The Development of a Framework for Assessing Complexity of Units of Learning Across Schools, VET and Higher Education

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ABSTRACT

The Victorian Qualifications Authority (VQA) developed a draft Credit Matrix Model for recognising the complexity of learning units delivered across the three educational sectors in Victoria, namely senior secondary education, Vocational Education and Training and the higher education sectors. This paper reports on the empirical validation of the complexity component of the model, in particular, the appropriateness of the domains and indicators of learning thought to capture increasing complexity. To examine the validity and reliability of the draft Complexity Model, the indicators for each domain were empirically tested and validated through survey techniques. Participants were requested to a) supply background information about the unit of learning; b) judge which of the indicators within each measure best captured the complexity of their unit; and c) rate each measure on its perceived effectiveness in defining the true complexity of the unit. Two hundred and fifty four (n=254) people responded to the survey. Of these people, 31% represented senior secondary education, 44% represented the VET sector and 25% represented Higher Education. Item Response Modelling was then used to evaluate the psychometric properties of the measures as well as to empirically develop and define levels of complexity within and across the measures. The data collected demonstrated the validity, accuracy and internal consistency of each Complexity Measure. The results also showed that the correlations among the five measures were significant, yet moderately positive, thus having direct implications for the factor structure that should underpin the Complexity Framework. Two variations of the framework were produced from this initial investigation: a six level structure and an eight level structure, each underpinned by the five domains: Application, Autonomy, Accountability, Problem Solving and Knowledge.

BACKGROUND

The Victorian Qualification's Authority (VQA) sought to develop a common approach to describing and recording achievement in post compulsory qualifications available in Victoria. The approach, referred to as the Credit Matrix was designed, amongst other things, to improve qualification linkages and pathways. A central, and indeed the most complex aspect of developing the model, was the identification of an effective approach to describing complexity of learning.

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Based on extensive national and international research, as well as a detailed analysis of approaches taken elsewhere, the VQA adopted a 'bottom up' approach to the development of overarching levels and level descriptors. The VQA identified the key underpinning factors that characterised increasing complexity of learning.

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A background study to the current investigation was undertaken to inform the development of the Credit Matrix. A number of international qualifications and credit frameworks were reviewed including: England/Northern Ireland/Wales, Ireland, Scotland, South Africa and New Zealand. While these frameworks have distinctive structures, they are typically organised into levels, with domain based taxonomies

An analysis of these existing frameworks informed the development of the preliminary constructs:

- Application
- Accountability
- Autonomy
- Knowledge
- Problem Solving.

The following table represents a synthesis of relevant international credit frameworks against these constructs.

Proposed constructs	**Ireland**	**Scotland**	**Wales**	**New Zealand**	**South Africa**
Knowledge	Knowledge – breadth and kind	Knowledge and understanding	Intellectual skills and attributes	Learning demand (employing…)	Applied competence
Problem solving	Know how and skill –selectivity	Generic cognitive skills			
Application	Know how and skill – range	Communication, ICT & numeracy skills Practice: Applied knowledge and understanding	Processes	Process (carry out…)	
Autonomy/ Accountability	Competence – context, role, learning to learn, insight	Autonomy, accountability and working with others	Accountability	Responsibility (applied…)	Autonomy of learning

The final development of the scales for the Credit Matrix were based on an analysis of the international frameworks, taxonomies related to novice to expert (Dave 1967, 1970, Bondy 1983 and Benner 1984), cognitive processes and types (Bloom 1956, Anderson & Krathwohl 2001, Webb 1999) and psychomotor complexity (Gallahue, 1996; Gallahue & Ozmun, 2002; Gentile 2000; Graham, Holt-Hale, Parker, 2001), as well as that of the *Register of Australian Tertiary Education (RATE*) (1991).

CURRENT INVESTIGATION

This paper reports on the empirical validation of the draft complexity model, in particular, the appropriateness of the domains of learning thought to underpin the Credit Matrix Model, including each domain's set of indicators thought to capture increasing complexity. To examine the validity and reliability of the draft Complexity Model, it was proposed that the indicators for each domain be empirically tested and validated through survey techniques. The analysis of the survey data would enable the:

- investigation of the ordered nature of the indicators within each domain, as well as the identification of redundancy and non-discriminating indicators.
- items to be calibrated on a single continuum, thus enabling the relative difficulty of each indicator to be determined not only within the domain, but across domains. This will assist with determining whether the domains are underpinned by an overarching single dimension, and if so, will enable the development of a single set of band level descriptors to define the model.
- relationships between the five domains to be determined;
- typical patterns of domain ratings within and across the three educational sectors to be explored.

The 'inherent' level of difficulty of each of the five domain indicators was to be determined on a single measurement scale through item response modelling procedures. This is different to all other models that have been analysed where each indicator had a presumed equivalent complexity indicator for another domain.

The Target Population

The 'target population' (Rust & Ross, 1997) of the study was defined as all personnel responsible for making state-wide decisions of a unit's[1] credit level point and volume within Senior Secondary Education, Vocational Education and Higher Education. However, this population represented a very small number of people whom occupied positions in either the VCAA, the OTTE or university (faculty specific) course accreditation committees and who possessed subject matter expertise. As a sufficient sample size was required to empirically validate the model with minimal measurement error, the 'target population' was redefined to include all senior secondary teachers, vocational educational trainers and higher educational lecturers who were responsible for delivering teaching and/or training in Victoria against the unit that would ultimately be assigned a credit level point. It was acknowledged however that this group of people would be the end users of the Credit Matrix (i.e., they would not be responsible for attributing volume or credit points to a unit, but instead would be users of this information).

A sample was selected in order (a) to provide variability on the measures used to assess the domains of complexity, and (b) to provide a representative mixture of units or modules offered within senior secondary education, vocational education and higher education. A sample was drawn from the consultant's and the VQA's existing network of contacts within schools, RTOs and university faculties, where a number of institutions were nominated to be representative of the redefined 'target population'. Due to anonymity of responses being assured to all participants, the names of the organisations involved have been withheld from this report.

[1] A unit could refer to a 'unit of competency', 'subject' or 'module'.

Questionnaire Development

The basic approach taken during the construction of the domains and subsequent 'indicator calibration' was based on a combination of both theoretical and psychometric approaches to scale development. The theoretical approach was used to initially identify a set of domains that could be used to recognise varying levels of complexity of units across the three educational sectors. Each domain was operationalised into a variable using indicators identified in international models as well as the literature, and were panelled on representatives within each of the educational sectors. Each indicator was reviewed according to the principles underpinning rubric development that were developed by Griffin (2000). In accordance with these principles, the indicators, when ordered in increasing complexity, were reviewed to ensure that they:

- illustrated a developmental learning pathway;
- were internally coherent in that the set of indicators describe a single underlying domain;
- were clearly differentiating movement from one indicator to the next;
- were transparent and explicit in their description of what was meant by increasing complexity within the domain; and
- represented a wide range of levels of complexity (i.e., across all qualifications within the Australian Qualifications Framework).

Each domain with its associated indicators is presented in Table 1.

The domains were then translated into questionnaire items, with each domain treated as a separate item. Participants were required to select the indicator within each domain ***that best described*** the complexity of learning associated with achievement of the outcomes of the unit. Participants were instructed to focus on the learning outcomes to be achieved. There was also opportunity for participants to provide written feedback to the researchers on each domain. The questionnaire is presented in Appendix A.

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Table 1:
The domains and indicators underpinning the Draft Complexity Model.

Domain (item)	Indicator
Domain 1: Application *The context in which the skills and knowledge are to be applied.*	1.1 The skills and knowledge to be acquired are to be *applied* in *stable* contexts involving *defined* and *predictable* variables. 1.2 The skills and knowledge to be acquired are to be *applied* in *changing* contexts involving *defined* and *predictable* variables. 1.3 The skills and knowledge to be acquired are to be applied and *contextualised* in *changing* contexts, involving *defined* but *unpredictable* variables. 1.4 The skills and knowledge to be acquired are to be *integrated*, contextualised and applied in *complex* and *changing* contexts, involving *broadly defined* and *unpredictable* variables. 1.5 The skills and knowledge to be acquired are to be integrated, contextualised and applied to influence *future* contexts.
Domain 2: Autonomy *The amount of guidance and the clarity of parameters in which individual or group activities are to be performed.*	2.1 Individual or group activities are undertaken within *clearly* defined parameters performed with *minimal* discretion under *close* guidance. 2.2 Individual or group activities are undertaken within *clearly* defined parameters performed with *some* discretion under *frequent* guidance. 2.3 Individual or group activities are undertaken within *clearly* defined parameters performed with a *significant* degree of discretion under *general* guidance. 2.4 Individual or group activities are undertaken within *broad* parameters performed with *minimal* guidance. 2.5 Individual or group activities are self-directed and are undertaken within *few* parameters, performed with *minimal* guidance.
Domain 3: Accountability *The degree of accountability for the processes and outputs of oneself and others*	3.1. Activities are undertaken with *minimum* accountability for own processes and outputs, within *clearly* defined parameters. 3.2. Activities are undertaken with *some* accountability for own processes and outputs, within *clearly* defined parameters. 3.3. Activities are undertaken with *full* accountability for own processes and outputs, within defined parameters. 3.4. Activities are undertaken with *full* accountability for *own* processes and outputs, and *some* accountability for processes and outputs of *others*, within *defined* parameters. 3.5. Activities are undertaken with *full* accountability for *own* processes and outputs, and *full* accountability for processes and outputs of *others*, within *broad* parameters. 3.6. Activities are undertaken with *full* accountability for *own* processes and outputs and *full* accountability for processes and outputs of *others*, with *few established* parameters.
Domain 4: Problem Solving *The type of problems to be solved and the strategies to be employed.*	4.1. *Established* guidelines and processes and past precedents are *used* to address *routine* problems. 4.2. *Established* guidelines are *interpreted* and *applied* with minor variations to processes, to address *routine* problems. 4.3. *New* guidelines are *developed* individually or in collaboration with others, to address *non-routine* problems. 4.4. New guidelines and processes are *identified* and *developed* to predict and/or address significant, *complex* or *emergent* problems. 4.5. Conceptual frameworks are used to formulate and test *problems* that make a significant *contribution* to theory, method or practice.
Domain 5: Knowledge *The kind of knowledge involved (ranging from concrete to abstract to metacognitive to strategic to new)*	5.1. *Concrete* or *factual* in reference, and basic in comprehension. 5.2. *Concrete* in reference, with *some comprehension* of relationships between knowledge elements. 5.3. *Concrete*, with *some* elements of *abstraction* or theory. 5.4. *Theoretical* and abstract, with significant *depth* in a number of areas. 5.5. *Theoretical* and abstract, with significant *underpinning theory*. 5.6. *Metacognitive*, in that learners must recognize limitations of current knowledge and have familiarity with sources of new information and integration of concepts across a variety of areas. 5.7. *Strategic*, in that learners must demonstrate a critical awareness of current problems or insights generally agreed to be at the forefront of a field of learning. *5.8. New* knowledge, in that the learners must create and interpret new knowledge through original research, or other advanced scholarship of a quality to satisfy peer review.

