Employing Computerised Graduate Attribute Mapping to Bridge the Divide from Education to Employment

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Abstract

How do employers know what knowledge university graduates possess at the point of hiring? This question drove a collaboration to develop a computerised prototype system (APMap) for eliciting and mapping any graduate's 'knowledge inputs' throughout their university degree pathway. This research distilled the 'knowledge requirements' of relevant professional and industry accreditation and academic bodies into categories relevant to the educational and institutional stakeholders for graduates. These 'knowledge requirements' are termed 'graduate attributes'. In the pilot study, university subject coordinators were then asked nominate the extent to which graduate attributes were present in their subject's curriculum. Using Visual Basic for Applications, a data base was developed to display the graduate attributes in a graphical form for each subject, and degree course. The research was extended to encompass assessments within subjects, revealing a gap between the graduate attributes expected by staff from subject mapping, and the mapped requirements for assessment of those attributes.

Keywords

Accreditation; Assessment; Graduate Attributes; Graduate Learning Outcome; Curriculum Mapping; Evaluation; Graphical Output; Employability

Introduction

This research had its origin in interviews with graduate employers. Their purpose was to understand what factors employers took into account in their graduate hiring decisions. Many potential employers, in rating the institution of study and the curriculum felt that they had "no idea" about the curriculum of the institutions from which they recruited graduates [1]. Hence they could not discriminate between graduates from different institutions by virtue of their understanding of the difference between candidates' knowledge deriving from different institutions' curricula. If it were possible to develop a simple tool which would map the curriculum, and display it in a form which was universally understandable, employers could know about the curriculum, and could use this as a means of discrimination, along with other attributes, should they wish.

This desire drove research to find a workable, durable, flexible and extendable computerised tool for the collection and display of information about the inclusion of any valued educational aspect in an education. The case study in this paper is provided as demonstration of "proof-of-type" only of the process and of the tool - which we have called Academic Program Map (APMap). The study could be replicated with any subject in any course in any university now that the prototype has been developed.

Graduate Attribute Mapping

Worldwide there are many motivating factors that underpin a sustained interest in displaying knowledge gained in any subject or unit in a graphical way in order to consider overlaps and gaps – so called 'curriculum mapping' or 'graduate attribute mapping'. Tertiary institutions pride themselves on the quality of their graduates through publishing, for each institution, a list of the qualities, or 'graduate attributes' - which are "the qualities, skills and understanding a university community agrees its students should develop during their time with the institution and consequently, shape the contribution they are able to make to their profession and as a citizen" [2]. They are acquired as a direct and intentional effect of an institute's curriculum design,

with Universities warranting their graduates will possess these attributes as a result of their institutional ethos. Two decades after Clanchy and Ballard [3] asserted that "a university ought to be able to say with reasonable explicitness what its objectives are in respect of its graduates" the present role of graduate attributes is still evolving, and remains an area of ongoing institutional development and academic interest partly because there has not been any way of "mapping" the precise graduate attributes accrued through taking any course within any given university, so that 'graduate attributes' are often expressed in very general terms. In this research, we have bundled together so called 'generic graduate attributes' or 'employability skills' (allegedly available to graduates undertaking any course in a university through attending that university) and curriculum-derived graduate attributes (specific to graduates of that particular subject and course; they could be treated separately in mapping). If an employer wants to know what is different between the knowledge of any graduate from course X in university Y compared with that of a graduate from course A from university B, it has not hitherto been easily quantified or expressed. The potential employer may read the syllabus for each course. This will provide an outline of the curriculum, but not the breadth nor depth of any areas of the curriculum, or how one subject complements another.

Thus, in response to these concerns and research into existing tools, development of an Academic Program Mapping tool – APMap - to map graduate attributes from any subjects accumulating to any course (or Program) was undertaken. The terminology used in this research is 'subject' for a unit, paper or course, and 'course' for a minimum three year progression (or program) of subjects which leads to Bachelor degree conferral, or two year course (or program) of subjects for Master degree conferral.

In order to map any curriculum, it is necessary to map the instances in the curriculum of the teaching and learning of the skills, knowledge and understandings which go to make up the eventual graduate attributes, and moreover, to map the breadth and depth of the instances – how much and how often – how deeply is the topic tackled? But which skills, knowledge and understandings should students' acquire? What is in the curriculum for students at various institutions and why is it different if the end pint is perceived to be the same? For all except accredited professional courses, desirable graduate end points are difficult to define. Developing staff enthusiasm to go beyond the current curriculum, and to find common ground around employers' future needs is fraught as staff are often not keen to spend their precious time resource on an exercise seen to be management auditing. Perhaps a computerised base is desirable for some motivated staff – whereas others would be better served by face-to-face round table workshops, mandated, attended and supported by management, with employers also in attendance, to minimise cynicism that curriculum insufficiently interfaces with the labour market.

A commencement point (for the pilot proof-of-type) involved distilling the requirements for accreditation bodies as well as the academic-derived 'graduate attributes' (each university publishes overarching attributes for *all* its graduates - such things as ethical behaviour, social justice awareness, sustainability awareness). Each course also publishes 'graduate attributes' as outcomes only for that course within the university. These requirements from industry/employers, and the university were then distilled to form one list of 'graduate attributes' for that course against which to benchmark each subject.

To test proof-of-type, a case-study activity proceeded by selecting one three year undergraduate degree for testing the process and outcomes. Subject coordinators teaching all compulsory subjects in the selected degree were asked to nominate the *extent* to which each graduate attribute was covered in the subjects they coordinated.

The results were mapped onto a data base developed to display each subject's attributes as bar graphs, donut charts or as an undulating landscape representing peaks and troughs of the attributes for all subjects in a course. When reported, the results received an enthusiastic reception from stakeholders, as the computerised data display system for eliciting and mapping the graduate attributes of subjects within a course was judged as fulfilling the original brief as being extendable, repeatable and robust, and informing all stakeholders of the 'graduate attributes' of graduates from those subjects and therefore, the course.

