ascilite 2011
CHANGING DEMANDS, changing directions.
Wrest Point | Hobart Tasmania Australia | 4–7 December 2011

Working from the evidence of prior art and experience in curriculum database development

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There are many potential benefits from systematic documentation of university degree curricula, including facilitation of curriculum review, accreditation reporting and better information for students, lecturers and administrators. The importance of such documentation and its growing complexity has motivated many attempts to create software systems to manage it more effectively. However, there has been little reported on the process of creating such systems and experience of using them. This paper describes the 10 year evolution of the CUSP curriculum database at the University of Sydney's Faculty of Engineering & IT, from a 200 unit, engineering- specific repository, to a multi-faculty platform for 169 degree pathways and over 2000 units of study. The paper contributes to the understanding of challenges of large scale curriculum modeling and curriculum information management and shares lessons learnt in building systems to support these processes and the people involved.

Curriculum databases, curriculum modeling, academic standards, learning outcome standards

Introduction

University degrees aim to instill in students a set of skills, attributes and competencies over a progressive sequence of units or subjects that usually span three to five years of full-time study. Each discipline typically has its own set of expected graduate outcomes but at widely varying levels of formalisation and external accountability, subject to presence or absence of professional accreditation and the different approaches of the professional bodies involved. Systems and tools for tracking and managing the delivery of expected graduate outcomes are similarly disparate. Online curriculum databases that map learning outcomes across teaching programs are well-established at the level of individual disciplines, medicine in particular, and at a few individual universities, but unknown elsewhere.

The need for greater consistency in identification and monitoring of university outcomes has been a major focus of current higher education reform, through the work of the new TEQSA Interim Commission (Tertiary Education Quality and Standards Agency, 2011) and the Learning and Teaching Academic Standards (LTAS) Project of the Australian Learning and Teaching Council (2010). The activity and interest around outcome standards development has so far not spilled over into comparable interest regarding the information resources required for effective implementation of outcome standards across large, complex teaching institutions. Interest in the underlying theoretical and practical issues of developing systems for managing learning outcomes information on a broad institutional scale has been largely confined to medical education so far.

This paper discusses the literature on such curriculum information management systems. It then presents the design, research, lessons learnt and long term evolution of a series of such systems, deployed and evaluated in a live environment at the University of Sydney over the last ten years.

Background

Computer based systems designed to manage the documentation of teaching curricula on a broad university scale represent a growing, though under-reported, field of educational technology innovation. Among these new systems, described for purposes of discussion as 'curriculum information management systems', three main types can be identified. The first, and most visible, are systems that focus on providing online access to detailed unit of study outlines to both prospective and current students, such as the Course Profiling Systems at the University of Queensland and Griffith University. The second type provides student coursework information restricted to students enrolled within specific units, as seen in the Equella system recently introduced at the University of Canberra (2010). The third type provides teaching managers with curriculum data analysis and reporting as an independent service, separate from the student information and communication aspect. Pearson's Learning Outcomes Manager and the Blackboard Outcomes exemplify this type of management-focused system, both designed to integrate with the broader information functions of their proprietor's LMS.

While the range of systems used in management of curriculum documentation continues to grow, documentation of the field itself remains limited. Evidence of the practical impact of such systems on learning and teaching practice in Australian universities is fragmentary and circumstantial. Evidence of design issues faced in developing new systems, and the potential design approaches and solutions available, is similarly indirect and piecemeal, coming from work at a much smaller scale than the design of whole of university information system. Electronic Course Profiling Systems of the type developed at Queensland are mentioned briefly but favourably in a 2008 Australian Council of Engineering Deans report on the state of engineering education (King, 2008, p.88-9). The systems are noted as part of a 'highly desirable' systematisation of teaching administration. Another passing mention from a less favourable perspective is found in the 2009 National GAP issues papers. The Course Profiling systems are described as part of a 'proliferation of technology' that fosters a mechanical 'tick- box' tendency among academic staff responsible for updating curriculum documents (The National GAP, 2009, p.15). The AUQA Good Practice database cites the online graduate attribute mapping system used at Murdoch University (Lowe & Marshall, 2005) as an exemplar of university good practice (Australian Universities Quality Agency, 2007). The system itself, however, has been discontinued.