Data Collection Procedures

In the first instance, senior personnel within the nominated organisations were approached to provide approval at the organisational level to participate in the study. Once consent was obtained at the organisational level, individual personnel were then approached to voluntarily participate in the investigation by completing and returning the questionnaire. All participants were briefed about the aims and objectives of the study both verbally and in writing (refer to Attachment B). Anonymity of responses was maintained at all times.

The following materials were provided to participants:

- The questionnaire (refer to Appendix A),
- A written statement explaining the aims of the project and the voluntary nature of participation.

Participants were requested to first identify a unit of learning (i.e., a unit of competency, module or subject), which was to form the focus of the questionnaire. They were then requested to complete the questionnaire by: -

1. Supplying background information about the unit under investigation (eg unit title, qualification title, industry/discipline area and its relationship to a qualification).
2. Judging which of the indicators within each domain best captured the complexity of the unit. Each domain was scored using the associated indicator levels, which ranged from a minimum of 5 to a maximum of 8 statements.
3. Rating each domain on its perceived effectiveness in defining the true complexity of the unit.
4. Providing optional written feedback on each domain.

These items are illustrated on the questionnaire in Appendix A.

The Sample

Two hundred and fifty four (n=254) people responded to the survey. Of these people, 31% represented senior secondary education, 44% represented the VET sector and 25% represented Higher Education. A range of learning areas was evaluated using the questionnaire. The listing of learning areas per educational sector is reported in Appendix B, whilst the discipline/industry areas are reported in Appendix C. Table 2 presents the number of questionnaires that were completed on a unit of learning that was to lead toward specific qualification levels within the Australian Qualifications Framework (AQF).

Table 2:
Number of units surveyed per qualification in each educational sector.

	AQF Level	*Frequency*	*Percentage*
Senior Secondary Education	VCAL	12	4.7%
	VCE	67	26.4%
Vocational Education & Training	Certificate I	13	5.1%
	Certificate II	13	5.1%
	Certificate III	20	7.9%
	Certificate IV	39	15.4%
	Diploma	20	7.9%
	Advanced Diploma	6	2.4%
Higher Education			
	Bachelor Degree	35	13.8%
	Grad Dip (or Post Grad Dip)	10	3.9%
	Masters Degree	15	5.9%
	Doctoral Degree	4	1.6%
Total		254	100%

It can be seen that the sample was representative of units offered across all levels of senior secondary education, vocational education and higher education.

RESULTS

A Relationship among the Domains

To examine the interrelationships among the five domains, Pearson's product moment correlations were computed using SPSS 11.5. These are displayed in Table 3.

Table 3:
Correlations among the Domains.

	Application	Autonomy	Accountability	Problem Solving	Knowledge
Application	1	.505(**)	.456(**)	.595(**)	.639(**)
Autonomy		1	.529(**)	.526(**)	.543(**)
Accountability			1	.447(**)	.442(**)
Problem Solving				1	.591(**)
Knowledge	.				1

** Correlation is significant at the 0.01 level (2-tailed).

Table 3 indicates that there were significant positive correlations among the six domains. The highest correlation estimate was between Knowledge and Application (r=0.64, p<0.01), which simply means that as the type of knowledge to be learnt increased in complexity, so too did the context in which the skills and knowledge were to be applied. The significant positive correlation among the other domains can be interpreted in the same manner (i.e., high scores on one domain were associated with high scores on another domain and visa versa). It should be acknowledged however that whilst all correlations were significant, they were moderate (ranging from 0.44 to 0.64).

This is an important finding as previous discussions with stakeholder representatives focused upon the notion of whether or not there should be five separate domains represented in the Complexity Model. In particular, some people were of the opinion that the Accountability and Autonomy domains may be measuring the same thing, and therefore should be represented as a single domain. However, the moderate correlation (r=0.53, p<0.01) between these two domains indicated that although there was some common variance in the ratings, each domain explained some unique variance. In fact, there were no two domains rated similar enough to warrant the merging of any two domains.

B The precision and accuracy of the domain measures

The precision and accuracy of the domain measures was determined through the examination of the *fit* of the five items to the Rasch Model (Rasch, 1960). This provides a means of determining how accurately the domains described the complexity of the learning area. Investigation of the fit of the five items to the Rasch model provided a means of determining how accurately the Complexity Model could be used to describe participants' ratings of unit complexity[2]. The relationship between 'item difficulty' and 'unit complexity' should be such that as unit complexity increases, the chances of a person judging a unit at a high level of complexity should also increase. When the relationship between item difficulty and unit complexity breaks down, the fit statistic indicates the extent to which the relationship has been lost. If an item is 'misfitting' it raises the question as to whether the item should be excluded from the model. However, omission of items from a measure (in this case, the domain from the complexity model) should not be based purely upon statistical information, but

[2] As each domain was treated as a separate item in the questionnaire, an 'item' refers to the domain question.

instead, it should be based upon a combination of both statistical considerations, as well as a value judgement of the domains substantive contribution to the interpretation of the complexity model.

The five items were calibrated using the Rasch measurement program Quest (Adams & Khoo). When the Rasch model fits the data, it is expected that the fit statistic (INFIT) would produce a value of 1. It is generally considered that a 30 percent variation is acceptable in most cases, so the limits of a fit statistic are *usually* set at 0.7 and 1.3 (Adams & Khoo, 1996). An item that overfits the Rasch model (i.e., has a value less than 0.7) indicates that the item contributes little additional information to the scale that is not already provided by the other items (or domains). That is, it indicates redundant or highly dependent domains. Alternatively, when an item underfits the Rasch Model (i.e., has an INFIT value of >1.3), this indicates that there is random error. That is, there is an inconsistent pattern of responses on that particular domain which may indicate guessing among the respondents. When the item sets are all within the acceptable range of 0.7 – 1.3, this is taken as evidence of a dominant construct underpinning the responses of the people to the items within the scale. Figure 1 depicts the fit of the items to the Rasch Model.

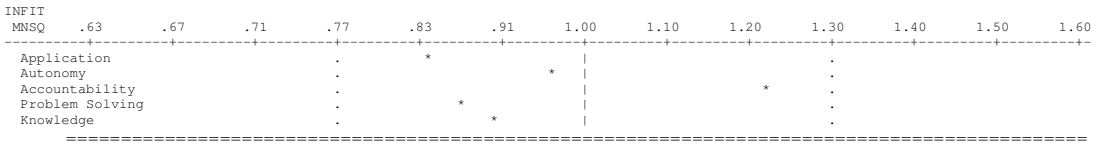

Figure 1: The fit of the items (Domains) to the Rasch Model.

Each of the five domains produced acceptable fit estimates thus providing evidence of construct validity. Furthermore, as there were no overfitting items, there is additional support there are five separate, yet related, domains that underpin the Complexity Model. The scale also had an internal consistency estimate of 0.83 (cronbach alpha), indicating high reliability (as indicated by the internal consistency).

C Indicator difficulty estimates

Each of the indicators used to define the Application, Autonomy, Accountability, Problem Solving and Knowledge domains of complexity were calibrated using item response modelling (IRM) (Rasch, 1960). Through the use of a partial credit model, the same scale of measurement was developed for expressing both indicator difficulty and unit complexity. This resulted in a difficulty estimate being developed for each of the indicators within a Domain, as well as an overall complexity estimate being developed for each unit.

The estimates for each indicator/unit were expressed in a metric called a 'logit'. The logit values are an indication of the indicator's complexity, with low values representing low complexity, high values representing high complexity (the same logic is applied to the unit's estimate of complexity, which is also reported on the same metric scale as the indicator difficulty estimates). A logit scale has equal interval units of measurement. This means that not only can the indicators (or units of learning) be ranked in order of increasing complexity, but also, the complexity differences between indicators (or units of learning) can be directly compared with one another (e.g. the difference between a logit value of 1.2 and 1.4 is the same as the difference between 0.8 and 1.0 etc).

The calibration estimates for the indicators are presented in Table 4. For each indicator, the summary statistics are as follows. The % represents the *percentage* of the sample that selected that particular indicator from the range of indicators within the domain. Next, the indicator difficulty estimates is reported as the *Logit* value. The standard error of measurement associated with each difficulty

estimate (*SE*) is then reported. The indicators are numbered and presented in the Table 4 according to decreasing difficulty.

Table 4:
Calibration estimates for the indicators within each of the five domains.