The Demand for Systematic Mapping

This section reviews the demand for systematic mapping of graduate attributes, as well as reviews other mapping processes currently available in Australian universities. Employers, employer groups, and government (advocating for growth of the

economy) are amongst those who, nationally and internationally, argue that universities have a role in preparing graduates for employment [4]. The 1999 Bologna Declaration emphasised the need for subjects to have a relevance to the labour market, for degrees to have a vocational purpose and for higher education to develop transferable skills that are relevant to subsequent employment.

TEQSA [24], the Australian Government Tertiary Education Quality and Standards Agency, has a role in accreditation of courses of study. TEQSA regulates and assures the quality of Australia's higher education sector, including the rationale of the course, and their expected graduate outcomes, including graduate employability. TEQSA requires an evidence basis for accreditation of courses, including "a summary of how the provider has ensured that there has been appropriate development of key graduate attributes for each course of study" [25]. In concert with regulatory change in auditing quality and standards in Australia (TEQSA) a desire to develop and state the academic standards in each profession or discipline through the Learning and Teaching Academic Standards project (LTAS) has emerged [26] [27]. The foundations for a 'new era of quality in tertiary education" would be laid by "whole-of-program curriculum review and reform based on a national understanding of the core attributes required of a graduate in the discipline" [26, p.5].

What is employability and why is it so important to universities? Hesketh wrote concerning employers' perceptions of graduate education and training (in the UK context) "[a] primary purpose of higher education is to prepare students for the world of work"… [t]his assertion…lacks no support in government, industrial or even student circles… recent research investigating industry's satisfaction with graduates suggests all is not well…employer dissatisfaction with the attributes of the individuals they recruit from our universities cannot be ignored…"[5]. Thus both in Australia [6] [7] [8] [9] and internationally [10] [5] [4] [11] there is sustained interest in identifying, quantifying and mapping graduate attributes as one device for preparing graduates for changing employment environments [12]. Providing mapping of courses is intended incentivise teachers, and motivate students to learn critical professional skills in an increasingly crowded curriculum. We took this overwhelming international desire to both articulate and map graduate attributes as our starting point and reviewed existing mapping tools in other universities in order to select a suitable mapping tool.

The University of Queensland [13], The University of New England [14] and Monash Faculty of Medicine, Nursing and Health Sciences [15] mapping projects utilise paper-based tools which are reliant upon external facilitation, are focussed upon academic staff as stakeholders, and have limitations upon dissemination due to their paper-based nature. Paper-based display necessarily limits distribution, uptake and utility to various stakeholders, as well as extendibility to other criteria and rapid response to an ever changing curriculum.

One of the most sophisticated Australian web-based subjects mapping tool can be found at Murdoch University [16] [17]. Its limitations are the use of a proprietary set of technologies and a copyrighted outcome display reminiscent of the graphical techniques used for displaying the (visually complex) map of the genome. The Murdoch tool is configured as a binary state device requiring the application of either 0% or 100% which consequently leaves no capacity for gradation. Therefore, in the visual display of Murdoch's tool, most subjects appear to totally fulfil subject and subject attributes, which may be overstatement. Curtin University's well tested CCMap (Curtin Curriculum Mapping Tool) fits into an assurance of learning for graduate employability framework. Utilising an Excel workbook, and designed to aggregate course information from subject worksheets, it creates six course analyses which display pie charts for quick visual analysis. The acknowledged limitation of the CCMap, from those trialling it, was the difficulty of incorporating subject "minors" or optional subjects in the map, and that having more subjects or learning outcomes than the map allowed for, or changing the pre-filled options, required extensive recoding [23].

Despite more than ten years of mapping tools' development, a review revealed that most tools for collecting and exhibiting graduate attribute data are still paper based, and thus of limited utility in data gathering or dissemination. Where web-based tools were developed, they were generally operated by specialist staff development units, within Universities, making them less accessible. Importantly, tools may not allow capacity for graduation of the extent to which graduate attributes were fulfilled.

A decision thus resulted to develop APMap, a web-base data gathering and graphics generation tool

which fills an identified gap in the array of tools which are available for mapping courses and subjects, for the benefit of all stakeholder groups. It is applicable widely beyond the case-study proof-of-type situation which is reported here.

Method

APMap – stakeholder identification

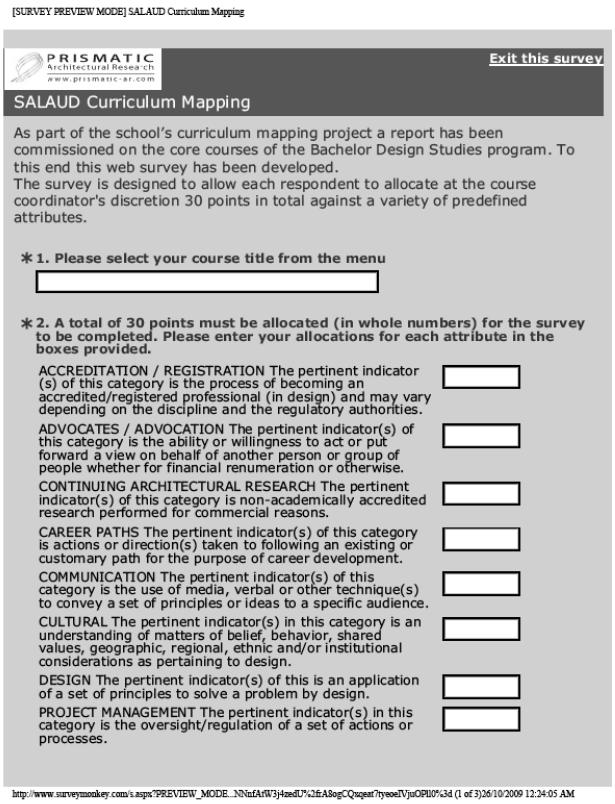
The APMap project outcomes are predicated on the belief that an instant graphical representation of the topography of the 'actual' compared with 'desired' graduate attributes' 'landscape' would be a useful tool to engage all disparate stakeholders in discussion about curriculum overlaps and gaps. Hence, the appropriate identification of stakeholders and their identified interests were pivotal to a successful outcome. The major or primary stakeholders were divided into three loose groups.