The Curtin Curriculum Mapping Tool (CCMap) has been relatively well-publicised through an ALTC Teaching Fellowship awarded to Curtin's Bev Oliver (Oliver, Ferns, Whelan & Lilly 2010). The Curtin tool aggregates unit of study details submitted via template to create overview charts summarising important curriculum aspects such as graduate attribute coverage, assessment methods, learning activities, learning resources. However the tool lacks the database support found in Course Profiling systems used at Queensland and Griffith. A full online database is planned for the future CCMap Version 3, but the current Version 2 remains dependent on spreadsheet technology. Updating is a slow manual process and there is no ability to integrate with other university systems for sharing data (Oliver et al. 2010, p.81).

The SUMO (Study Unit Organiser and Manager) system at the Sydney's Faculty of Education and Social Work is subject of a brief report in the university's *Synergy* magazine (Waugh, 2009), following the system's success in winning the inaugural Vice Chancellor's award for System's that Achieve Collective Excellence in Teaching. The report describes the general functions of the system and some of the benefits resulting. The benefits comprise more consistent and reliable unit of study information for students, improved quality assurance of curriculum design and easier preparation of curriculum design reports for external accreditation. The report does not include any discussion of broader implementation of the system beyond the local faculty, or any issues that might affect the chances of such an expansion. Why such systems emerge and remain at faculty level rather than operating as general university systems, despite their award-winning qualities, remains to be explained.

The literature of computer-based curriculum information management also includes a number of works dealing with different stages of the University of Sydney curriculum database work described in this paper. These contributions have been concerned with individual curriculum information management issues rather than overall system design. Calvo, Carroll and Ellis (2007) describe the OpenACS database technology used in the initial engineering unit of study database. Zhang, Calvo, Carroll and Currie (2006) describe the quantitative method used in analysing and reporting the data collected there. Currie, Carew and Zabella (2005) describe a curriculum mapping exercise conducted via the engineering database and present examples of curriculum mapping visualisations generated by the reporting interface, though without mentioning the database itself. Subsequent revision and expansion of the engineering system beyond its original engineering base has resulted in new work dealing more directly with the challenges of curriculum information management at a broad university scale. Papers by Kay & Gluga (2009) and Gluga, Kay & Lever (2010) focus on the challenge of analysing and reporting the alignment of teaching and assessment with teaching goals in an environment where learning is no longer bound within a single disciplinary representation of the intended goals, but involve multiple sets of learning goal specifications. The second of the two papers describes the eventual solution to this problem through the cross-mapping of different goal specification frameworks amongst themselves and how this solution was implemented in the new multi-faculty, multi-disciplinary system known as CUSP. This was welcome progress on a difficult issue, but still not much of an advance in terms of documenting the individual system, let alone developing a more systematic understanding of the field around.

The documented history of computer based curriculum information management as a specific field of educational and technical inquiry belongs primarily to medical education. Medical educators in the early 1990's were already attempting to formulate the generic features and software architectures of what they had come to call the ‘curriculum database’ (Mattern et al. 1992). There was also in-depth discussion of the broader dimensions and issues of computer-based curriculum information systems generally, and the design principles relevant to their development (Nowacek and Friedman 1995). Nowacek & Friedman's work includes explicit definitions of the terms 'curriculum information system' and 'curriculum database'. The former is defined as 'a representation, usually stored on a computer of the content and structure of the curriculum.' The curriculum database is defined as a particular type of curriculum information system, designed for administrative reporting rather than teaching or student use. Nowacek and Friedman postulate as a basic principle of curriculum information system design that the different information needs of students, academic staff and administration should be addressed separately by different systems, rather than all at once. The creation of a single integrated curriculum information platform is considered beyond the realistic expectations of university project budgets.