Indicator		%	Logit	SE
5.8	New knowledge, in that the learners must create and interpret new knowledge through original research, or other advanced scholarship of a quality to satisfy peer review.	2.4	3.10	0.51
2.5	Individual or group activities are self-directed and are undertaken within few parameters, performed with minimal guidance.	4	2.92	0.44
3.6	Activities are undertaken with full accountability for own processes and outputs and full accountability for processes and outputs of others, with few established parameters.	3.6	2.84	0.47
1.5	The skills and knowledge to be acquired are to be integrated, contextualised and applied to influence future contexts.	11.3	2.03	0.29
5.7	Strategic, in that learners must demonstrate a critical awareness of current problems or insights generally agreed to be at the forefront of a field of learning.	5.7	2.03	0.41
4.5	Conceptual frameworks are used to formulate and test problems that make a significant contribution to theory, method or practice.	10.8	1.91	0.31
3.5	Activities are undertaken with full accountability for own processes and outputs, and full accountability for processes and outputs of others, within broad parameters.	8.4	1.74	0.35
2.4	Individual or group activities are undertaken within broad parameters performed with minimal guidance.	17.3	1.22	0.31
5.6	Metacognitive, in that learners must recognize limitations of current knowledge and have familiarity with sources of new information and integration of concepts across a variety of areas.	17	0.89	0.30
4.4	New guidelines and processes are identified and developed to predict and/or address significant, complex or emergent problems.	15.7	0.88	0.27
3.4	Activities are undertaken with full accountability for own processes and outputs, and some accountability for processes and outputs of others, within defined parameters.	22.9	0.55	0.28
5.5	Theoretical and abstract, with significant underpinning theory.	14.6	0.32	0.26
1.4	The skills and knowledge to be acquired are to be integrated, contextualised and applied in complex and changing contexts, involving broadly defined and unpredictable variables.	31.9	0.25	0.27
4.3	New guidelines are developed individually or in collaboration with others, to address non-routine problems.	20.1	0.05	0.27
5.4	Theoretical and abstract, with significant depth in a number of areas.	11.7	-0.13	0.27
2.3	Individual or group activities are undertaken within clearly defined parameters performed with a significant degree of discretion under general guidance.	35.9	-0.41	0.29
1.3	The skills and knowledge to be acquired are to be applied and contextualised in changing contexts, involving defined but unpredictable variables.	19	-0.56	0.28
3.3	Activities are undertaken with full accountability for own processes and outputs, within defined parameters	39.8	-1.30	0.30
5.3	Concrete, with some elements of abstraction or theory.	26.3	-1.41	0.30
1.2	The skills and knowledge to be acquired are to be applied in changing contexts involving defined and predictable variables.	27	-2.53	0.34
2.2	Individual or group activities are undertaken within clearly defined parameters performed with some discretion under frequent guidance.	33.5	-2.81	0.38
4.2	Established guidelines are interpreted and applied with minor variations to processes, to address routine problems.	46.2	-3.25	0.41
5.2	Concrete in reference, with some comprehension of relationships between knowledge elements.	16.2	-3.31	0.41
3.2	Activities are undertaken with some accountability for own processes and outputs, within clearly defined parameters.	22.5	-4.47	0.59
4.1	Established guidelines and processes and past precedents are used to address routine problems.	7.2		
1.1	The skills and knowledge to be acquired are to be applied in stable contexts involving defined and predictable variables.	10.9		
2.1	Individual or group activities are undertaken within clearly defined parameters performed with minimal discretion under close guidance.	9.3		
3.1	Activities are undertaken with minimum accountability for own processes and outputs, within clearly defined parameters.	2.8		
5.1	Concrete or factual in reference, and basic in comprehension.	6.1		

The range of indicator difficulty estimates provide an indication of the range of complexity levels that the instrument is able to measure with reasonable precision[3]. The indicator difficulty estimates (logit values) ranged from +3.10 to >-4.47, a range of more than 7.79 logits.

[3] The mean indicator difficulty was arbitrarily set to be zero.

The analysis showed that the most difficult indicator to assign to a unit was from the Knowledge Domain, indicator 5.8 (logit value of +3.10), followed closely by indicators 2.5 and 3.6 (logit values +2.92 and +2.94, respectively). Next, were indictors 1.5, 5.7, 4.5 and 3.5 and so on. As expected, the easiest indicators to assign to a unit were the first indicators from each of the five domains of learning[4]. In fact, all 254 units that were evaluated, had a complexity level at or above the easiest indicator within each domain. This illustrated that the first indicators on each domain were collectively easier than any of the units evaluated, even those that were related to Certificate I (e.g., work education units). At the other end of the scale, only two of the 254 units that were evaluated, were rated at or above the most difficult indicator (i.e., Indicator 5.8). All other units had a complexity estimate that was within the range of the difficulty estimates of the domain indicators.

Given the logit range and the relatively small measurement errors, it appeared as though the indicators permitted the reliable measurement of the domains over a broad span of unit complexity.

The complexity estimates of each of the 254 units surveyed and the indicator difficulties were then simultaneously plotted on a chart called a variable map, which illustrates the relative complexity of the unit and the difficulty of the indicators. This has been shown in Figure 2.

On the left of the variable map is the logit scale ranging from -5.0 to +4.0. The variable map also represents the complexity estimates of the unit, represented by Xs (where each X represents 2 learning areas). On the same measurement scale is also the difficulty estimates of each indicator within each domain. Again, a two-digit code is used to identify each indicator (e.g. 2.1 refers to Domain 2, Indicator 1 etc).

In this example, the unit complexity estimates varied from–4.77 logits to +3.95 logits, a range of 8.72 logits, indicating a large range of unit complexity. This is not surprising given the sample of units surveyed was deliberately targeted to be representative of qualifications across the entire AQF. As the indicator difficulty estimates also had a large logit range (i.e. > 7.79 logits), this indicates that the range of complexity estimates of the 254 units surveyed was well matched to the range of difficulty levels of the domain indictors.

[4] Note that the first indicator within each domain does not have a logit score estimated. This is because the partial credit model estimates the amount of complexity required from moving from one indicator to the next within a domain (hence if there is five indicators within a domain, four thresholds are estimated). Although it is uncertain as to the exact logit value of each domain's first indicator, it is known that they had greater than –4.47 logit scores. As such, they have been placed at the bottom of the table and represent the easiest indicators in the model.

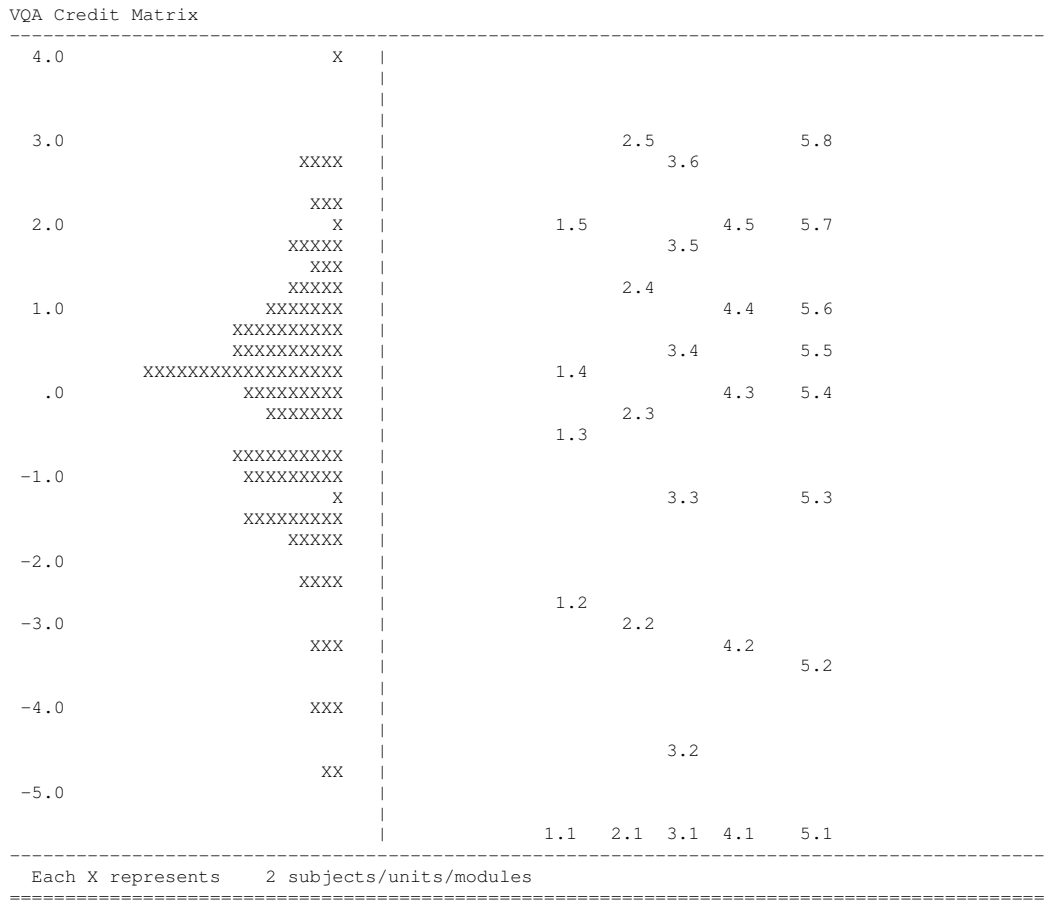

Figure 2: Variable Map of the Draft Complexity Model.

D Units within qualification complexity estimates

The average logit estimate for each qualification was also produced from the complexity estimates of each unit, according to its relationship to a qualification. These are presented in Table 5 and have been ordered in terms of increasing complexity.

Table 5:
Average logit scores for units within each qualification level.

AQF Title	Mean Logit score	N	Std. Deviation
Cert I	-3.74	13	2.14
Cert II	-2.05	13	1.46
VCAL	-0.99	12	0.94
Advanced Diploma	-0.89	6	0.94
Cert III	-0.41	20	1.32
VCE	-0.38	67	1.63
Cert IV	0.09	39	1.33
Diploma	0.17	20	0.76
Bachelor Degree	0.44	35	0.91
Graduate Diploma (or Post Grad Dip)	1.03	10	0.67
Doctoral Degree	1.71	4	1.29
Masters Degree	1.74	15	1.06
Total	-0.27	254	1.74

It can be seen that the units that were related to Certificate I were, on average, judged as the least complex units of learning (average logit score of –3.74), whilst those that were aligned to the Masters program, were, on average, judged as the most complex (average logit score of 1.74). However, due to the small number of units within some of the qualifications (namely the Advanced Diploma and the Doctoral program), some of the units had to be regrouped into broader qualification levels. The regrouped average difficulty levels of each the units within each of the broader qualifications are presented in Table 6 below.

Table 6:
Mean logit scores for units within recoded qualification levels.

AQF Grouping	Mean	N	Std. Deviation
CERT I & II	-2.90	26	1.99
VCAL	-0.99	12	0.94
VCE	-0.38	67	1.63
CERT III & IV	-0.08	59	1.33
DIP & ADV. DIP	-0.08	26	0.91
BACHELOR	0.44	35	0.91
GRAD / P.GRAD DIP	1.03	10	0.67
MASTERS & DOCTORAL	1.74	19	1.07

There were too few units reviewed within the VCAL program to determine whether there were significant differences between the mean (average) logit score for the VCAL and VCE subjects. However, a significant difference[5] was found between the mean logit values for units within 'Cert I & 'II and those within the 'VCE', with the former being perceived as significantly less complex. Furthermore, the VCE subjects were also seen as equivalent in complexity as all units of competency that were to be packaged toward certificate III and above in the VET sector. Furthermore, there was no significant differences between the units of competencies that were packaged toward Certificate III right through to Diploma/Advanced Diploma in terms of overall perceived complexity. There were however significant differences between units of competency that were aligned toward VET qualifications at or above Cert III, and units of learning offered within Bachelor Degrees programs in higher education, with the latter judged as more complex. Due to the small sample size of the Grad Dip units, tests of equality of means were not performed. As expected, the master and doctoral subjects were, on average, rated more significantly complex than subjects within the Bachelor Degree.

