bachelor of Education (Technical) course of the School of Adult
Vocational Education (now School of Adult Education), University of
Technology, Sydney. (For your information I shall hand out in this
session a list of the titles and authors of more than seven hundred
Bachelor of Education (Technical) research projects completed between
1984-93).

The first study, undertaken by a technical trainer within the Royal
Australian Air Force, used the Delphi technique to develop a
competency-based workplace assessment model suitable for use in the
aircraft maintenance environment. The second study, conducted by a
teacher in TAFE NSW, used an experiment to determine the effect of
grading competency-based tests on performance in electrical trades
subjects.

Toward Competency-Based Workplace Assessment for RAAF Aircraft
Technical Trades (Paul McGlynn, Technical Distance Learning Facility,
RAAF Williamstown)

Aircraft technical trade training within the Royal Australian Air Force
(RAAF) takes the form of Integrated Job Performance Training (IJPT), an
approach in which an employment related off-the-job course is conducted
concurrently with workplace attendance. The off-the-job component of
training is based on the national competency standards for the
aerospace industry which have been developed by the National Aerospace
Project and endorsed by the National Training Board. The off-the-job
training comprises theory developed from the National Aerospace
Curriculum, presented as self-paced learning packages and assessed by
paper-based multiple-choice examination papers. It was argued by the
researcher that although the national competency standards for the
aerospace industry are available for competency-based workplace
assessment, there is no formal and systematic approach to workplace
assessment.

Therefore, the purpose of the study of McGlynn was to review and
summarise the key issues in the current literature relating to
competency-based workplace assessment, and then share these issues with
a panel of experts with the aim of reaching consensus on a proposal for
a competency-based workplace assessment model and procedures suitable
for its implementation in the RAAF aircraft maintenance environment.

Literature Review
From the literature review emerged five questions that became the focus of the study:

- Which assessment methods will be the most effective and practical in collecting the evidence required?
- When and how will the assessment event be set up?
- What amount of evidence is regarded as sufficient for competency to be inferred?
- Who will assess the performance and what training will they need?
- How should demonstrated competencies be reported and recorded?

Method

Population. The method used for collecting data needed a target population which met the following criteria: a high standard of technical and trade knowledge, a wide range of workplace experience, and current training experience. The application of these criteria led to a target population of RAAF Senior Non-Commissioned Officer (SNCO) aircraft and avionics technicians employed in the RAAF School of Technical Training (RAAFSTT), the Technical Distance Learning Facilities (TDCFs), and the Field Training Flights (FTFs). The resultant population which met these criteria comprised 155 RAAF personnel spread geographically across Australia.

The accessible population did not equal the target population as the sponsors of the research believed that the inclusion of all SNCOs would place a large burden on the participating units, and hence recommended four SNCOs be selected for each unit. As a result of the restriction the accessible population of 78 members became the panel of experts for the Delphi technique. The distributions of target population and accessible population differed in representation by training areas (RAAFSTT, TDLF, and FTF). Furthermore, the officer-in-charge of each training facility was allowed and encouraged to select as many respondents as possible.

Instrument. The Delphi technique was considered to be the most appropriate method of collecting data. It is useful in situations where change is taking place and where experts are geographically widely spread. The Delphi technique has been used to elicit opinions about the demand and supply of accounting education for the future (Gonczi, Hager & Oliver, 1990) and for the development of competency standards for the accountancy and veterinary science professions.
The Delphi technique also had the advantage of involving persons who would ultimately be involved in the implementation of a workplace assessment system in the RAAF.

The Delphi technique used in the present study consisted of three rounds of questionnaires sent by mail to the panel of experts. The first round survey contained a questionnaire containing the five open-ended questions derived from the literature review. To ensure a common frame of reference for discussing issues in competency-based workplace assessment a background briefing paper and examples of national competency standards for the aerospace industry were included with the questionnaire.

The second round survey contained a series of questions seeking clarification of issues raised from the first round responses. Also included was an issues briefing paper which provided feedback from the first round responses by containing selected comments raised from collated responses from the first round questionnaire.

The third round survey included a draft proposal for the competency-based workplace assessment model and procedures for implementation. These were derived from the collated responses of the second round questionnaire. The panel of experts was asked to comment on the proposal.

An operational squadron questionnaire was designed to ensure consideration of the practical requirements of the proposed competency-based workplace assessment model and procedures. The survey package included a briefing paper, proposed workplace model and procedures, and operational squadron questionnaire.

Administration of Questionnaires. The three rounds of questionnaires were sent by mail to the section heads of each of the training facilities to be distributed to as many of their personnel as possible (with a minimum of four SNCOs for each training facility). It was claimed that this procedure allowed central points for the distribution and collection of questionnaires, and reduced the number of follow-up telephone calls. The operational squadron questionnaire was sent to the officer-in-charge for completion by all SNCO avionics and aircraft technicians.