Nowacek and Friedman's approach assumes a curriculum that is relatively simple in structure and tightly controlled to start with. Otherwise the costs and risks of separately managing information for student, teacher and management purposes would be difficult to contain. Nowacek and Friedman's specific proposals may thus be contested in teaching areas where the curriculum is more complex and/or more loosely controlled than is the case in the teaching of medicine. There are nonetheless some important implications to be drawn for curriculum systems more broadly. One implication is that a core problem of university curriculum information management remains largely unaddressed in both theory and practice: the problem of integration between the different systems and processes involved in the creation and sharing of curriculum data. A second implication is that addressing curriculum information management at an integrated level will require a long-term strategy not just a single project. If the solution cannot be broken down in simple terms of different systems for different user groups following Nowacek and Friedman's model, then some other sort of staging will have to be found.

Purpose

The purpose of this paper is to document the design experience of an ongoing series of curriculum database projects at the University of Sydney in a way that enables a clearer understanding of the general issues and requirements of such systems in academic discussion and the planning and operation of future systems. The documentation takes the form of a retrospective design comparison reflecting back upon the principles and lessons of each successive database design. The contrasting succession of linked cases over a sustained period of time provides a means of developing a more precise and practically grounded picture of the problem to be solved and essential system requirements, from a long-term perspective, through critical reflection on the results and limitations of the different approaches tried.

Method

The use of longitudinal design comparison as a means of revealing and clarifying design ideas derives from the educational design research approach where complex educational problems are investigated through the iterative solution prototyping that enables a progressive clarification of the problem at stake and the solution possibilities (Reeves, 2006). A more distant source is Glaser & Strauss's 'grounded theory', which provides the general template for the generation of theory from data in the research of social phenomena (Glaser & Strauss, 1967). The instrument of comparison is a design reflection grid that compiles the key design elements of each successive curriculum database version in a simple concise form and enables contrastive analysis between the different instances. Key design elements are identified under four categories:

212. General concept: what was the design solution in practical terms?
213. Design principles: what were guiding principles and sources, if adopted from elsewhere?
214. Results: what outcomes were most significant from a practical perspective?
215. Limitations: what difficulties were most significant for ongoing operations?

These categories were extrapolated from Reeves' 'three characteristics of design research': (1) addressing complex problems in real contexts in collaboration with practitioners; (2) integrating known and hypothetical design principles with technological advances to render plausible solutions to these complex problems; and (3) conducting rigorous and reflective inquiry to test and refine innovative learning environments as well as to define new design principles. The first two of these characteristics match the first and second categories respectively. The third characteristic, concerning evaluation of the implemented design is addressed in the 'results' and 'limitations' categories.

The design reflection grid was completed in three stages. The first stage involved compiling the maximum possible detail on each grid item, working from available design records. These records comprised: (1) internal planning documents and project reports, (2) performance statistics from the individual databases and (3) previous published accounts by Zhang et al. (2006), Calvo et al (2007) concerning the first database version and from Kay and Gluga (2009) and Gluga, Kay and Lever (2010) concerning the current CUSP version.
The second stage involved identification of key design themes amongst the material elicited in the 'principles' category. There were many points to be made on this subject, reflecting the complexity of the systems under development. Some sort of internal structuring was required. Three aspects of curriculum information

management design were identified as major common elements in the design principles of each stage. These were the quality model, the process model and the visual representation model embodied in each system. The design principles were accordingly under these three headings. The concept of the quality model was adopted from Biggs' stages of 'institutional teaching reflection' and a conscious aspect of system design from the first database attempt (Zhang et al 2006). Under Biggs' three stage theory, the quality model (or QM) comprises 'the articulation of an espoused theory of teaching' and informs processes of quality enhancement (through teacher development) and quality feasibility (which removes obstacles to teaching quality) (Biggs 2001). The process model and the visual model represented entirely new suppositions, but connected with the 'articulation' aspect of Biggs' quality model through the issues arising when the model is articulated on a large institutional scale. The notions of the 'process model' and the 'visual representation model' correspond respectively to the questions of procedure and format when articulating a curriculum quality model on a systematic institution-wide basis.

The third stage involved identifying the major trends across the design series and refining the individual design descriptions around them. Descriptions for each design version were reduced to their most salient elements and first ideas of major trends were formulated. The process of writing up these trends generated further reflection on the decisive contributions of the different design versions. Design descriptions were then revised to ensure that these contributions were captured. Table 1 below shows the results in the completed design reflection grid.