E Determining levels of complexity - cut point decisions

The next step was to determine how many levels should be included in the overall Complexity Model, and where the cut points should be set. Two options have been presented. The first presents a case for recognising 6 levels of complexity based upon the research findings. Secondly, an alternative option for recognising 8 levels has also been presented to be consistent with other international models.

E.1 Six Levels of Complexity

The difficulty estimates (logit values) of each of the indicators reported in Table 4 were plotted in decreasing order. The set of indicators were then examined to identify specific clusters or groupings to determine cut-points for varying complexity levels within the model. The chart in Figure 3 reveals where the nature of the indicators changed in terms of difficulty.

[5] Mean logit scores for each qualification were tested for significant differences using a series of independent sample t-tests at the 0.05 level.

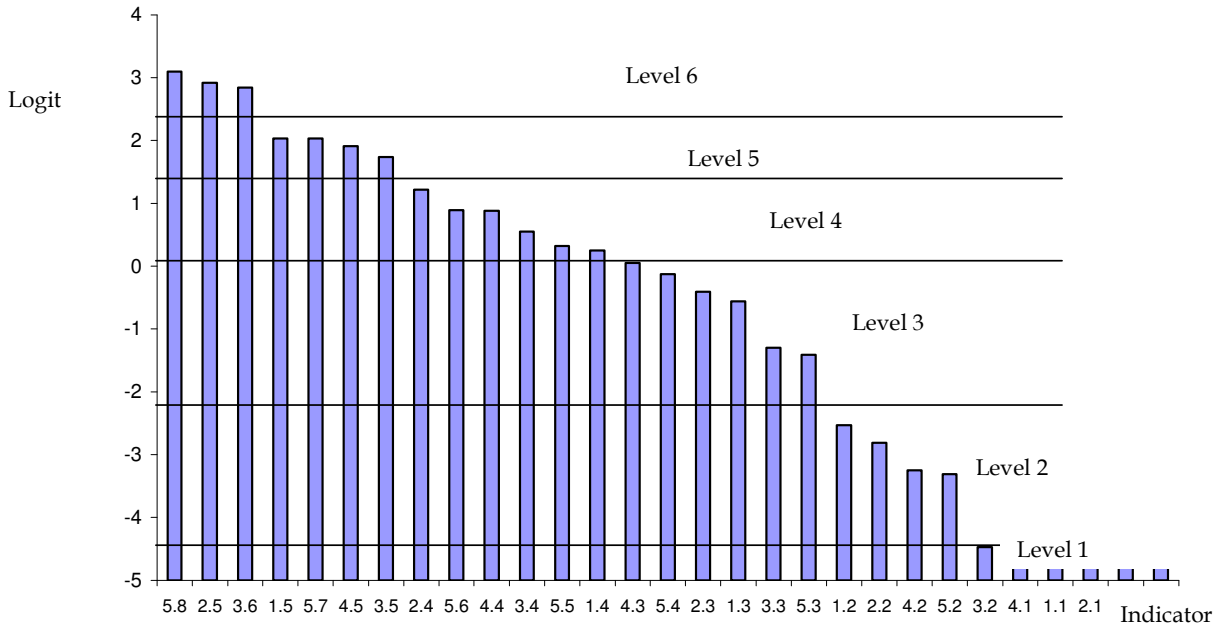

Figure 3: Relative difficulty estimates of each indicator and cut points for complexity level.

Five cut points were identified that showed clear groupings of indicators according to similar difficulty estimates. The separation of the levels is indicated by the straight lines in Figure 3, with indicators 5.8, 2.5 and 3.6 forming Level 6, then indicators 1.5, 3.5, 4.5 and 5.7 forming Level 4 etc.

Deleted: Six

To further investigate the appropriateness of the six cut points, the characteristics of the units that were typically positioned at each level were examined according to the unit's relationship to a qualification (as determined by the average complexity estimates of the units within each qualification). The variable maps in Figures 4 presents the:-

- six cut-points for the Complexity Model
- positioning of each indicator on the logit scale (as reported in Table 4), and
- average complexity estimates of the units within each qualification (as reported in Table 6).

Figure 4 also presents the percentage of units surveyed that were judged to be at each of the six levels.

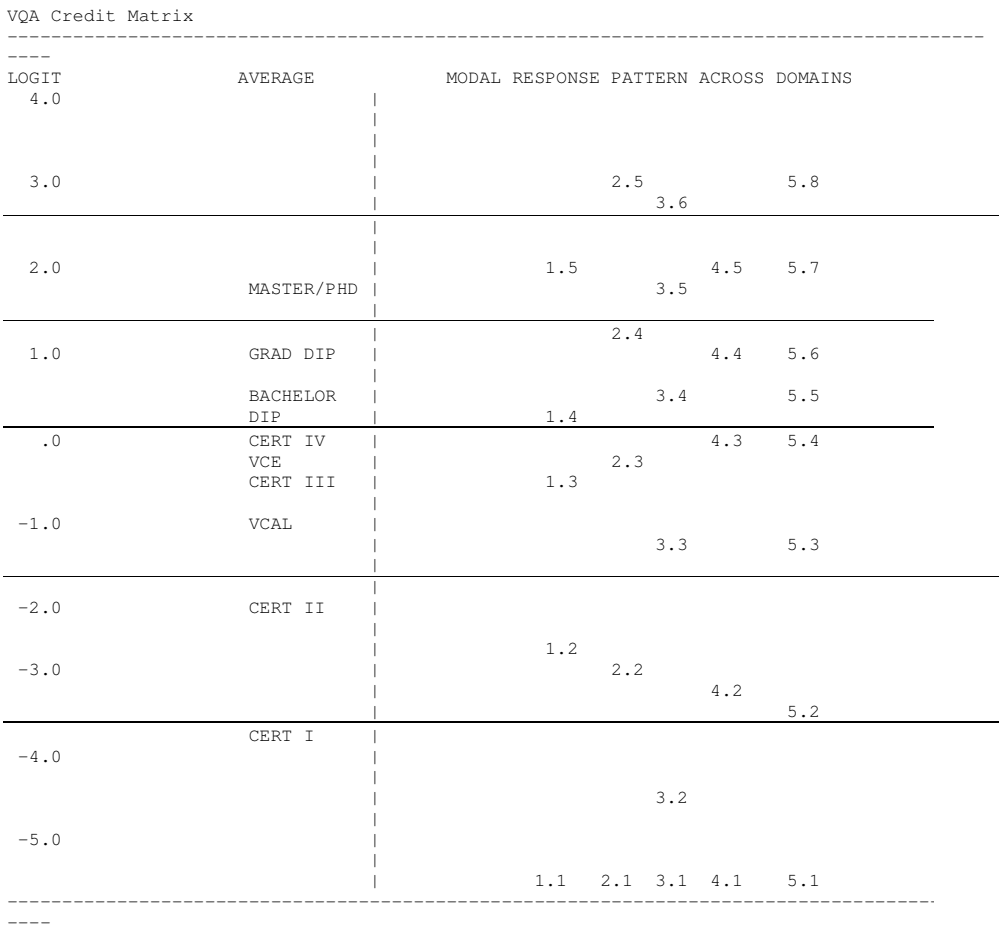

Figure 4: The average difficulty level of each unit according to its relationship to the AQF and the difficulty levels of the indicators, according to a six level model.

The proposed six-level model is presented below.

	Application	Autonomy	Accountability	Problem solving	Knowledge
Level 6		Individual or group activities are self-directed and are undertaken within few parameters, performed with minimal guidance.	Activities are undertaken with full accountability for own processes and outputs and full accountability for processes and outputs of others, with few established parameters		New knowledge, in that the learners must create and interpret new knowledge through original research, or other advanced scholarship of a quality to satisfy peer review.
Level 5	The skills and knowledge to be acquired are to be integrated, contextualised and applied to influence future contexts.		Activities are undertaken with full accountability for own processes and outputs, and full accountability for processes and outputs of others, within broad parameters.	Conceptual frameworks are used to formulate and test problems that make a significant contribution to theory, method or practice.	Strategic, in that learners must demonstrate a critical awareness of current problems or insights generally agreed to be at the forefront of a field of learning.
Level 4	The skills and knowledge to be acquired are to be integrated, contextualised and applied in complex and changing contexts, involving broadly defined and unpredictable variables.	Individual or group activities are undertaken within broad parameters performed with minimal guidance.	Activities are undertaken with full accountability for own processes and outputs, and some accountability for processes and outputs of others, within defined parameters.	New guidelines and processes are identified and developed to predict and/or address significant, complex or emergent problems.	Theoretical and abstract.
Level 3	The skills and knowledge to be acquired are to be applied and contextualised in changing contexts, involving defined but unpredictable variables	Individual or group activities are undertaken within defined parameters performed with a significant degree of discretion under general guidance.	Activities are undertaken with full accountability for own processes and outputs, within defined parameters	New guidelines are developed individually or in collaboration with others, to address non-routine problems.	Concrete, with some elements of abstraction or theory.
Level 2	The skills and knowledge to be acquired are to be applied in changing contexts involving defined and predictable variables.	Individual or group activities are undertaken within defined parameters performed with some discretion under frequent guidance.		Established guidelines are interpreted and applied with variations to processes, to address routine problems.	Concrete in reference, with some comprehension of relationships between knowledge elements.
Level 1	The skills and knowledge to be acquired are to be applied in stable contexts involving defined and predictable variables.	Individual or group activities are undertaken within clearly defined parameters performed with minimal discretion under close guidance.	Activities are undertaken with some accountability for own processes and outputs, within clearly defined parameters.	Established guidelines and processes and past precedents are used to address routine problems.	Concrete or factual in reference, and basic in comprehension.

Figure 5: The Proposed Six-Level Complexity Model.

To investigate the influence of the units' relationship with each of the qualifications on the six levels of complexity, a series of cross tabulations were undertaken from the recoded qualification groupings described in Table 6. Using the unit logit estimates of the level of complexity, the units were classified to be operating at one of the six band levels. The band levels were then cross tabulated with the recoded qualification levels and the results are displayed as a bar chart in Figure 6. In this figure, the Complexity Level is labelled on the y axis and the number of units is reported on the x axis. The key is used to determine the qualification type.