The first group, the academic stakeholders, were identified as the academic staff and university management. Collectively the academic group is the only group capable of graduating students and hence has a more obvious requirement for such a codified set of values. They also make publicly available their Graduate Attributes and hence their intentions are the most transparent. The second group, student stakeholders, were identified as the university's students and prospective students. The third group, institutional stakeholders, representing employers, the profession and other accrediting organisations capable of accrediting professional courses for example in Law, Medicine, Dentistry, Architecture, Veterinary Science. Overall the Institutional group does not state its desired attributes for graduates in a similar or comparable manner to the academic group.

Hence a methodology that could cope with these dissimilarities was required which established an agreed frame of reference which would allow stakeholders' interests to be represented in a shared set of graduate attributes across all subjects in any degree. A reductive method was needed to take the desired attributes and transpose them into a clear and understandable set of categories. Grounded Theory techniques [18] provides this framework for looking at the literature available from stakeholders and ultimately producing a list of categories for use in gathering the data. Figures 1 and 2 indicate some of the categories for the sample proof-of-type Bachelor of Design Studies 3 year course which formed the case study for research. It should be noted that for any other institutional usage, and for different courses and subjects, these categories would obviously be different, and the X axis display of categories on Figure 2, would be different. This capacity for substitution and difference of categories captures the simplicity of the APMap tool.

Once the categories were defined a data gathering device was designed for gathering the curriculum data online using a web-based questionnaire (such as Survey Monkey interface shown in Fig 1). To test the validity of the proposed system a pilot was undertaken. Approximately a quarter of the overall sample set of subject coordinators from the case study course was requested to pilot the survey tool. The results returned from this pilot were used both to confirm the categories' usefulness and understandability and to define the nature and type of the graphical output. As there were no problems encountered in the pilot with either the descriptions of the categories, or the method used to gather the data, the pilot data confirmed the approach, and the validity of the instrument.

Questionnaire and Survey Process


[SURVEY PREVIEW MODE] SALAUD Curriculum Mapping

PRISMATIC Architectural Research www.prismatic-ar.com

Exit this survey

SALAUD Curriculum Mapping

As part of the school's curriculum mapping project a report has been commissioned on the core courses of the Bachelor Design Studies program. To this end this web survey has been developed.
The survey is designed to allow each respondent to allocate at the course coordinator's discretion 30 points in total against a variety of predefined attributes.

*1. Please select your course title from the menu

*2. A total of 30 points must be allocated (in whole numbers) for the survey to be completed. Please enter your allocations for each attribute in the boxes provided.

ACCREDITATION / REGISTRATION The pertinent indicator (s) of this category is the process of becoming an accredited/registered professional (in design) and may vary depending on the discipline and the regulatory authorities.

ADVOCATES / ADVOCATION The pertinent indicator(s) of this category is the ability or willingness to act or put forward a view on behalf of another person or group of people whether for financial renumeration or otherwise.

CONTINUING ARCHITECTURAL RESEARCH The pertinent indicator(s) of this category is non-academically accredited research performed for commercial reasons.

CAREER PATHS The pertinent indicator(s) of this category is actions or direction(s) taken to following an existing or customary path for the purpose of career development.

COMMUNICATION The pertinent indicator(s) of this category is the use of media, verbal or other technique(s) to convey a set of principles or ideas to a specific audience.

CULTURAL The pertinent indicator(s) in this category is an understanding of matters of belief, behavior, shared values, geographic, regional, ethnic and/or institutional considerations as pertaining to design.

DESIGN The pertinent indicator(s) of this is an application of a set of principles to solve a problem by design.

PROJECT MANAGEMENT The pertinent indicator(s) in this category is the oversight/regulation of a set of actions or processes.

http://www.surveymonkey.com/s.aspx?PREVIEW_MODE...NNnfAriW3j4zedU%2fcA8ogCQxqeat7yeoeIVjuOPl0%3d (1 of 3)26/10/2009 12:24:05 AM

FIG. 1 WEB-BASED QUESTIONNAIRE (FIRST PAGE SCREEN SHOT)

To gather curriculum mapping data there were 2 stages. Stage 1: A web-based questionnaire (Fig 1) was