Table 1: Design reflection grid

	Database version 1.0	Database version 2.0	Database version 3.0 (current CUSP system)	Database version 4.0 (planned CUSP ugrade)
GENERAL CONCEPT	UoS (Unit of Study) design repository is integrated with quantitative analysis & visualisation tools to inform institutional teaching reflection.		Integrated repositories of (1) unit of study outlines, (2) program sequence tables and (3) discipine learning standards. This enables fine-grained analysis for curriculum review and more detailed and reliable information for students.	Integrated curriculum information management system with personal study planner as interactive student interface. Student interaction drives review and improvement of curriculum communication.
PRINCIPLES				
QUALITY MODEL	UoS design is consistent with intended learning outcomes of the university [university graduate attributes]	UoS design is consistent with intended learning outcomes of the discipline [discipline attributes]	Program design is consistent with the intended learning progression of the discipline	Program design provides a clear and logical picture of intended learning progression
PROCESS MODEL	UoS review -> 1. Student information 2. general curriculum review	Student UoS information -> 1. UoS review 2. general curriculum review	Program + UoS student information -> 1. UoS review 2. general curriculum review	Program + UoS information pool grows interactively from student reflection as well as academic review
VISUAL MODEL (STUDENT INFORMATION)	Simplfied program map (without finer details of elective choice)	Detailed program map for basic range of programs	Full program guide	Personalised program guide.
VISUAL MODEL (ADMIN REPORTING)	Program sequence with UoS attribute details	Program sequence with attribute details	Program learning progression map with distribution of (a) core vs elective UoS (b) assessment and (c) learning outcomes against discipline learning standards	Student activity statistics Program learning progression map with distribution of (a) core vs elective UoS (b) assessment and (c) learning outcomes against discipline learning standards
RESULTS	206 units of study. 15 program sequences in single discipline/faculty Most UoS with complete outlines. Exact proportion not tracked.	389 units of study. 30 program sequences in two disciplines, single faculty. UoS outline full completion at 81.5%.	686 published units of study with 2579 unit outline versions, plus 1897 proxy outlines for outside faculty units. 169 program sequences in three faculties, 16 discipline areas Uos outline full completion at 86%.	Pending . . .
MAIN LIMITATIONS	Relies heavily on 5 yearly curriculum review to drive UoS review and updating. Falls into disuse outside review period. Graduate attribute descriptors need more precise definition.	Still lacks basic technical features to support regular use in student information. Especially session versioning and connectivity with other university systems. Graduate attribute levels need more precise definition.	Teaching leadership workload. Not resourced for surge of new curriculum quality issues. Program admin workload. At capacity limits in maintaining new course information. Student role remains under-developed. Original plan to incorporate student as feedback agent has shown limited appeal. Alternative student interaction strategy required. Assessment details often insufficient to verify outcomes.	Pending . . .

Results

The design evolution across the four database versions follows a generally consistent direction at the level of the overall design concept, information process, and visualisation. The general design concept remains one of an integrated student information and curriculum management tool. The information process remains one where information produced for student purposes is analysed and reported for management purposes. The principal visual image of the curriculum remains the sequential program map. The lessons learned in these areas are mainly at the level of how the original design vision is to be delivered, rather than a major rethinking. The main change of direction is in the approach to curriculum quality. There is a movement away from the analysis of curriculum quality based on whether particular outcomes are delivered or not and more on the question of what the intended outcomes actually are and how they are organized across the program as a whole.

Curriculum quality

The first database version was designed as a tool for supporting curriculum quality through the analysis and reporting of education design details compiled from unit of study outlines. The model of curriculum quality adopted was one of learning outcomes alignment, based on the quality of alignment between intended learning outcomes, teaching/learning activities and assessment (Biggs & Tang 2007). The concept had originated as model for individual teaching practice rather than large scale curriculum management but was assumed to apply equally well to learning and teaching at any scale. The flaws in this assumption were not initially recognized.