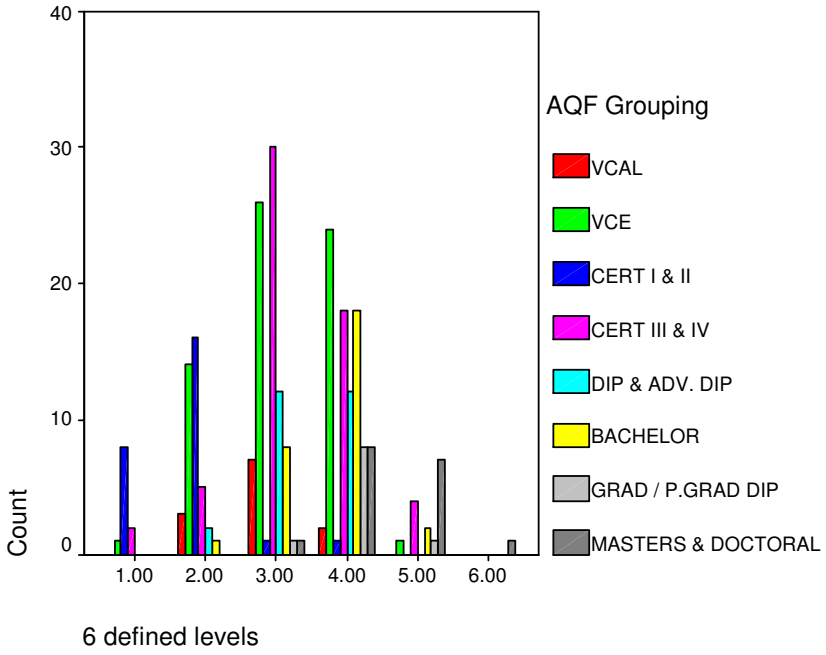

Figure 6. Qualification characteristics of the units aligned to each of the six levels of Complexity.

It can be seen that of the 11 units that were classified at Level 1 on the Complexity Model, the majority packaged toward a Certificate I qualification. There were no higher education units that were classified at this band level. Of the 42 units that were classified at Level 2 on the Complexity Model, most were either units of competency that led toward Certificate I or II qualifications, or VCE subjects. Of the 86 units that were classified at operating at Level 3 of the Complexity Model, the majority were either leading toward the VCE or Cert III or IV qualifications. A similar pattern of the qualifications was found at Level 4, but in addition, there was also a stronger representation of Bachelor Degree subjects and some post graduate subjects. Of the 6% of units that were classified at Level 5, the majority were either master or doctoral subjects with less than 5 units of competency from the VET sector classified at this level.

Similarly, at the highest level of the Complexity Model, the 1% of the units at this level were all masters and doctoral subjects.

E.2 Eight Levels of Complexity

This process was repeated, but this time with the a priori decision of recognising 8 levels within the model (to be more in line with its international counterparts). Again, the logit values of each of the indicators reported in Table 4 were plotted in decreasing order. The set of indicators were then examined to identify 8 or possibly 9 specific clusters. Figure 7 reveals where 8 levels could be identified.

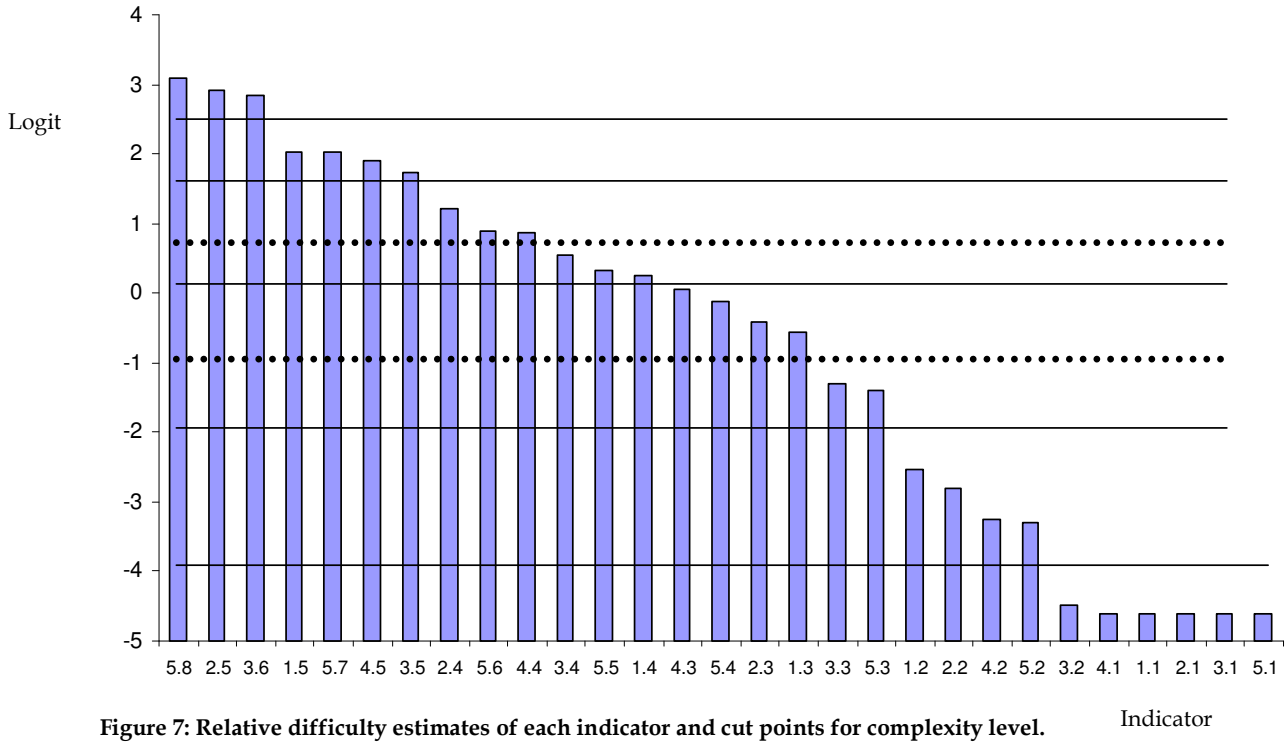

Figure 7: Relative difficulty estimates of each indicator and cut points for complexity level.

In this example, the two highest and the two lowest levels have the same cut points as the previous model (refer to Figure 3). That is, the same indicators are positioned within Levels 1, 2, 7 and 8 in the Eight-Level Complexity Model as Levels 1, 2, 5 and 6 respectively, in the Six-Level Model. However, the models differ in that the Eight-Level model has finer cuts in the middle of the logit scale. These are represented by the dotted lines in Figure 7.

The variable map is presented in Figures 8, including the percentage of units surveyed that were judged to be at each of the eight levels.

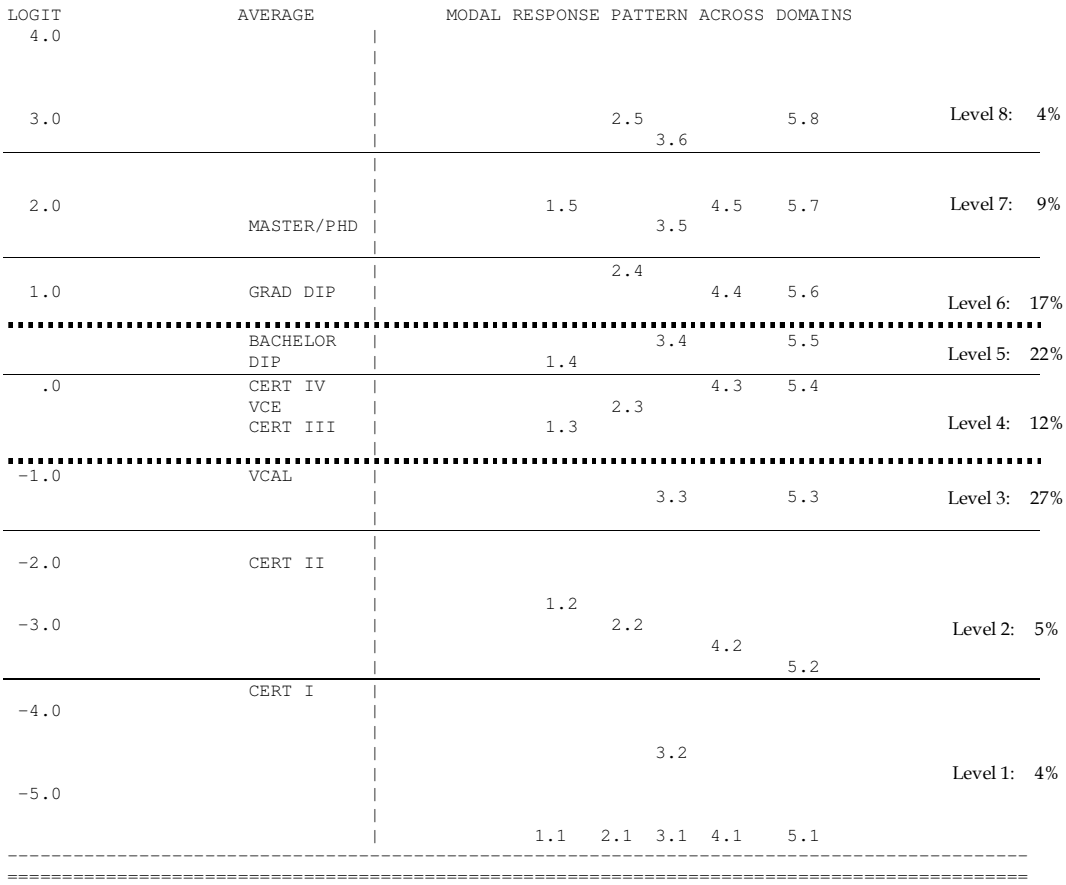

Figure 8: The average difficulty level of each unit according to its relationship to the AQF and the difficulty levels of the indicators according to an eight level model.

The Complexity Model with eight levels is presented below.

