CREATION AND EVALUATION OF A WORKPLACE BASED CERTIFICATE IN OFFICIAL STATISTICS FOR GOVERNMENT POLICY MAKERS.

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Statistics New Zealand recently developed a pre-university Certificate of Official Statistics aimed at increasing the statistical literacy of government policy advisors. It has four compulsory statistics units taught by academics from several New Zealand universities together with Statistics New Zealand staff, and one optional unit. Student cohorts are kept small and both the learning and assessment is based on real statistical, research, policy and media publications. The assessment is competency based and students can re-sit questions until a satisfactory standard is achieved. The first cohort of students (enrolled in 2007) was used as a pilot and evaluated for the appropriateness of the learning, possible enhancements to assessment questions and the impact of their prior level of statistical knowledge, motivation and management support on the time taken to complete units. The results of this evaluation are given together with the resulting changes made to the Certificate.

INTRODUCTION

For some time concerns had been expressed by Statistics New Zealand managers and Chief Executives of other government agencies that staff did not have as high a level of statistical skill as in the past, and that it was becoming more difficult to retain those staff that did have statistical skills. A Victoria University of Wellington pilot study (Macky & Saffron, 2004) and Statistics New Zealand consultation with statisticians and policy managers in 18 agencies established a lack of quantitative skills across the state sector and identified areas needing improvement as:

a) Basic quantitative skills
b) Basic statistical skills and literacy
c) Professional development
d) General statistical knowledge
e) Specialised areas of statistics (e.g. cohort and longitudinal analysis).

In response Statistics New Zealand developed a basic qualification that would enable government employees to obtain the required statistical literacy skills. This paper discusses the form, content and assessment in this qualification, the National Certificate in Public Sector Services (Official Statistics), herein called the Certificate in Official Statistics. The first cohort of students participating in the certificate was viewed, in part, as a pilot, and they were surveyed together with their managers and the assessor. This evaluation resulted in some changes to the teaching and assessment questions. Factors related to the time students took to complete units within the certificate were also investigated.

INFLUENCES ON THE FORM OF THE CERTIFICATE

There are some fundamental differences between official (government) statistics and other forms of statistics and research. Official statistics are usually based on large surveys or administrative data (to allow the characteristics of small groups to be investigated), involve complex sample designs, have broad coverage but often at a high level of measurement and often (in New Zealand) have mandatory participation. Balances need to be made in official statistics between: statistical and administrative needs; continuity (time series) and relevance (new statistics to meet emerging needs); providing access to data and maintaining confidentiality of respondents; minimising the burden on respondents while maximising the information gained; providing objective baseline information and

responding to policy demands for increased understanding of social and economic phenomena, and pragmatism and timeliness or quality (robustness). Official statistics need to be 'fit for purpose' and usually come with a high cost. Information technologies have created efficiencies but these have been offset by the increased demand for new statistics relevant to today's environment and for longitudinal information. Generally, only simple analyses are done by the collectors of official statistics, who provide a primary data source for other researchers to use. However, there are usually constrains on access to these data sets. One of the distinguishing features of official statistics is that they are subject to ethical considerations (for example, the ten Fundamental Principles of Official Statistics adopted by the United Nations Statistics Commission (United National Statistics Commission, 1994)) and legislative constraints (such as those defined in the Statistics Act 1975). For government employees to provide good advice to their managers or directly to Government through its Ministers they need to collect, interpret and present a base of evidence. That is, they require basic numerical and statistical literacy skills and an understanding of the official statistics available to them.

There have been changes to workplace based learning in New Zealand. In 1989 the New Zealand Qualifications Authority (NZQA), was established and the legislative base for the National Qualifications Framework was set as

> '*a flexible system for the gaining of qualifications, with recognition of competency already achieved*', section 253 (c). (Education Act, 1989).

Assessment in the units of learning (unit standards) registered on this framework focuses on measuring learner performance against published standards (New Zealand Qualifications Authority, 1991 cited in National Qualifications Project Team, 2005). Students are assessed on a competency basis and are able to re-sit parts of, or whole, units until they meet the required standard (within a specified timeframe). There are also no formal requirements to undertake specific learning, with both prior knowledge and workplace based (manager) evaluations being allowed for. Capper (1996) suggested that the determinants of competence used in standards based assessment on the National Qualifications Framework should be an amalgam of work, training and assessment making the maximum use of performance events across a number of competencies. With competency-based assessment, the only variables available for analysis are the number of re-sits and the time taken to completion. Curson (2004) reported that factors related to the non-completion of workplace-based learning were having training of low quality or low relevance to learners' skill needs, learners moving jobs to a different employer or industry and learners needing structured time and support in the workplace.