The first problem with outcomes alignment as a macro-scale model for curriculum analysis was underestimation of the data quality issues to be encountered when dealing with large numbers of units across different programs and disciplines. Even with the most powerful curriculum database available, there were still major difficulties in ensuring that unit of study data was present, let alone accurate and relevant. Even where reasonably consistent details existed, anything more than superficial relationships were often hard to find. Outcomes alignment at a large scale became a search for lowest common dominators, which were in some cases so low as to be not worth the trouble of finding. Apart from being somewhat naive regarding the issues of aggregating educational design data from large numbers of units, the outcomes alignment approach was also misdirected in placing the focus on unit level educational design to start with. The primary problem in trying to understand different university curricula was not the question of whether individual units happen to address particular program outcomes or not but what outcomes need to occur where in the program sequence. The primary information need was not the design details of individual units but the intended learning progression of the program as a whole.

Bachelor of Engineering (XXXX) (2012) - Assessed Course Goals: Engineering & IT Graduate Attribute Matrix
Print View

	No Level	Level 1	Level 2	Level 3	Level 4	Level 5
1: Design and Problem Solving Skills		CIVL2110 CIVL2410 CIVL2611 CIVL3205 CIVL3812 ENGG1801 ENGG1802 ENGG1803	CIVL3010 CIVL4903	CIVL3206 CIVL4024 CIVL4025		
2: Discipline specific expertise		CIVL2810 CIVL4903	CIVL2230 CIVL2410 CIVL2611 CIVL3206	CIVL3205 Recommended Yr3	CIVL4024 CIVL4025	
3: Fundamentals of Science and Engineering		CIVL2110 CIVL2810 ENGG1800 ENGG1801 ENGG1802 MATH1001 MATH1002 MATH1003 MATH1005 PHYS1001	CIVL2201 CIVL2410 CIVL2611 CIVL3205 CIVL3612 MATH2061 Recommended Yr3	CIVL4024 CIVL4025		Level N/A
4: Information Skills			CIVL2201 CIVL2410 CIVL3205 CIVL3206		ENGG4000	Level N/A
5: Professional Communication		ENGG1800 ENGG1801 ENGG1803	CIVL2410	CIVL3010 CIVL4024 CIVL4025 ENGG4000		Level N/A
6: Professional Values and Conduct		ENGG1801 ENGG1803	CIVL3812	CIVL3010 ENGG4000		Level N/A
7: Teamwork and Project Management		ENGG1803	CIVL3812 CIVL4903 ENGG4000			

Figure 1: Summary report on outcomes progression within a degree program from Database Version 3.

The model of curriculum quality in successive curriculum database designs has accordingly evolved away from the quality of outcomes delivery and attainment and towards the quality of descriptive knowledge about what outcomes were intended to be. The final formulation of the curriculum quality model at the fourth database iteration was one where the curriculum design 'provides a clear, logical picture of learning progression'. This model still allows space for attention to unit level outcomes alignment as part of the global learning picture, but more at the level of explanatory detail, not the main picture itself. The macro-view of the curriculum 'wood' is prioritised over that of the individual unit of study ‘trees’.

The database reporting screen at Figure 1 above illustrates a transitional moment in between the two approaches to curriculum quality. In the Version 3 database design, curriculum quality still remained first of all a question of outcomes alignment, but with learning progression a growing concern at the same time. Simpler discipline outcome descriptions had been tried in previous database versions and found inadequate because they failed to adequately represent more advanced levels of learning. Tables of program outcomes descriptors in a matrix format had been developed for various disciplines to better define the learning progression there. These discipline outcome tables identified the key learning domains for the discipline and a set of criteria-based performance levels for each domain. The descriptive content for the performance criteria was developed using a combination of external accreditation standards and current unit of study content for reference. All learning domains and performance levels were matched against relevant elements of the external accreditation standards.

The matrix shaped outcome description frameworks could be used as a template for the reporting of outcomes alignment, as the reporting screen at Figure 1 above shows. The key learning domains are listed down the left side while columns across the table from left to right represent performance levels. Unit codes are listed against the different learning domains at a specific performance level wherever there is assessment of relevant unit level learning outcomes, based on current unit of study outlines. Elective units are included (in red) based on the extent that particular learning domains and performance levels are assessed across the group as a whole.