	Application	Autonomy	Accountability	Problem solving	Knowledge
Level 8		Individual or group activities are self-directed and are undertaken within few parameters, performed with minimal guidance.	Activities are undertaken with full accountability for own processes and outputs and full accountability for processes and outputs of others, with few established parameters		New knowledge, in that the learners must create and interpret new knowledge through original research, or other advanced scholarship of a quality to satisfy peer review.
Level 7	The skills and knowledge to be acquired are to be integrated, contextualised and applied to influence future contexts.		Activities are undertaken with full accountability for own processes and outputs and full accountability for processes and outputs of others, within broad parameters	Conceptual frameworks are used to formulate and test problems that make a significant contribution to theory, method or practice.	Strategic, in that learners must demonstrate a critical awareness of current problems or insights generally agreed to be at the forefront of a field of learning.
Level 6		Individual or group activities are undertaken within broad parameters performed with minimal guidance.		New guidelines and processes are identified and developed to predict and/or address significant, complex or emergent problems.	Metacognitive, in that learners must recognize limitations of current knowledge and have familiarity with sources of new information and integration of concepts across a variety of areas.
Level 5	The skills and knowledge to be acquired are to be integrated, contextualised and applied in complex and changing contexts, involving broadly defined and unpredictable variables.		Activities are undertaken with full accountability for own processes and outputs, and some accountability for processes and outputs of others, within defined parameters.		Theoretical and abstract, with significant underpinning theory.
Level 4	The skills and knowledge to be acquired are to be applied and contextualised in changing contexts, involving defined but unpredictable variables	Individual or group activities are undertaken within defined parameters performed with a significant degree of discretion under general guidance.		New guidelines are developed individually or in collaboration with others, to address non-routine problems.	Theoretical and abstract, with significant depth in a number of areas.
Level 3			Activities are undertaken with full accountability for own processes and outputs, within defined parameters		Concrete, with some elements of abstraction or theory.
Level 2	The skills and knowledge to be acquired are to be applied in changing contexts involving defined and predictable variables.	Individual or group activities are undertaken within defined parameters performed with some discretion under frequent guidance.		Established guidelines are interpreted and applied with variations to processes, to address routine problems.	Concrete in reference, with some comprehension of relationships between knowledge elements.
Level 1	The skills and knowledge to be acquired are to be applied in stable contexts involving defined and predictable variables.	Individual or group activities are undertaken within clearly defined parameters performed with minimal discretion under close guidance.	Activities are undertaken with some accountability for own processes and outputs, within defined parameters.	Established guidelines and processes and past precedents are used to address routine problems.	Concrete or factual in reference, and basic in comprehension.

Figure 9: The Proposed Eight-Level Complexity Model.

Again, the eight band levels were cross-tabulated with the recoded qualification levels and the results are displayed as a bar chart in Figure 10.

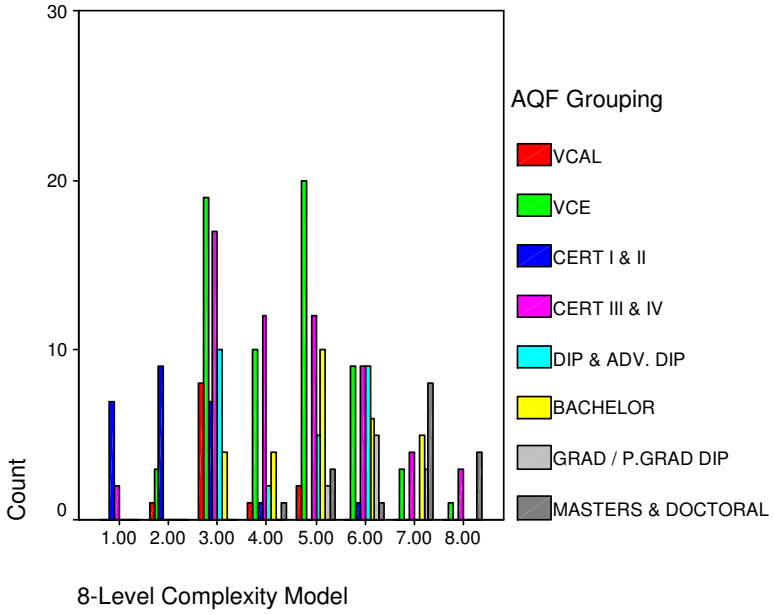

Figure 10. Qualification characteristics of the units aligned to each of the eight levels of Complexity.

It can be seen that of the 6 units that were classified at Level 1 on the Complexity Model, the majority packaged toward a Certificate I & II qualifications. A similar pattern was found for those at Level 2 of the Complexity Model. There were no higher education units that were classified at either Complexity Level 1 or II. Of the 73 units that were classified at Level 3 on the Complexity Model, most were units of competency that led toward either Certificate III or IV qualifications, or VCE subjects. A similar pattern was found for those at Level 4 and 5. At level 6, there was a mixture of units from senior secondary, VET and Higher Education. Whilst at Level 7 & 8, most units were at the Master's and PhD levels. *Hence, with the introduction of more band levels, there were fewer tendencies for a band level to be characterized by certain qualifications.*

F Perceived Importance of each domain

Finally, the participants were asked to rate the level of importance of each domain on a 7 point scale, rating from 1 "not at all" to 7 "extremely". Figures 11-15 present the modal response of participants according to the qualification level of the unit in which they were judging. Note that on the vertical axis is the code that relates to the level of importance with 1 referring to "not at all" to 7 " extremely important".

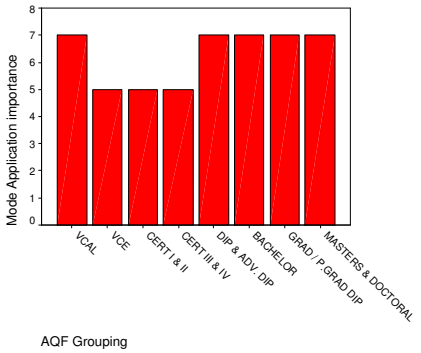

Figure 11: Modal response for perceived level of importance for the Application Domain according to qualification type.

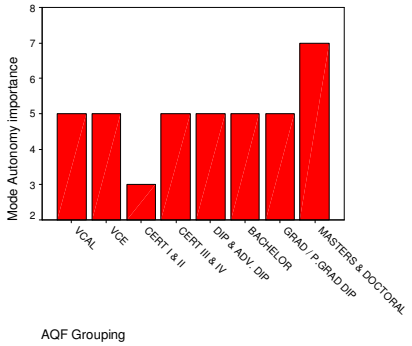

Figure 12: Modal response for perceived level of importance for the Autonomy Domain according to qualification type.

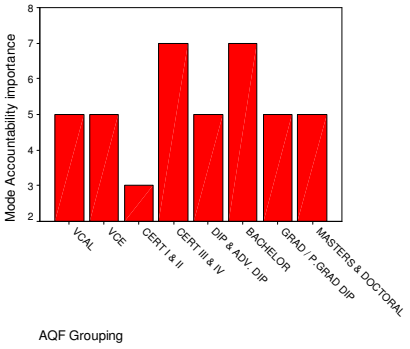

Figure 13: Modal response for perceived level of importance for the Accountability Domain according to qualification type.

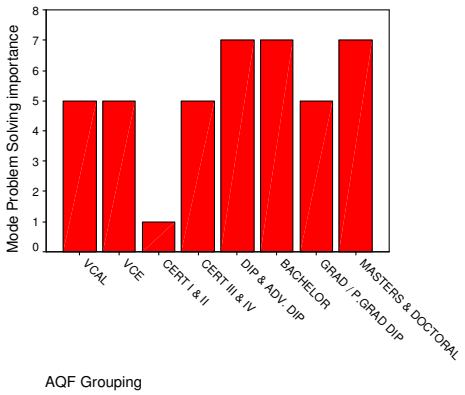

Figure 14: Modal response for perceived level of importance for the Problem Solving Domain according to qualification type.

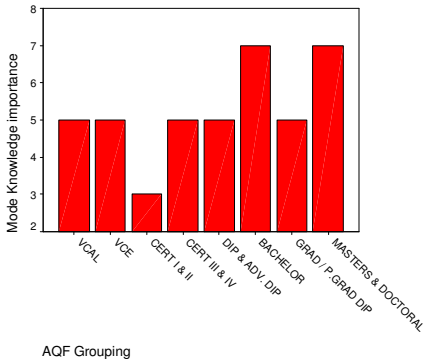

Figure 15: Modal response for perceived level of importance for the Knowledge Domain according to qualification level.

It can be seen that all units that were evaluated across all qualifications, with the exception of Certificate I and II, thought that each of the domains were reasonably to extensively important in capturing the complexity of the unit. Whereas with Certificate I and II, most people thought that only the Application Domain was reasonably important, whilst Knowledge, Autonomy and the Problem Solving domains were 'somewhat important', and the Accountability 'not at all'.

CONCLUSIONS AND RECOMMENDATIONS

This study sought to empirically validate the five complexity measures thought to underpin the Credit Matrix, namely Knowledge, Autonomy, Application, Accountability and Problem Solving. It was shown that each of these five domains contributing some unique variance, as indicated by the moderate correlation coefficients. Such variations indicated that the units were judged to be at different levels across each domain and as such, each was an important factor in profiling the complexity level of the unit. Furthermore, participants tended to rate each domain as reasonably to extremely important in terms of effectively defining complexity. Consequently, it is recommended that each domain should remain as a separate domain within the overall model.

The study also demonstrated that when each of the five domains was calibrated on a single scale, each provided accurate measurements of complexity, as indicated by their fit estimates. The findings therefore provided evidence of the construct validity of the model. The scale also had an internal consistency estimate of 0.83 (cronbach alpha), indicating high reliability. As such, the five domains were shown to be both valid and reliable measures of complexity.

The study also showed that the indicators within each domain had varying estimates of difficulty, which spanned across the entire Australian Qualifications Framework (AQF). The positioning of the units, according to their estimated difficulty level, was also shown to conform to the AQF, such that units aligned to Certificate I were judged to less complex than those at Certificate II, and so on. As expected, those units delivered as part of a masters or doctoral degree were shown to be the most complex. Hence, the model demonstrated high levels of face validity within all three educational sectors.

The findings also revealed that each indicator produced a unique difficulty estimates, such that a rating of 4 on one domain, was not necessarily as difficult as a rating of 4 on another domain. It is

therefore recommended that further refinements to the model should maintain the inherent difficulty estimates of each indicator, and that each domain should preserve its variable number of indicators.

Finally, an analysis of the clustering of the indicators across all five domains produced two alternative models, one based on a six level model, the other on an eight level. The former was the preferred model as a) the cluster and positioning of the indicators on the scale led to clearer differentiation, and b) the clustering and positioning of the units within each level showed greater alliance to the AQF. As such, the six-level model was thought to increase consistency of unit ratings by judgers as well as the interpretation by the end users. However, future studies should examine the degree to which the Complexity Measures yield consistent outcomes when administered to the same units of learning.