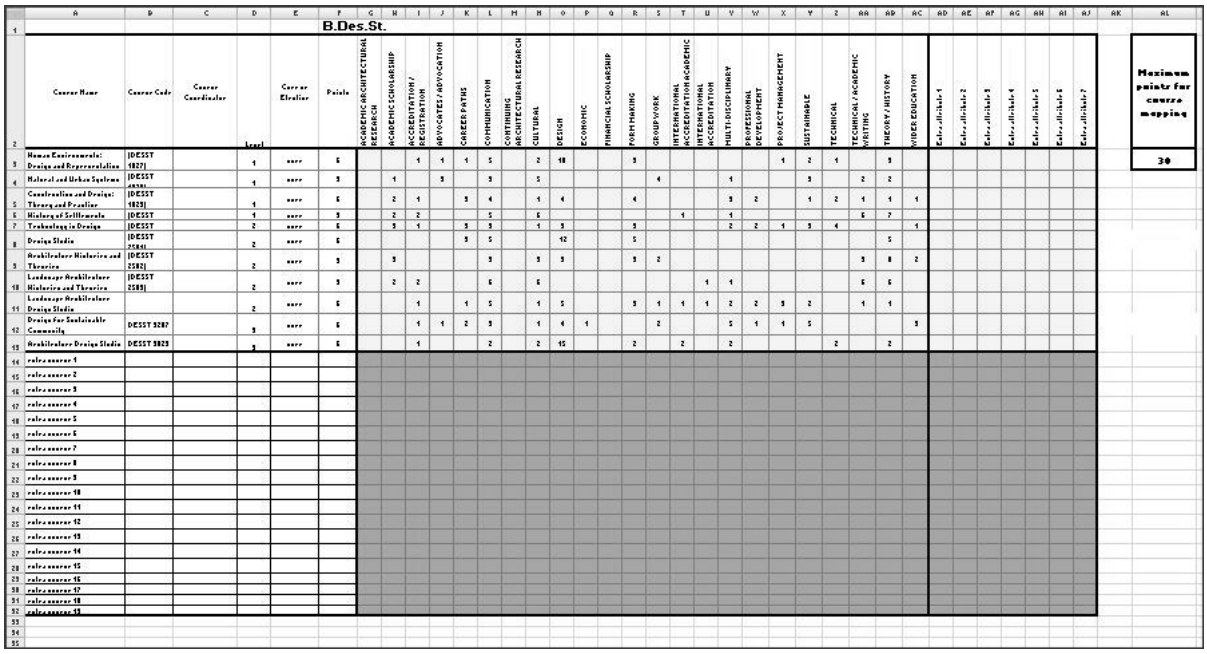


FIG. 2 SOFTWARE APPLICATION TOOL DATA INPUT SHEET – INDICATIVE SCREEN SHOT ONLY

developed and distributed as a web survey (after piloting). To complete the questionnaire the case study B Design Studies subject coordinators assigned a limited number of thirty "voting points" or "values" against their subject's attributes. This 30 token limitation circumvented a potential bias toward attributing full marks to each category. It forced subject coordinators to consider *the extent* to which their subject taught or related to those attributes. As the questionnaire could not be completed until all thirty points were allocated, a reflective distribution of the available points was encouraged. A significant additional Grounded Theory technique of eliciting spontaneous feedback was employed to allow for the subject coordinators 'voice' to be heard via a text box to capture any comments and any suggestions for additional categories or other comments. (No comments were recorded by any subject coordinators). Once this data collection phase was completed the display of this data needed to be addressed.

The software used for this data analysis and display needed to be three dimensional as the requirements for plotting were attributes (categories) vs. subject vs. assigned value (zero to thirty). The most appropriate tool for data display needed to be user friendly and preferably with a familiar interface. Microsoft Excel was chosen as the most practical and appropriate tool as Excel forms part of the Microsoft office suite, and there is an expectation that the program was widely available and extensively used, more so than other analytical programs. A series of Visual Basic Application (VBA) scripts were authored to collect and compile the data, and to automatically generate the images which were used to populate the web tools. Figure 2 shows the input matrix used for image generation (as a screen shot, simply to show that the X and Y axis can both have limitless substitutions of categories, or subjects to extend applicability). To make the output from the software tool universal Hyper-Text Mark-up Language (html) and Joint Photographic Experts Group (jpeg) format images was considered the most appropriate media for displaying the data in an easily disseminable format.

Results

Subject Mapping for Proof-of-type – Bachelor of Design Studies

Figure 3 shows all core subjects in B Design Studies plotted against all attributes for an overview of the core subjects and how they relate to each other as a topographic view. Due to the discrete nature of the categories they have been plotted so as to avoid the appearance of continuity or reciprocal relationships or connectivity to other attributes in the topographic display. Hence, this project utilises a non-continuous data display approach. A weighting of subjects by unit points was also used throughout this section. Figure 4 is an automatically generated screenshot of the mapping tool when one subject only is chosen for display and Figures 5 and 6 depict the two alternate jpg output images from Fig 4 for any subject that can

be used in either a report or web application. In web-based and colour printed applications, a colour coding regimen was applied to the multi and donut charts (Figs 4 & 5) to provide an immediate visual indication of the quantum. However, due to the number of categories some colours appear more similar than would be ideal. To mitigate this effect a bar chart (Fig 6) was generated in parallel, using the same data, to provide an alternative visual device linked to the donut charts (Fig 5).