The intention in developing the matrix framework had been to enable a more precise evaluation of the way individual units contributed to the intended discipline outcomes by defining more precisely the kind of learning progression involved. However, once it became possible to ask such questions about the individual units, the individual unit ceased to be the problem. In the Design learning domain, for example, it was possible to ask whether Unit of Study 'X' was at Level 5, 4 or 3 and to answer the question according to criteria of whether students in the unit had to independently address complex design problems (Level 5), or simply complete complex tasks to given specifications (Level 4), or just work through a guided design exercise (Level 3). The hard question to answer was the question of what level was actually required. Until this question could be answered, there was not much point in knowing whether the attainment of Unit of Study 'X' happened to be at Level 5, 4 or 3. The real question here was not: 'Is this unit achieving what we want?' but 'What do we really want from this unit?'

Curriculum information process

The expansion of the database into the student information domain has been slow and incremental, beginning with a limited investment in one specific student information channel. The process design of the first database version, illustrated in Figure 2 below, comprises a process of curriculum design monitoring and reporting (represented by the grey dotted line) wrapped around the production and distribution of unit of study outlines (black arrows). The combined process begins with unit outline development shared jointly between unit coordinators and program coordinator, followed by release of approved unit outline for student viewing, followed by generation of analytical reports based on aggregate unit of study data. The reports would then inform periodic high level curriculum review that would then, in turn, feed back to the unit of study development process. Students are positioned off to side of this process, as ultimate recipients of the unit outlines, but otherwise having little role to play. The primary purpose of the combined process is management level reporting and analysis, as was the case in Nowacek and Friedman original 1995 curriculum database concept. The new database departs from Nowacek and Friedman's model mainly in dealing more directly with the sourcing of curriculum data. The different approach was a practical necessity in a discipline context where curriculum development was not centrally based to start with, but dispersed across individual units of study.

Attempting to link decentralised curriculum development into a centralised curriculum management process was obviously a significant change from the perspective of academic autonomy. The need for staff good will and co-operation in achieving this change meant that strict care was needed to avoid any intrusion beyond what was reasonably required for the flow of curriculum data (Oliver et al., 2010; Sumsion and Goodfellow, 2004).). This was an additional reason for database development to remain focused on its original purpose and cautious about any sort of wider role in managing communications between academic staff and students. The expansion that came was not through attempting to take over established communication channels but rather the need to fill gaps where communication was under-developed or non-existent.

The basic features of the growth experienced by the database are summarised graphically in the contrasting information flows of the first database design (Figure 2) and the most recent attempt (Figure 3). The basic features were an (1) expanding functions and content resulting in (2) intensified content development and (3) a need to draw upon a broader range of content contributors. The two additional functions developed were management of learning outcome frameworks (such as faculty or discipline learning outcome tables and competency standards for external accreditation) and ‘program planner’ pages that provided information about program structure and requirements for enrolment planning purposes. Of the two functions, the program planner pages were by far the largest growth area for new content development.