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APPENDIX A: THE QUESTIONNAIRE

Background and Instructions

Unit/subject/module Title	
Qualification Title	
Industry/discipline	

What qualification does the unit/subject or module lead toward?

School Sector	VET Sector*	Higher Education
❒ VCAL	❒ Cert I	❒ Associate Degree, Advanced Diploma
❒ VCE	❒ Cert II	❒ Bachelor Degree
	❒ Cert III	❒ Graduate Diploma (or Post Grad Dip)
	❒ Cert IV	❒ Masters Degree
	❒ Diploma	❒ Doctoral Degree
	❒ Advanced Diploma	

*Note: * Where does the unit first appear in the packaging arrangements?*

DIRECTIONS

The following items have been designed as a step in the process of trying to define the level of complexity of learning in different units in different qualifications. It focuses on learning outcomes – the aim is to try to best capture the level of complexity of the knowledge and skills students are expected to have acquired as a result of having successfully undertaken a particular unit of study or training. To complete this questionnaire please read each question carefully and answer each of the six questions by ***circling the statement that best describes*** the complexity of learning associated with achievement of the outcomes of a subject/module or unit that you teach (and have listed above). This means focusing on the learning outcomes to be achieved. There are no right or wrong answers so please attempt to answer each of the six questions accurately and honestly. Do not leave any questions unanswered. ***REMEMBER THAT THIS QUESTIONNAIRE IS CONCERNED WITH capturing the complexity of learning outcomes – the knowledge and skills students are expected to have acquired as a result of having successfully undertaken a unit of study or training.*** There is also space for you to write any comments about each of the domains if you want to provide feedback etc to the researchers.

Example

Domain 1: APPLICATION
The context in which the skills and knowledge are to be applied.

		Circle the most appropriate
1.	*Which of the following **best describes** the context for which the skills and knowledge is to be applied?*	
1.1.	The skills and knowledge to be acquired are to be *applied* in *stable* contexts involving *defined* and *predictable* variables.	**1**
1.2.	The skills and knowledge to be acquired are to be *applied* in *changing* contexts involving *defined* and *predictable* variables.	**2**
1.3.	The skills and knowledge to be acquired are to be applied and *contextualised* in *changing* contexts, involving *defined* but *unpredictable* variables.	**3**
1.4.	The skills and knowledge to be acquired are to be *integrated*, contextualised and applied in *complex* and *changing* contexts, involving *broadly defined* and *unpredictable* variables.	**4**
1.5.	The skills and knowledge to be acquired are to be integrated, contextualised and applied to influence *future* contexts.	**5**

In this example, the trainer has identified that of the five statements listed, item 1.3 ***best describes*** the type of context for which the learning is to be applied.

Questionnaire

Domain 1: APPLICATION ***The context in which the skills and knowledge are to be applied.***	
1. *Which of the following **best describes** the context for which the skills and knowledge is to be applied?*	***Circle the most appropriate***
1.1. The skills and knowledge to be acquired are to be *applied* in *stable* contexts involving *defined* and *predictable* variables.	**1**
1.2. The skills and knowledge to be acquired are to be *applied* in *changing* contexts involving *defined* and *predictable* variables.	**2**
1.3. The skills and knowledge to be acquired are to be applied and *contextualised* in *changing* contexts, involving *defined* but *unpredictable* variables.	**3**
1.4. The skills and knowledge to be acquired are to be *integrated*, contextualised and applied in *complex* and *changing* contexts, involving *broadly defined* and *unpredictable* variables.	**4**
1.5. The skills and knowledge to be acquired are to be integrated, contextualised and applied to influence *future* contexts.	**5**

Comments: (optional)

Domain 2: AUTONOMY ***The amount of guidance and the clarity of parameters in which individual or group activities are to be performed.***	
2. *Which of the following **best describes** the level of learning autonomy required to successfully achieve the unit/module/subject outcomes?*	***Circle the most appropriate***
2.1. Individual or group activities are undertaken within *clearly* defined parameters performed with *minimal* discretion under *close* guidance.	**1**
2.2. Individual or group activities are undertaken within *clearly* defined parameters performed with *some* discretion under *frequent* guidance.	**2**
2.3. Individual or group activities are undertaken within *clearly* defined parameters performed with a *significant* degree of discretion under *general* guidance.	**3**
2.4. Individual or group activities are undertaken within *broad* parameters performed with *minimal* guidance.	**4**
2.5. Individual or group activities are self-directed and are undertaken within *few* parameters, performed with *minimal* guidance.	**5**

Comments: (optional)

Domain 3: ACCOUNTABILITY ***The degree of accountability for the processes and outputs of oneself and others.***	
*3. Which of the following **best describes** the level of accountability associated with successful achievement of the unit/module/subject outcomes?*	***Circle the most appropriate***
3.1. Activities are undertaken with *minimum* accountability for own processes and outputs, within *clearly* defined parameters.	**1**
3.2. Activities are undertaken with *some* accountability for own processes and outputs, within *clearly* defined parameters.	**2**
3.3. Activities are undertaken with *full* accountability for own processes and outputs, within defined parameters.	**3**
3.4. Activities are undertaken with *full* accountability for *own* processes and outputs, and *some* accountability for processes and outputs of *others*, within *defined* parameters.	**4**
3.5. Activities are undertaken with *full* accountability for *own* processes and outputs, and *full* accountability for processes and outputs of *others*, within *broad* parameters.	**5**
3.6. Activities are undertaken with *full* accountability for *own* processes and outputs and *full* accountability for processes and outputs of *others*, with *few established* parameters.	**6**

Comments: (optional)

Domain 4: PROBLEM SOLVING ***The type of problems to be solved and the strategies to be employed.***	
*4. Which of the following **best describes** the type of problems and the problem solving strategies associated with successful achievement of the unit/module/subject outcomes?*	***Circle the most appropriate***
4.1. *Established* guidelines and processes and past precedents are *used* to address *routine* problems.	**1**
4.2. *Established* guidelines are *interpreted* and *applied* with minor variations to processes, to address *routine* problems.	**2**
4.3. *New* guidelines are *developed* individually or in collaboration with others, to address *non-routine* problems.	**3**
4.4. New guidelines and processes are *identified* and *developed* to predict and/or address significant, *complex* or *emergent* problems.	**4**
4.5. Conceptual frameworks are used to formulate and test *problems* that make a significant *contribution* to theory, method or practice.	**5**

Comments: (optional)

Domain 5: KNOWLEDGE *The kind of knowledge involved (ranging from concrete to abstract to metacognitive to strategic to new).*	
*5. Which of the following **best describes** the type of knowledge to be acquired?*	***Circle the most appropriate***
5.1. *Concrete* or *factual* in reference, and basic in comprehension.	**1**
5.2. *Concrete* in reference, with *some comprehension* of relationships between knowledge elements.	**2**
5.3. *Concrete*, with *some* elements of *abstraction* or theory.	**3**
5.4. *Theoretical* and abstract, with significant *depth* in a number of areas.	**4**
5.5. *Theoretical* and abstract, with significant *underpinning theory*.	**5**
5.6. *Metacognitive*, in that learners must recognize limitations of current knowledge and have familiarity with sources of new information and integration of concepts across a variety of areas	**6**
5.7. *Strategic*, in that learners must demonstrate a critical awareness of current problems or insights generally agreed to be at the forefront of a field of learning.	**7**
5.8. *New* knowledge, in that the learners must create and interpret new knowledge through original research, or other advanced scholarship of a quality to satisfy peer review.	**8**

Comments: (optional)

6. ***The aim of this study is to effectively capture complexity of learning outcomes. We would like to know whether you think there are some domains that play a more important role in defining complexity than others. It may be that some domains are not needed at all. Please tell us what you think by circling the most appropriate response below.***

In terms of effectively defining complexity, how important is....

Application
The context in which the skills and knowledge is to be applied

I----------I----------I----------I
Not at all somewhat reasonably extremely

Autonomy
The amount of guidance and the clarity of parameters in which individual or group activities are to be performed.

I----------I----------I----------I
Not at all somewhat reasonably extremely

Accountability
The degree of accountability for the processes and outputs of oneself and others.

I----------I----------I----------I
Not at all somewhat reasonably extremely

Problem Solving
The type of problems to be solved and the strategies to be employed.

I----------I----------I----------I
Not at all somewhat reasonably extremely

Knowledge
The kind of knowledge involved (ranging from concrete to abstract to metacognitive to strategic to new)