Results

The first round response ratio was 58% (N=45) of the target population, the second round was 32% (N = 25) and the third round was 35% (N= 27) . The first, second and third round responses were not representative of accessible population in terms of the three training areas (TDLF, FTE & RSTT) but the differences were not significant. The response rate to
the squadron survey questionnaire was 59% (N=19).

The data elicited by the first round and second round were analysed and discussed in terms of each of the five research questions. From an analysis of the collated responses competency-based workplace assessment procedures were proposed for the RAAF's aircraft maintenance environment. The procedures were organised under the following headings:

- method of assessment
- how the assessment events will be set up
- amount of evidence required
- who will assess performance
- training required by assessors
- reporting and recording requirements

From an analysis of the responses to the five research questions, and other questions a model of competency-based workplace assessment for the RAAF's aircraft maintenance environment was proposed.

From the third round there were 10 responses which contained only statements of agreements to the draft competency-based workplace assessment model and procedures, while the other 17 responses fell into one of the categories of suggested improvements, commented on implementation, and disagreed with proposals.

Most respondents to the operational squadron survey questionnaire supported the proposed competency-based workplace assessment model and procedures. Only three indicated total disagreement.

As a result of the collation of responses to the three rounds of the Delphi technique, and an analysis of the views of respondents from the operational squadron a competency-based workplace assessment model and procedures was proposed by the researcher.

Discussion

The researcher considered that the issue briefing paper in the first round survey package may have had a limiting effect in that the panel of experts may have considered and examined only those issues in the paper. Also, the length and complexity of the paper may have deterred potential respondents.

By limiting the study to SNCOs it excluded corporals who, it was learned during the study, conduct workplace assessment of mechanic
level training. And it is the corporal rank that will provide most of
the supervisor assessors in the competency-based workplace assessment
scheme.

The Delphi technique contains a number of disadvantages that should be
considered. They include time considerations (for the present study
each round was in excess of six weeks), interest and commitment of
participants, and skill in written communication.

Recommendations (Research)

Recommendations for further study included an evaluation of the
proposed competency-based assessment model and procedures at an
operational squadron; case studies of the workplace assessment scheme
in different operational working environments such as aircraft
operational, squadrons, aircraft maintenance squadrons and aircraft
equipment maintenance squadrons; and analysis of national competency
standards developed by National Aeroskills Project so performance
criteria are specific to each weapons system, and development of
enterprise competency standards relevant to RAAF's aircraft maintenance
environment.

Effect of Grading for Competency-Based Tests on Student Performance for
Electrical Trades Students (Bob O'Brien, Electrical Trades,
Engineering Services, Mt Druitt College of TAFE)

Competency-based assessment is criterion referenced. Students or
trainees are assessed as either "competent" or "not yet competent". Howevet, as argued by McGraw (1993) and later Hager, Athanasou and
Gonczi (1994) there is nothing in a competency-based system which
prevents the introduction of gradings beyond this dichotomy. On the
other hand, they caution that because it is possible to grade in a
competency-based system it does not mean that it is desirable or
feasible. They consider question of grading is a policy decision
depending on factors such as the need to provide more comprehensive
information on performance, the motivational effect of higher grades,
the effect on learning, the pressure from commerce and industry, and
the requirements of higher education institutes for more information
for the purposes of competitive entry or articulation. According to
Byrne (1993) grading has its pros and cons. She emphasises the need
of employees who have to provide evidence of competency when seeking
appointment or promotion, and the need of employers looking for
guidance in the selection, promotion and compensation of personnel.
Hager, Athanasou and Gonczi (1994) provide further arguments for (and
against) competency-based education and training. According to them,
one reason for having grading is the richer information it gives
learners. Another they suggest is that grades may motivate learners to
achieve their potential.
The Vocational Education, Training and Employment Commission (VETEC) has also discussed the strengths and limitations of criterion-referenced assessment, recognised the concerns of students and employers that excellence should be acknowledged, and recommended further research be conducted into the acknowledgment of excellence in competency-based assessment (VETEC, 1991). Recently Cartwright (1993) found that 80 per cent of a sample employers in the sheetmetal industry considered that marks on student reports were a very important source of feedback on the performance of their apprentices. He concluded that further research needed to be undertaken into the provision of marks for competency-based tests in trade areas.

Gregor Ramsey (1993) managing director of TAFE, has asked the question, "Does the concept of competence include or preclude the notion of excellence?" and has acknowledged that NSW TAFE has received many requests from industry for adequate grading to be provided for vocational courses. Also Byrne (1993) states that a number of TAFE clients have expressed the need for graded results and concludes that much work has to be done to develop a valid and reliable procedure for providing graded competency assessments.