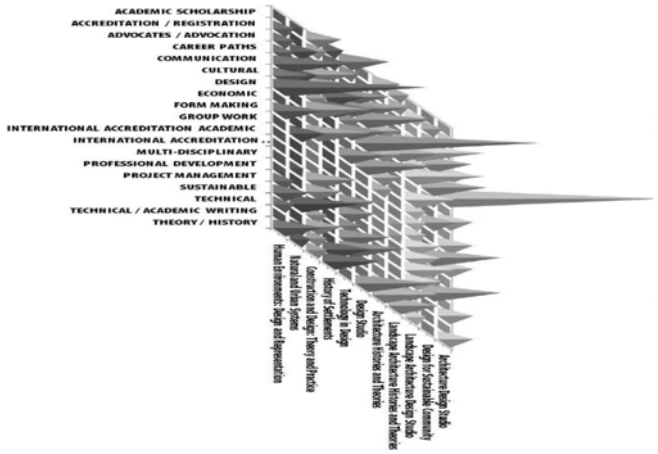


FIG. 3 BACHELOR OF DESIGN STUDIES CORE SUBJECTS– TOPOGRAPHIC VIEW

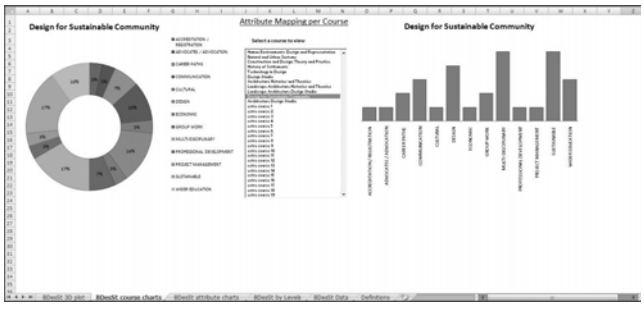


FIG. 4 SOFTWARE APPLICATION TOOL GRAPHIC OUTPUT SHEET – INDICATIVE SCREEN SHOT

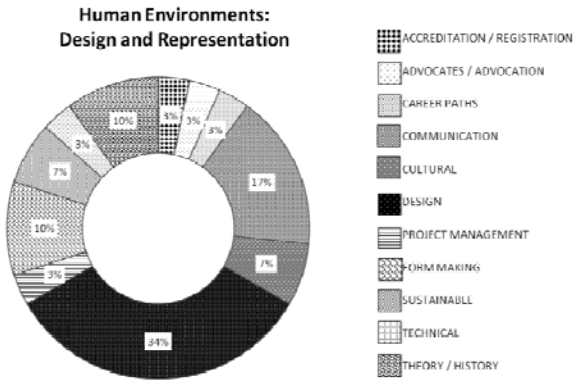


FIG. 5 HUMAN ENVIRONMENTS SUBJECT ATTRIBUTES - DONUT CHART

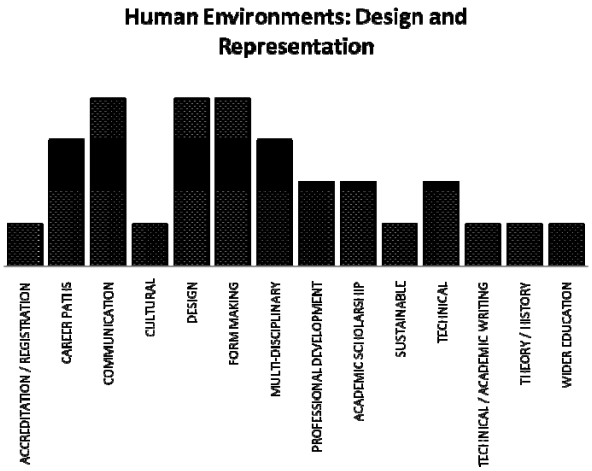


FIG. 6 HUMAN ENVIRONMENTS SUBJECT ATTRIBUTES – BAR GRAPH

Figure 7 shows a clustered bar chart that displays an amalgamation for each year level, to give an overview of where the concentration of various attributes lie by cumulative Level 1, 2 and 3 core courses. (The seemingly uneven displacement is due to the differing number of 'core' subjects offered at each year level).

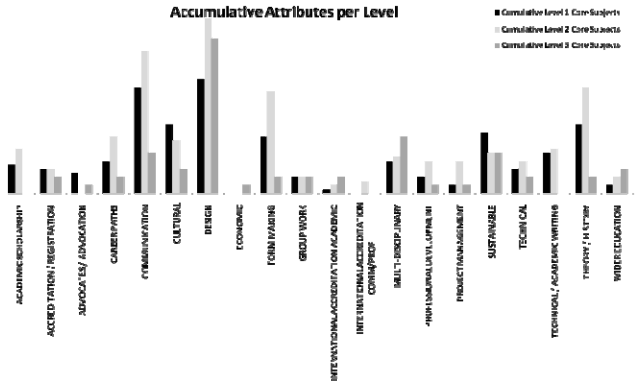


FIG. 7 BACHELOR DESIGN STUDIES CORE SUBJECTS AMALGAMATED BY LEVEL 1~3 - BAR CHART

Assessment Level Mapping

In an extension to the APMap research, researchers and academic staff collaborated to explore a further dimension of curriculum mapping – namely mapping the graduate attributes of assessment tasks within subject. A sample of six already mapped subjects, spanning 1st and 2nd year, theoretical essay-based subject to technical "simple answer" subjects, which were already mapped at subject level, were mapped at assessment level. Assessment tasks from exams to essays, written or graphic assignments, production of designs, and documentation including individual and group work were mapped against the same categories of 'graduate attributes' using the perception of the

academic as to the percentage of each summative task devoted to attainment of each graduate attribute. If they existed, academics utilised already determined, published rubrics to complement their memory. A limitation of both the assessment mapping and the course level mapping is that it is just the opinion of the course coordinator; it was not audited, and as was discovered in the same course coordinators mapping at subject and assessment level, there are discrepancies. If an audit was undertaken by a third party, of either mapping, further discrepancies could be expected.

This new mapping was very rich in displaying any potential gap between subject coordinators' *intentions* at subject level (graduate attributes expressed as their course objectives), and their *practice*s at assessment level. Assessment tasks were selected as the mapping domain to tease out the relationships between overall subject mapping and what students perceived as important in the subject; as Boud [19] describes getting assessment right as critical to the learning and teaching nexus.

Results – Assessment Level Mapping vs. Subject Level Mapping

In all six subjects evaluated in the extension study there was a gap between the values displayed for graduate attributes mapped at subject and at assessment levels. The assessment level mapping 'graduate attributes' for two (technically oriented) subjects are given – Construction and Design: Theories and Practice (Year 1 - Fig 8) and Technology in Design (Year 2 – Fig 9).