Given the above influences, and the fact that it was not an education provider, Statistics New Zealand collaborated with the State Services Commission (agency responsible for cross-departmental state sector issues) and Learning State (the Industry Training Organisation responsible for state sector training). Together they developed a Certificate in Official Statistics specifically designed to enhance the statistical literacy of state sector employees, that took account of the evidence in the two studies above, that some employees and managers preferred short courses to the traditional year-long university courses and that getting a formal qualification in statistics was an incentive to study. The certificate was based on statistical thinking theory (Wild & Pfannkuch, 1999) but focused on official statistics as well as general statistics methods.

THE CERTIFICATE OF OFFICIAL STATISTICS

The goal of the Certificate is to enable policy analysts to critically evaluate statistics releases, research reports and published policy and media documents for their appropriateness and quality of information about a given policy question (such as, how to reduce unemployment). Basic statistics, official statistics and non-statistical aspects are covered. There is open entry to the certificate with only a basic level of numeracy being assumed and it is a vocational (pre-university) level qualification. The certificate comprises four compulsory statistics units and one of a number of optional general units (e.g. project management, research report). A group of academics from

statistics departments in the seven main New Zealand universities came together, advised on the number and content of each unit and agreed to work collectively with Statistics New Zealand to deliver the four statistics units: Unit Standard 23268 (US 68) *Interpret statistical information to form conclusions for projects in a public sector context;* Unit Standard 23269 (US 69) *Evaluate and use statistical information to make policy recommendations in a public sector context;* Unit Standard 23270 (US 70) *Assess a sample survey and evaluate inferences in a public sector context;* Unit Standard 23271 (US 71) *Resolve ethical and legal issues in the collection and use of data in a public sector context*. Two of these unit standards (US 68 and US 70) are at level 4 on the framework (equivalent to final year secondary school) and two (US 69 and US 71) are at level 5 (first year undergraduate degree). These four units account for 24 of the 40 learning credits in the certificate, and the optional unit for 16. Overall, the certificate was assessed to be at level 4. One university was contracted to formally assess these units and the certificate was registered on the National Qualifications Framework in July 2007.

Within the compulsory units teaching is in full day blocks in a traditional classroom setting using small workshops. Both the learning and assessment focus on evaluating real statistical, research, policy and media publications. The course providers agree annually on two publications that will be used as case studies for teaching in all four units, and two others for assessment. Examples of those used in teaching include: Household Labour Force Survey media releases, (Statistics New Zealand, 2007 and 2008); an evaluation report commissioned by the Ministry of Social Development (Ferguson at al, 2005); the 2001 Māori Language Survey (Te Puni Kokiri, 2002); excerpts from the New Zealand Health Surveys, 2002/3 and 2006/07 (e.g. Mason and Arnold, 2007); and media articles such as *'Gore the least gay town in New Zealand'* (Gault & Chapple, 2007). Examples used in assessment include: Innovation in New Zealand 2005 (Statistics New Zealand, 2007); Retail Trade Survey media release (Statistics New Zealand, 2008); an education research report (Russell & Haney, 1997); and the 2006 Maori Language Survey (Te Puni Kokiri, 2007). Students are required to give their answers to key assessment tasks in the context of the two supplied reports. Answers are completed in the student's own time (supposedly over a three week period) then submitted to the assessor either in writing or orally (but most choose in writing).

The size of student cohorts in the certificate is kept small (fewer than 25) and the certificate was run for the first time in 2007 with 13 candidates, all but one from within Statistics New Zealand. It was expected that students would take a year to complete the qualification and 10 of these did so. These 13 students (and their managers) were interviewed while they were participating in the certificate, as described below.

EVALUATION OF THE 'PILOT' CERTIFICATE

Methodology

By the time (November 2008) of the evaluation all 13 students had completed at least one unit standard. The measures used to evaluate the four compulsory units in the certificate were:

a. The level of complexity of the assessment questions in each unit was analysed using a method designed by Murray Black (described in detail in Forbes et al (2008)) where each question receives a score according to the following increasing level of complexity: 1=Idiosyncratic; 2=Verbal; 3=Transitional; 4=Procedural; 5=Integrated Process.
b. The students' views of the certificate were surveyed using a structured questionnaire with open-ended responses. Reasons for enrolling in the certificate were obtained from 8 students and used to determine their level of motivation. Those that enrolled to increase their statistics knowledge or assist with career advancement were classed as 'high', and those who wanted a refresher or to contribute to the pilot process were classed as 'low' motivation. The students' managers were surveyed for their expectations, support and perception of the statistical skills of learners prior to enrolment.

c. Feedback was sought from the assessor on the influence of the form or content of the assessment questions on students' completion.

Results

Assessment questions were written by the course providers, but the scoring of their complexity was done by the assessor. The two level 4 standards had considerably more questions at the lowest two levels of statistical reasoning and higher mean complexity scores than the two level 5 units providing reassurance that there was a difference between the two levels.