In the context of the discussion the relative advantages and disadvantages of competency-based assessment, and the need and demand for graded assessments for competency-based courses, O'Brien (1993) set out to investigate the merit of providing graded results for competency-based assessment. Prior to data collection he formulated the hypothesis that: Students who have their work graded require less retests to achieve competency than students who do not have their work graded.

Method

Subjects The experimental group comprised 45 students in stage one (15) and stage two (30) of the Electrical Trades course at Lithgow College of TAFE, and the control group comprised 45 students in stage one (15) and stage two (30) of the Electrical Trades course at Mt Druitt College of TAFE.

The groups were similar in terms of the on-the-job component of their apprenticeship training in that the subjects in each group were employed by a variety of employers such as electrical generation and supply corporations, large and small industrial manufacturing companies, large and small contracting businesses, and group apprenticeship schemes.

Any difference in student performance caused by geographical influences were considered minimal due to the proximity of Lithgow to Mt Druitt which was supported by the fact that many students from each college
live in the Blue Mountains area.

Research Design. In semester one and semester two the experimental group and control group were provided with similar learning conditions. However, in semester one both groups were assessed without grading being applied, while in semester two the experimental group was assessed with grading and the control group without grading. Table 1 shows the experimental design.

Table 1

In this study the independent variable was considered to be method of competency-based assessment which takes the form of either graded or non-graded and the dependent variable to be total number of retests to achieve competency. Possible extraneous variables include differences in student characteristics expertise of teachers, college facilities and place of residence. However, a form of pre-testing during the first semester prior to the manipulation of the independent variable in second semester provided some measure of equivalence of groups.

Tasks. The tasks were the normal competency assessments for each module which were developed by the Engineering Services Training Division of NSW TAFE. These assessments, having been developed through the Industry Training Division, are accepted as valid and reliable instruments for the measurement of student competencies in the modules in the Electrical Trades course. There are nine competency tests (one for each module) for each of the stages.

Procedure. At the start of semester one students in each group were informed that for each module they would be permitted to have one retest for any failed section of the test, and that the test result would be "pass" or "fail" with no grading. At the time this was current practice for the Electrical Trades course throughout NSW. Students completed identical test papers for each module.

At the start of semester two students in the experimental group were informed that in future grading in the form of marks would be applied to all module assessments and that marks would be sent to their employer. A retest would be required for any failed section of the test. The control group had the same condition as in semester one in which there was no grading other than "pass" or "fail".

Results

Figure 1 shows the total number of retests required by each group for each semester. In semester one the experimental group needed, on the average,
3.89 retests, and the control group, 4.51 retests. This difference is not significant (t = 0.87, p > .05). Therefore, the groups were considered equivalent prior to the manipulation of the independent variable.

In semester two mean number of retests for the experimental group was 1.86, while the mean for the control group was 3.52. This difference is statistically significant (t = 3.12, p < .01). The findings, therefore, appear to support the hypothesis that students who have their work graded require less retests to achieve competency than students who do not have their work graded.

Discussion

The results showed that in semester one when the students in both groups were aware that there would be no grading of module assessment there was no significant difference between the two groups in terms of number of retests to achieve competency. However, in semester two when the students in the experimental group were told that grading would be applied to each module test and students in the control group told that, as in the previous semester, there would be no grading other than "pass" or "fail", the number of retests needed by the experimental group was less than that required by the control group. The researcher considered that the provision of grading for competency-assessed modules increased student motivation and improved performance.

Little research had been carried out in this area. The findings of the present study support Byrne (1993) who cited a study in which it was found that a good criterion-referenced grading system would provide students a motive to master the basic knowledge/skills and then go on to pursue excellence. The findings are consistent with the view of Hager, Athanasou and Gonczi (1994) that grading may motivate learners to achieve their potential; and with the argument of Thomas (1993) who stated that for the pursuit of excellence, it is necessary to recognise better performance and that the provision of grading is consistent with the philosophy of competency-based assessment.

The results, however, do not support the view expressed by VEETAC (1993d) that people would be encouraged to reach their potential if the assessment was simply satisfactory" or "not yet satisfactory". On the other hand, the VEETAC CBT Working Party Assessment Steering Group (1993a) did concede that many people believed that competency-based assessment could and should enable excellence to be rewarded, and that this would not impede competency-based assessment in ensuring satisfactory performance.
O'Brien points to some limitations to the study which may affect its validity. As the number of students was small and chosen from the total population of students (approximately 4,000 electrical trades students in NSW), and only two colleges were represented it restricts generalisation beyond the population of the Electrical Trades Section of Lithgow College of TAFE. Also due to the short space of time available for the study, it is not known what would be the long term effect of grading on motivation and performance.

Recommendations (Research)

One of the recommendations was that the study be replicated using a larger sample and involving a greater number of colleges. Also, it was suggested that if the study was conducted over a longer period of time than that of the present study, then it might be possible to establish the long-term effects of grading on student performance.

References