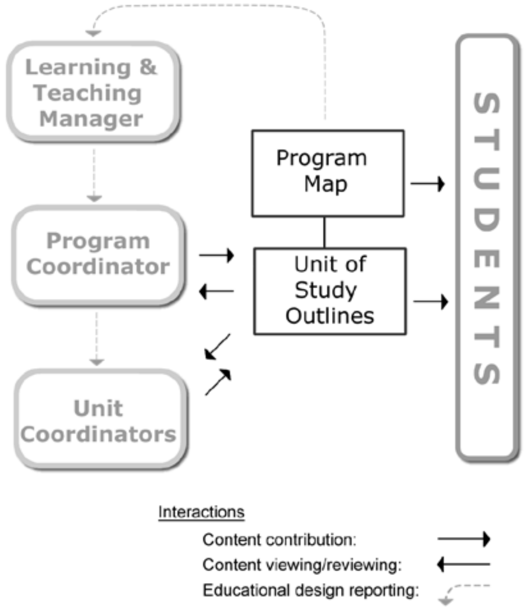

Figure 2: Information flow in Version 1 Database

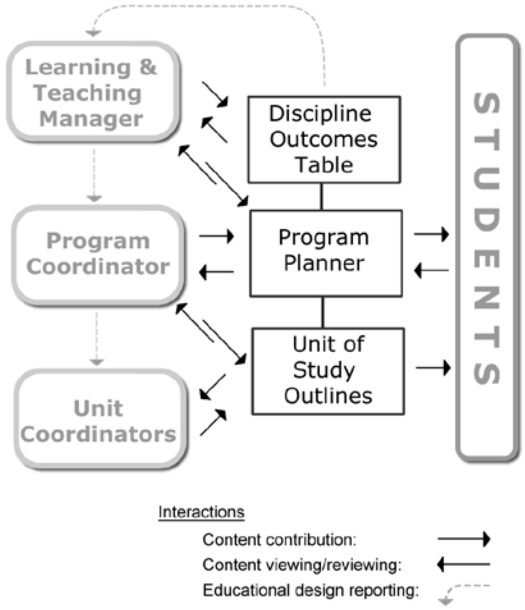

Figure 3: Information flow in Version 4 Database

Growth in program planner information took a number of forms. There was first of all greater depth of program information, focusing in particular on enrolment sequence details and core/elective relationships, in order to meet the need for more accurate analysis of learning progression in degree programs. There was growth at the same time in the range of programs covered, driven partly by extension of the database to other faculties and disciplines and partly by gaps in existing program documentation, particularly concerning combined degrees.

The initial motive for improvement in program planner information had come from the curriculum analysis side of the database. Following the initial involvement with program planning, however, it became apparent that there was a broader issue of student access to relevant program information when making enrolment decisions. This student information need coincided closely with the curriculum management need for better tracking and analysis of learning progression. There remained a question however of how exactly to address need for better program planning details. The problem was essentially a combination of (1) the volume and complexity of the information (2) its scattered location, (3) unreliability and ambiguity in the program documentation that existed, (4) reliance on undocumented informal practices to fill gaps in official documentation and (5) limited human resources to address these matters. The curriculum database development process had been helpful in taking measure of these issues but the database as it existed was nowhere near offering an actual solution.

A possible solution was identified in student feedback responses to a trial attempt at standardising combined degree information in the Version 3 database. The suggested solution was an interactive online course planner where guidance could be provided based on previous enrolment patterns as well as official rules and requirements. The planner would provide both flexibility in the exploration of individual enrolment options but also structure and direction. It would at the same time feed a new and more dynamic pool of enrolment planning information that would be continuously updated from current student experiences. The proposal forms part of the design specifications for the Version 4 database.

Curriculum visualisation

The visual approach of the successive curriculum database designs did not change to the same as extent as was seen in their approaches to curriculum quality and information process. The main visual form representing the curriculum remained essentially the same throughout: a program map comprising units of study in some sort of enrolment sequence from first to final year down the page. The program map was realised in different forms from one database to the next but the basic idea remained the same. The main changes were growth in the amount of program information to be conveyed and an accompanying move towards simpler text based representation of program elements and away from use of more complex visual techniques such as icons and colour coding. The first database version provided the most aesthetically pleasing program map, with units of study represented by series of tile icons (Figure 4), but was hard to maintain amid repeated revisions of program information requirements.

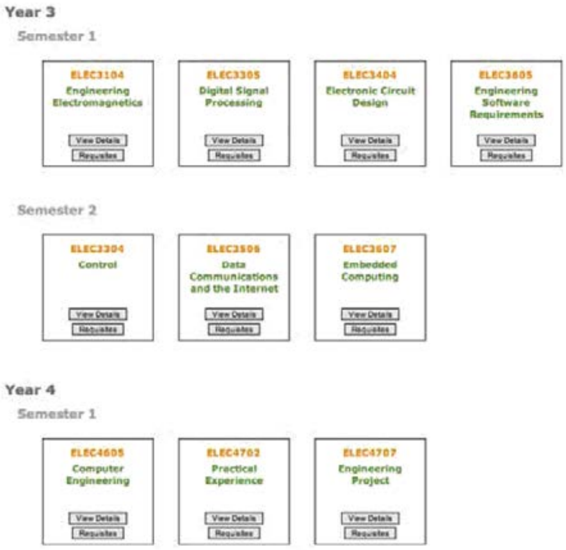

Figure 2. Program Map from Version 1 Database (Zhang et al., 2006)

Continuous growth on the content side has encouraged a preference in subsequent database versions for simpler, more functional layouts over those requiring graphical investment. Growth in program-related content also meant growing problems of information load and navigation. Satisfactory solutions are still to be found for the integrated visual presentation of major and minor options within enrolment sequence tables, and for referencing of degree rules at the same time. Further design experimentation will be required in these areas.