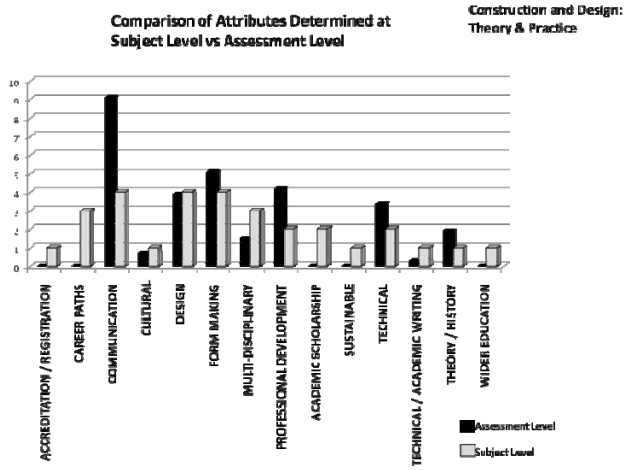


FIG. 8 CONSTRUCTION AND DESIGN: THEORY AND PRACTICE GRADUATE ATTRIBUTES EVALUATED AT SUBJECT LEVEL AND ASSESSMENT LEVEL

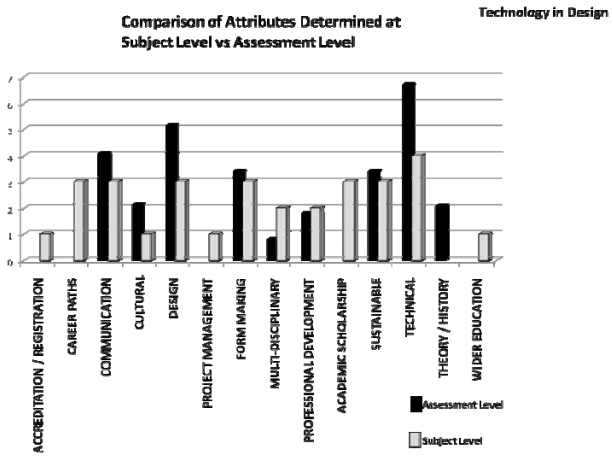


FIG. 9 TECHNOLOGY IN DESIGN: GRADUATE ATTRIBUTES EVALUATED AT SUBJECT LEVEL AND ASSESSMENT LEVEL

Displays of assessment mapping using a weighted system (Figure 10), and unweighted system (Figure 11) were devised to allow for differences in percentages by assessment to be made available to the various stakeholders. Figure 10 maps all assessment pieces (Assignments) in a particular subject - Human Environments. It breaks that assessment down into its constituent parts – so for each Assignment, we can see how much of each "attribute' is covered relative to all other attributes. This was achieved by mapping the relative proportion of the whole 30 tokens available to the subject convenor to distribute for all the assessment attributes for the 5 assessments shown. For example Assignment 1 has more Communication assessed than any other attribute.

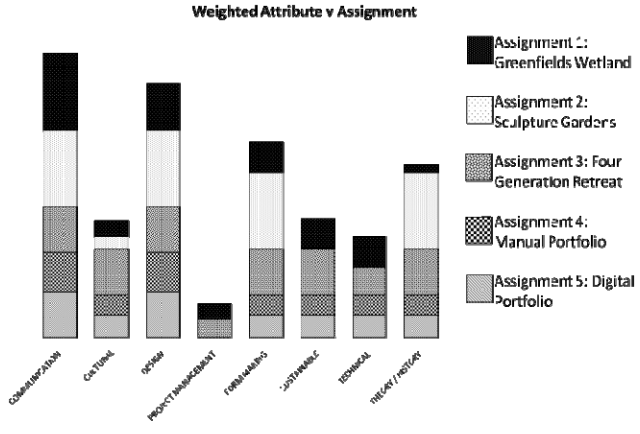


FIG. 10 HUMAN ENVIRONMENTS WEIGHTED ATTRIBUTES V ASSIGNMENT - BAR CHART

Figure 11 is an unweighted bar chart, such that each of the bars is 100% of that Assignment (from Assessment 1-5). Within each bar exactly how each attribute contributes to that Assessment is shown graphically.

For example, Communication is the largest attribute in each Assignment.

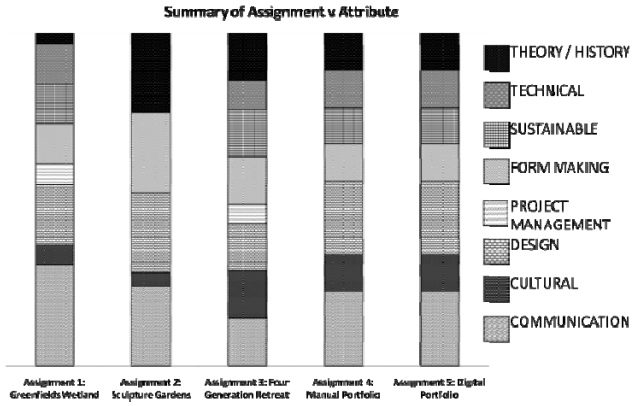


FIG. 11 HUMAN ENVIRONMENTS ASSIGNMENT V ATTRIBUTES - BAR CHART

Subsequent to the data gathering, coding and analysis, the three participating subject coordinators (for the six subjects) were interviewed in semi-structured interviews to ascertain why they thought this discrepancy between mapping at the subject and the constituent (assessment) levels existed. The interviews were transcribed, themed and research inferences drawn within the limitations of a case study mode. We looked to the assessment literature for any insights into the gap we exposed between mapping subjects at assessment and subject levels, theorising that there could be several reasons for this gap or discrepancy. The first was a limitation of the research methodology - that the subject coordinators, when completing the assessment level mapping, after having completed the subject level mapping some three months previously, did not look back to the subject level mapping and make an attempt to replicate the subject level mapping when conducting assessment level mapping. Through interviews we found that this was the case. Interview respondents thought had the time lapse been less, or their familiarity with the graduate attributes *descriptions* (categories) been greater, their responses may have been more consistent.