I----------I----------I----------I
Not at all somewhat reasonably extremely

APPENDIX B: UNIT/SUBJECT/MODULE TITLE

HIGHER EDUCATION	SECONDARY EDUCATION
ASSESSMENT DESIGN AND ANALYSIS	ACCOUNTING UNIT 1
ASSESSMENT INSTRUMENT DESIGN	ART UNIT 3-4
BIOLOGY OF MAMMALIAN SYSTEMS	AUSTRALIAN HISTORY UNITS 3+4
BIOSCIENCE I	BASIC METHODS OF COOKERY
CHEMISTRY	BIOLOGY (UNITS 1-4)
COMMUNITY DEVELOPMENT	BUSINESS (VET VCE STUDY)
CONTEXT AND CULTURE	CHEMISTRY
CURRENT DIRECTIONS IN HISTORY	CISCO - VET AND VCE
DEAFNESS AND LANGUAGE : ASSESSMENT	CONTEMPORARY AUSTRALIAN SOCIETY 3&4
DEAFNESS AND LANGUAGE : TEACHING AND LEARNING	CONTRIBUTE TO SMALL BUSINESS PLANNING
DOCTORAL THESIS (PHD)	DANCE (UNIT 3)
DRUGS & JUSTICE (3RD YEAR)	DESIGN AND TECHNOLOGY
EARLY LANGUAGE DEVELOPMENT	DESIGN USING 2D SOFTWARE,
ED 4A	DEVELOP AND APPLY INDUSTRY KNOWLEDGE (CURGEN01A)
EDUCATION 3B	DRAMA / THEATRE (UNIT 1-4)
EDUCATION POLICY IN AUSTRALIA	ENGLISH
EDUCATION POLICY IN AUSTRALIA	ENGLISH - STUDY OF TEXTS
ENV2726 CONSERVATION BIOLOGY	ENGLISH (UNITS 1+2)
FORECASTING METHODS	ENGLISH (UNITS 3&4)
FOUNDATIONS OF MEDICAL / SURGICAL NURSING	ENVIRONMENTAL SCIENCE
GLOBAL MEDIA: THEORY AND RESEARCH	FOLLOW HEALTH, SAFETY AND SECURITY PROCEDURES
HEBREW	FOUNDATION MATHS
INCLUSIVE LEARNING ENVIRONMENTS	FRENCH
INDIGENOUS STUDIES	FRENCH THE FRENCH EDUCATIONAL SYSTEM
INSITUTIONS OF CRIMINAL JUSTICE (1ST YEAR)	FURTHER MATHS
INTEGRATED CURRICULUM STUDIES	GENERAL MATHEMATICS
LANGUAGE AND LITERACY DEVELOPMENT	HEALTH AND HUMAN DEVELOPMENT
LANGUAGE AND LITERACY	HISTORY - REVOLUTIONS
LEADERSHIP AND PROGRAMMING	HISTORY : RENAISSANCE ITALY
LEARNING AND TEACHING	INFORMATION PROCESSING AND MANAGEMENT
LITERATURE OF DESTRUCTION	INTERMEDIATE LITERACY
MALTING AND BREWING SCIENCE	INTERMEDIATE VCAL WORK RELATED SKILLS UNIT
MARKETING IN EDUCATION	LATIN
MASTER (RESEARCH)	LEGAL STUDIES (UNITS 3-4)
MATHEMATICS	LEGAL STUDIES / SOSE
MULTIVARIATE METHODS	LEGAL STUDIES UNIT 1 AND 2
NATURAL AREA MANAGEMENT ENV3656	LITERATURE (UNIT 3)
ORGANISATIONS AND MANAGEMENT	LOTE - GERMAN (UNIT 3/4: WRITTEN EXAMINATION)
ORGANIZATIONAL CHANGE AND STUDENT WELFARE	MATHEMATICAL METHODS UNITS 3 AND 4
PHYSICAL DEVELOPMENT	MATHEMATICS
PRODUCT AND PROCESS DEVELOPMENT.	MEDIA
QUANTITATIVE METHODS	MEDIA PRODUCTION PROCESS
REFLECTION AND METACOGNITION FOR LEARNING AND TEACHING	MUSIC
SECOND YEAR STATISTICS	MUSIC PERFORMANCE
SOSE	PERSONAL DEVELOPMENT - SENIOR
SOUTH AFRICA UNDER APARTHEID	PHYSICAL EDUCATION (UNITS 3 AND 4)
STATISTICAL METHODS FOR SCIENCE	PHYSICS (UNITS 1-4)
SUCCESSFUL LEARNERS	PROCESS PAYROLL (BSAFIN304A)
TEACHING CHILDREN WITH SPECIAL NEEDS	PSYCHOLOGY
MASTER'S THESIS 20,000 WORDS	PSYCHOLOGY (UNIT 3)
UNDERSTANDING AUSTRALIAN MEDIA	PSYCHOLOGY (UNIT 3)
VET POLICY ANALYSIS AND IMPLEMENTATION	S+T UNIT 1 / APPLIED ELECT
VISUAL ARTS STUDIO 6	STUDIO ARTS
WORKING WITH CHALLENGING BEHAVIOUR	USE BUSINESS TECHNOLOGY
	VCAL - SENIOR LITERACY
	VISUAL COMMUNICATION AND DESIGN (UNIT 3)
	WORK RELATED SKILLS
	WORK RELATED SKILLS - INTERMEDIATE (YR11)
	WORK RELATED SKILLS - SENIOR
	WORK RELATED SKILLS - UNIT 1

VOCATIONAL EDUCATION AND TRAINING

ADVANCED INTERNET
ALL SUBJECTS
APPLY BASIC MATHS
BEVERAGES VBF175
BS2401A PLAN ASSESSMENT
BS2402A CONDUCT ASSESSMENT
BS2403A REVIEW ASSESSMENT
BS2501A ANALYSE COMPETENCY REQUIREMENTS
BS2503A DESIGN AND ESTABLISH THE ASSESSMENT SYSTEM
BS2505A EVALUATE THE TRAINING AND ASSESSMENT SYSTE
BSBFLM404A LEAD WORK TEAMS
BUILD AN INTERNET INFRASTRUCTURE
CERT III CGFA ALL SUBJECTS
CERT III IN GENERAL ED FOR ADULTS ALL SUBJECTS
CERTIFICATE IV IN HEALTH (NURSING)
CHCAOD8A - ASSESS THE NEEDS OF PEOPLE WITH AOD ISS
CHCAOD8C ASSESS THE NEEDS OF CLIENTS WHO HAVE ALCO
CHCAOMIN5A WORK WITHIN THE ADMINISTRATION PROTOCOL
CHCCS402A RESPOND HOLISTICALLY TO CLIENT ISSUES
CHCMH8A PROVIDE INTERVENTIONS TO MEET NEEDS OF CON
COMMUNICATION AND WORK PRACTICE 1
COMMUNICATIONS / CERTIFICATE IV IN HEALTH
COMMUNITY SKILLS
COMPUTER MAINTENANCE - HARDWARE
COMPUTERS FOR LEARNING VBG 782
CREATE CODE FOR APPLICATIONS
CREATE CODE FOR APPLICATIONS ICAIT069B
CUVCRS04A PRODUCE TECHNICAL DRAWINGS
DELIVER TRAINING
DEVELOP AND IMPLEMENT A CAREER PATH
DEVELOP SOFTWARE ICAITB070A
EDITING 1B VBK384
ESTABLISH MONITOR CASE PLAN
FNBACC05B ESTABLISH AND MAINTAIN ACCOUNTING INFORM
FOLLOW WORK PROCEDURES TO MAINTAIN FOOD SAFETY
FOLLOW WORK PROCEDURES TO MAINTAIN GMP
FOLLOW WORK PROCEDURES TO MAINTAIN QUALITY - FDFCO
GENERAL CURRICULUM OPTIONS
ICAITB070B CREATE CODE FOR APPLICATIONS
IMPLEMENT GMP PROCEDURES
IMPLEMENT THE FOOD SAFETY PROGRAM AND PROCEDURES
INDIVIDUAL VOCATIONAL PLAN
INFORMATION TECHNOLOGY
INTEGRATE TECHNOLOGY IN TEACHING AND LEARNING
INTERNETWORKING 1
INTRODUCTION - ALL SUBJECTS
INTRODUCTION TO RESEARCH
LAW OF MARKETING
MAINTAIN AND USE HAND TOOLS
MATHEMATICAL SKILLS FOR ELECTROTECHNOLOGY TRADES
MONITOR IMPLEMENTATION F/S QU/ASS
MONITOR OH&S
MONITOR THE IMPLEMENTATION OF GMP
MONITOR THE IMPLEMENTATION OF QUALITY AND FOOD SAF
MULTIUSER OPERATING SYSTEMS
MYTHS AND SYMBOLS
NUE403 ELEC INSTALLATIONS - EQUIP DESIGN AND SELEC
NUMERACY AND MATHEMATICS
OH&S MANAGEMENT SYSTEMS
OPERATE A WORD PROCESSING APPLICATION ICAIT0130
ORAL COMMUNICATION CERT II
ORGANISE IN HOUSE FUNCTIONS
ORGANISE WORKPLACE INFORMATION (BSBCMN305A)
PALLATIVE CARE
PEOPLE WITH DISABILITIES
PHYSICS AND CHEMISTRY
PLAN ASSESSMENT
PRESENT AND APPLY WORKPLACE COMMUNICATION
PRODUCE A BREAD DOUGH
PROMOTE INNOVATION AND CHANGE
PROVIDE PASTORAL CARE PUADEFCH001A
PSPMNGT603A FACILITATE PEOPLE MANAGEMENT
READING ACCESS III
READING AND WRITING CERT II
READING AND WRITING III ORAL COMMUNICATION III NUM
READING II WRITING II SPEAKING II LISTENING II HEA
READING WRITING III GENERAL CURRIC OPTS III ORAL C
REFLECTIVE LEARNING AND PLANNING 1A
SEND AND RETRIEVE INFO OVER THE INTERNET USING BRO
SERVICE VEHICLE COMPONENTS
SEX EDUCATION VBG 765
SMALL PRESS PUBLISHING
SOCIETY, CULTURE AND NURSING
SRXEVT003A
SRXTEC 004A
SUPPORT AND MENTOR INDIVIDUALS AND GROUPS
USE ADVANCED FEATURES OF COMP APPS ICAITU126B
USE ADVANCED FEATURES OF COMP. APPLICATIONS
VAE SHORT STORY 1A
VBH 780 MAINTAIN PROFESSIONAL COMPETENCE
VBH 789 DESIGN AND CUSTOMISE LEARNING PROGRAMS
VET
WORK EFFECTIVELY IN AN IT ENVIRONMENT ICAITTW001B
WORK WITH EQUITY AND DIVERSITY PUADEFEQ001A
WORKPLACE SAFETY
WRB31A DESIGN AND PERFORM COSMETIC TATTOOING/MICRO
WRITER AND RESEARCH
WRITING IV - FURTHER STUDY
WRPPK211A APPLY PRODUCT KNOWLEDGE FOR SKIN AND FUN
YTH 1 C
YTH 2 C
YTH 3 C
YTH 6 C
YTH 7 C
ALL MODULES
DELIVER NURSING CARE TO CLIENTS
TRAIN SMALL GROUPS

APPENDIX C: INDUSTRY/DISCIPLINE

Higher Education	Vocational Education	Senior Secondary Education
Assessment and evaluation Art and design Art/craft Biology Criminology Education Environmental science Arts (cultural & language studies) Arts (history) Information technology/systems Media & communication Mathematical sciences Social welfare Statistics Nursing Food science	Accounting Adult education / ACFE Assessment & training Automotive Beauty therapist Business services Community service Electrotechnology Engineering English as a second language Food processing &/or manufacturing Health and community services Hospitality and tourism Human services Humanities Information technology Management Marketing Pharmacy Public safety Public services Sport and recreation Teacher education Transport and distribution Writing/editing	Accounting Automotive Business services Classics Commerce / financial services Dance LOTE Electrical Education Fine art French Graphic design Literature Multimedia (arts) Music performance & musicology Numeracy Physical education SOSE Systems and technology auto Theatre - Arts (performance) Video production Woodwork Science English Hospitality Mathematics Information Technology