The most common reasons given by the students for enrolment were to improve their statistical knowledge and promotion prospects, or as a refresher course. Students with little or no prior knowledge of statistics found the statistical content difficult compared to those with some prior knowledge. A number stated that they initially found the assessment questions difficult, as they were not sure what was expected. All the students reported that there was a tension between completing of assessments and work and personal life. Most gave the certificate a relatively low priority but some worked on several units at the same time. Some also mentioned that fixed deadlines would have given them more incentive to complete sooner. In general, the students seemed to have been given very little support from their managers. One manager stated "*I relied on the Certificate process to help her (tutoring, study groups, etc)*". Most managers indicated that it was too soon to determine if the certificate had met their expectations and had a '*wait and see*' attitude regarding its impact in the workplace. However, the managers of 6 students stated that there was a noticeable increase in their confidence.

The order of presentation of the unit standards to this first cohort of students was US 70, US 68, US 69 and US 71 and a small group managed to complete each unit standard in the time given. However, most were given extensions from the three weeks. There was a lot of variation in the time taken to complete each unit with a range over all four units of from 4 to 240 days. The assessor identified barriers to completion as: timing (allocated time too short, not enough time between courses); design of the assessment questions (e.g. no example covering the content in the given reports), problems in teaching (concepts not covered in enough depth, limited support for weaker learners, etc.); and other student specific factors (such as, reluctance to request assistance, order of doing assessments, time management and work commitment conflicts). Half or more (77%, 67%, 50% and 60% respectively) of students in each unit standard re-sat at least one question. Again, the assessor identified the reasons for needing a re-sit on at least one question as teaching, assessment design or student specific (incomplete or too brief answers). The assessor suggested that there was a higher proportion of re-sits in the level 4 (US68 and US70) than the level 5 units (US69 and US71) because student incorrectly explained statistical concepts. Over all units, the major cause of re-sits was that questions were not answered fully enough. He suggested that the questions themselves were part of the reason for this.

There was no obvious relationship between the student's motivation and their prior statistics knowledge (for the 8 candidates for whom both items of information were available). That is, the low motivation candidates were not necessarily those with low prior background. There was no consistent pattern across all the unit standards between the time taken to complete a unit standard and the prior level of statistics (as perceived by students' managers) but the median time for completion was substantially longer for candidates with low motivation than for those with high motivation in all the compulsory units. At present the duration of the Training Agreement for the certificate is 12 months but Learning State allowed the pilot candidates two three month extensions (one for operational reasons). Of the 13 students in the first cohort 10 (77%) completed the whole certificate, and 11 (85%) completed all four compulsory unit standards, in the eighteen month timeframe. One learner completed the certificate even though he changed workplaces midway through (contrary to the findings of Curson (2004) that changing workplaces is a barrier to course completion).

Changes to the certificate

The assessor made the following suggestions for improvements to the assessment: having fewer questions; linking assessment components across unit standards; assessing more components as part of the teaching process; producing exemplars; using workplace evidence with workplace verification where possible; introducing a component in the assessment to see if learning is maintained over time; using questions that are applicable to the assessment report rather than having 100% coverage of content; choosing reports so coverage of content isn't always the same; and exploring the use of group assessments. Not all of these suggestions were implemented, but the following changes were made for the second student cohort. The number of assessment questions in units US 69, US 70 and US 71 were reduced and the question order aligned with the five stages of statistical reasoning. Overlaps in questions requiring similar answers between units were removed and linkage provided across units. Exemplars and/or worked examples used in teaching were fine tuned to indicate what was required in the assessment. The order of delivery of the unit standards was changed so that legal and ethical constraints (US 71) were considered within a report before the various statistical concepts (US 68, US 70 and US 69). One of the course providers made substantial changes to the style of their delivery in response to student feedback, and tutorial and mentoring systems for learners were extended. Although it was intended that this certificate include workplace based learning and assessment these students were only asked to use examples from their own workplace in one of the possible optional units. A new 'umbrella' unit consisting of a project based in the learner's own workplace was registered on the National Qualifications Framework in December 2008 to replace the optional units. The assessment for the new unit will include an evaluation from the student's manager.

CONCLUSIONS

Even though this evaluation was undertaken at an early stage, (while the students were still completing the certificate) it was possible to use the results to make a number of improvements to the certificate. The time taken to complete individual units varied markedly between students and, even though there was only a small sample in this analysis (8), it did seem to be related to the students' level of motivation. As the time allowed for completion of the whole certificate was extended to eighteen months for these students, this will require further monitoring. One way that the success of the certificate can be measured is by future enrolments. A second cohort of 16 candidates was enrolled in the certificate in April 2008 and a third group of 14 in September 2008. These candidates are mainly from state sector agencies other than Statistics New Zealand (e.g. New Zealand Police Department and the Department of Labour). Early interest has also already been registered for 2009.

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