Our second speculation was that subject coordinators did not see assessment as capturing everything that the subject sought to offer in the realms of skills, knowledge and understandings. We were correct in this assumption as subject coordinators said that there were aspects of their subjects which were not intended to be assessed at first or second year level. The curriculum was there to build a knowledge base for the future, or that the curriculum related to so-called 'employability skills' of team work, ethics, self and time management relating to university Graduate Attributes, which were important, but not directly assessable. Notwithstanding this acknowledgment about those aspects not directly assessed, subject coordinators did think there should be more consistency between the subject and assessment level mapping.

Achieving this consistency is termed *constructive alignment* - alignment between subject goals, teaching practices and assessments. The discrepancies which exist in the aggregation of graduate attributes of assessment tasks, when mapped, compared with the graduate attributes of subjects, when mapped, indicate the difficulties of alignment, between a subject, where the Graduate Attributes are frequently proscribed, and the assessment tasks, where the teacher is scaffolding learning, through a number of assessments, to attain those attributes, (however imprecisely). Furthermore, Boud and Falkichov [20] argue that construing assessment tasks in curriculum mapping should not be considered within subjects, but rather within courses (of three years minimum duration). This longer term view is captured in the current APMap depictions, which use subjects as the basic units, accumulating to courses, as APMap indicates graphically where overlapping and neglected areas occur in the course. Notwithstanding these perceived difficulties of alignment Biggs [21] concludes that if curriculum objectives are clearly stated, in terms of "content specific levels of understanding that imply appropriate performances" and thereafter teaching methods are designed to place students in situations which elicit those performances, and assessment tasks designed to evaluate those performances, a reasonable level of alignment can be expected.

Discussion

We have reported on the development of the APMap tool for subject and course mapping against any attributes developed by the stakeholder. We have not restricted the tool to use by experts, as the inputs to the Y axis (subjects) and the X axis (attributes) can be altered on a spreadsheet (Fig 2) which then automatically, through embedded VBA script, generates graphical output (Fig 4) of any data inputted. The APMap brief was for a system to be durable, extendable and editable; the research was particularly focused upon durability due to the prevalence of software and platform changes within tertiary institutions. Accordingly Excel was selected for its pre-eminence and universality of usage.

The results mapped for the pilot (proof-of-type) B. Design Studies course show that there is an adequate although patchy treatment of some accreditation categories. We consider that uncovering inadequacies in the coverage of accreditation categories is APMap's major contribution, along with, long prior to that, uncovering deficiencies in university documents where a gap exists between the lofty ideals of university mission statements and the need, at the coalface of teaching, to break them down into subject and course graduate attributes with aligned assessment. The belief of the subject coordinators who contributed data is that the APMap tool will be useful to them for course and subject planning, course professional accreditation and reflection upon subject content. The belief of the Faculty (comprising five Schools) is that it can be extended to mapping all courses in the Faculty - Law, Education, Commerce, Business and Architecture - and as a planning tool for subject and course review. The Business, Industry and Higher Education Collaboration Council, in delivering its commissioned report [22] to the Minister for Education, Science and Training, stated that, in order to maximise the efficiency and effectiveness of any Australian Government intervention into graduate employability, the most highly prioritised recommendation was "to explicitly identify employability skills in all university curriculum".

We believe that a tool such as APMap provides the capacity to gather, evaluate and disseminate such vital knowledge to all stakeholders, including employers, thus supporting more confidence in hiring graduates. The simplicity of the data manipulation system and subsequent display means that once the template has been established, the allocation of resources for further development is expected to be minimal. This simple approach (which masks the underlying elegance of the APMap tool), coupled, we believe, with universal accessibility, is essential to the adoption of the tool as the preferred method of course mapping and hence increases the likelihood of use as both an analytical tool and a web image creation device.

Conclusions

We believe the APMap course and subject mapping tool is an approachable active management tool which should (if adopted as intended) provide a flexible and evolvable tool into the future. The versatility of the tool allows for subject coordinator, management or accreditation bodies to alter the description of any graduate attribute (category, on the X axis) and map it against any listing of subjects, or assessments (on the Y axis). Therefore the major differences between the APMap tool and others, in part relates to the development 'from the ground up' of the tool. Subject coordinators map the *extent* to which a subject fulfils any graduate attribute; hence any course is revealed subject-by-subject to show how, and in what proportion *all* graduate attributes are mapped onto a given course. To facilitate this deliberation, the user interface is friendly and the underlying system is inherently durable. Interrogation can be by attributes assigned to a subject or conversely which subjects contribute to a particular attribute by percentage of the total population of an attribute. It also gives an overview of an entire three year course using a three-dimensional topological image. In short, the difference between this APMap tool and the reviewed UNE, UQ and Murdoch tools (amongst others) is its web-based nature and the non-specialised nature of its data gathering and/or display.

The main use for this tool is as an analytical device for immediate graphical feedback to aid reflection. This reflection, it is hoped, may include that of prospective employers, to aid their decisions about graduate hiring, and indeed to help them shape university curricula through better understanding the gaps and overlaps.

REFERENCES

[1] S.J. Shannon "Talking to practitioners about their graduate hiring practices: how highly are technical skills valued?" *Proc 44th Annual Conference of the Australian and NZ Architectural Science Association (ANZAScA)* 24-26 Nov, 2010 Unitec Campus, Auckland, NZ.

[2] J. Bowden, G. Hart, B. King, K. Trigwell & O. Watts (2002) Generic capabilities of ATN graduates Available www.clt.uts.edu.au/ATN.grad.cap.project.index.html

[3] J. Clanchy & B. Ballard "Generic Skills in the Context of Higher Education" *Higher Education, Research and Development* vol 14 (2) p 156, 1991.