Conclusion

This paper attempts to clarify the design requirements of large scale university curriculum information management systems through reflection on previous design experience. The key design problem has been essentially one of integrating the monitoring and reporting of curriculum quality with student course information. The design experience has brought lessons for each of these two areas, as well as for the integration problem itself.

The lesson in relation to curriculum quality is that more attention is needed to the quality of learning outcomes description from the perspective of learning progression, and possibly less attention to the question of whether particular outcomes are attained or not. Do the program's learning outcome specifications provide a clear and logical picture of learning progression through the program? Or just a list of vague qualities that graduates might hopefully possess? In relation to student course information, the experience has shown how information quality can benefit from the use of a curriculum database, particularly in the area of enrolment planning. In relation to the problem of integration between curriculum outcomes management and student course information, the experience confirms Nowacek and Friedman's warning that the problem is forbiddingly complex and unlikely to be fully resolved in a single university project. However the experience, also shows that improved integration can still be achieved incrementally, focusing on specific areas of information need, rather than all at once. Concerning the future direction of curriculum database development, the experience has suggested that students may potentially play a more active role and indicates how this might be achieved through the development of an interactive online planner.

The point regarding learning outcome quality requires some further discussion in the context of the current national initiatives on university outcome standards and in the context of curriculum theory more broadly. The need for clearer, more systematic descriptions of university learning outcomes is well recognised, to judge by recent ALTC and TEQSA work in the development of discipline-level learning outcome standards (Tertiary Education Quality Standards Agency, 2011; Australian Learning & Teaching Council, 2010). The key issue in this paper, however, is not simply one of having better outcome standards, but standards that ensure a clear and logical picture of learning progression across university programs. In the new discipline Threshold Learning Outcome standards (TLOs) developed by the ALTC's Learning and Teaching Academic Standards project, learning progression is present to an extent that distinguishes between undergraduate and postgraduate educational levels, but nothing deeper. The new TLO's are intended as normative standards against which university teaching programs are held accountable rather than as tools for analytically breaking down the key elements of learning progression within programs. From the perspective of the curriculum database experience, this kind of analytical breakdown of the learning area is precisely the first step required before any specific targets are defined. The idea is that defining the field of play should come before any goal posts are set up, rather than trying set up goal posts with only a rough notion of the terrain they stand upon.

It must be acknowledged that this is not the first occasion on which learning progression has been raised as a curriculum design issue. Sumsion and Goodfellow (2004) and Green, Hammer and Star (2009) mention the inability to capture learning progression as problems in mapping of university graduate outcomes. A concern with learning progression may more indeed be seen as a core thread of modern educational thought, embodied in work of Piaget, Bloom's taxonomy and the SOLO taxonomy. The idea that learning should be defined against some sort of progressive scale, such as Bloom or SOLO, is a standard part of currently recommended methods of outcomes-based curriculum design (Biggs & Tang, 2007). While a concern with learning progression has always been present in curriculum theory, the general concern has not yet translated into any sense of urgency regarding learning outcome progression across university programs, let alone a systematic approach to the question. It has taken repeated exposure to the same problem, in many different teaching programs and discipline contexts, to begin to appreciate that identification of intended learning progression is not just one problem of university curriculum design but the most important problem currently faced.

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Acknowledgments

The curriculum database initiatives reported in this paper were completed with funding from the University of Sydney's Teaching Improvement and Equipment Scheme and the subsequent Teaching Improvement Project Scheme.

Please cite as: Lever, T., Gluga, R. & Kay, J. (2011). Working from the evidence of prior art and experience in curriculum database development. In G. Williams, P. Statham, N. Brown & B. Cleland (Eds.), *Changing Demands, Changing Directions. Proceedings ascilite Hobart 2011*. (pp.799-809).

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