[4] Dearing Committee (1997) *Higher Education in the Learning Society* Report of the National Committee of Inquiry into Higher Education London: The Stationery Office Available http://www.leeds.ac.uk/educol/ncihe/.

[5] A. J. Hesketh "Recruiting Elite? Employers' perceptions of graduate education and training" *Journal of Education and Work* vol 13(3) p. 246, 2000.

[6] S.C. Barrie "A research-based approach to generic graduate attributes policy" *Higher Education Research and Development* vol 23 (3) pp. 261-275, 2004.

[7] S.C. Barrie "Understanding what we mean by generic attributes of graduates" *Higher Education* vol 51(2) pp. 215-241, 2006.

[8] S.C. Barrie "A conceptual framework for the teaching and learning of generic graduate attributes" *Studies in Higher Education* vol 32(4) pp. 439-458, 2007.

[9] ALTC (2010) Australian Learning and Teaching Council "Assessing and assuring Australian graduate learning outcomes: Principles and practices within and across the disciplines Available http://www.altc.edu.au/project-australian-graduate-learning-outcomes-sydney-2010

[10] P. Hagar and S. Holland (2006) *Graduate attributes, learning and employability* Dordrecht: Springer.

[11] Association of Graduate Recruiters (2005) *Skills for graduates in the 21st century* Available http://www.agr.org.uk/UserAccount/RoadBlock.aspx?contentid=649&redirect=http://www.agr.org.uk:80/DisplayContent.aspx?id=649&monetised=True&viewable=2

[12] K. Purcell. and P. Elias (2004) *Seven years on: Graduate careers in a changing labour market* London: Higher Education Careers Service Unit.

[13] University of Queensland (undated) *Mapping and embedding graduate attributes* Teaching and Educational Development Institute: The University of Queensland http://www.tedi.uq.edu.au/Teaching/GradAttributes/

[14] University of New England (undated) *Graduate attributes at UNE – Guidelines for implementation of the graduate attributes policy and quality management processes* University of New England Available http://www.une.edu.au/gamanual/staff/guidelines.php

[15] D. Krasey, A. Jackson and L. Mc Call (undated, c 2004) *Final report: Project in mapping of graduate attributes into the subjectwork curriculum* Faculty of Medicine, Nursing and Health Sciences, Monash University Available http://www.med.monash.edu.au/pgrad/docs/graduate-attributes-report-final.doc.

[16] Murdoch University (undated) M*urdoch university graduate attribute mapping tool* Available http://our.murdoch.edu.au/Educational-Development/Preparing-to-teach/Graduate-attributes/Mapping-graduate-attributes/

[17] K. Lowe and L. Marshall "Plotting renewal: Pushing curriculum boundaries using a web based graduate attribute mapping tool" In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds), *Beyond the comfort zone* Proc. 21st Australasian Society for Computers in Learning in Tertiary Education Conference (ASCILITE) pp. 548-557. Perth, 5-8 December, 2004. Available http://www.ascilite.org.au/conferences/perth04/procs/lowe-k.html

[18] J. Corbin & A. Strauss "Grounded Theory Research: Procedures, canons, and evaluative criteria" Q*ualitative Sociology* vol. 13 pp. 3-21, 1990.

[19] D. Boud "Assessment and the Promotion of Academic Values" *Studies in Higher Education* vol. 15(1) p. 102, 1990.

[20] D. Boud and N. Falchikov "Aligning assessment with long-term learning" *Assessment and Evaluation in Higher Education* vol. 31(4) p. 410, 2006.

[21] J. Biggs "Enhancing teaching through constructive alignment" *Higher Education* vol. 32(3) pp. 361 – 362, 1996.

[22] Precision Consultancy (2007) *Graduate employability skills* Report prepared for the Business, Industry and Higher Education Collaboration Council, August 2007 Available http://www.dest.gov.au/NR/rdonlyres/1C24A4DE-AFCF-4B88-AE05-401898DAEEC/18859/GraduateEmployabilitySkillsFINALREPORT.rtf.

[23] B. Oliver "Teaching Fellowship: Benchmarking Partnershipsfor Graduate Employability" ALTC: DEEWR (2010) Available http://www.olt.gov.au/resource-benchmarking-partnerships-oliver-curtin-2010.

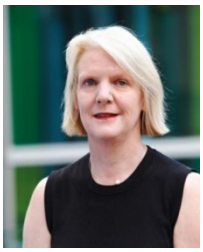
[24] TEQSA (undated) Tertiary Education Quality and Standards Agency Available http://www.teqsa.gov.au/about-teqsa.

[25] Commonwealth of Australia (2012) Application Guide Higher Education Provider: Application for Renewal of Accreditation of a Higher Education Course of Study (AQF Qualification) Available

http://www.teqsa.gov.au/sites/default/files/Renewal%20of%20Course%20Accred%20Guide%20FINAL%20280612.pdf p.24

[26] Commonwealth of Australia (2010) DEEWR ALTC Learning and Teaching Academic Standards Project Final Report Available http://www.griffith.edu.au/__data/assets/pdf_file/0004/334084/ALTC-Academic-Standards-Final-Report.pdf

[27] Commonwealth of Australia (2011) DEEWR ALTC Learning and Teaching Academic Standards Project Final Report for the Second-Intake Disciple Groups of: Architecture, Building and Construction, Education & Science Available at http://www.olt.gov.au/resources/3899?solrsort=score%20desc



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S.J. Shannon, R. L. Francis, Y.L. Chooi & S.L. Ng "Approaches to the use of Blended Learning in Teaching Tectonics of Design to Architecture and Architectural Engineering Students" *Architecture Science Review* forthcoming December 2012, accepted Oct 2012

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