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Designing IS Curriculum to Meet Industry Requirements

Kathy Lynch
University of the Sunshine Coast, Kathy.lynch@usc.edu.au

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University of the Sunshine Coast
Queensland, Australia
Email: kathy.lynch@usc.edu.au

Abstract

Curriculum development does not just happen, it needs to be carefully designed; to be effective it needs to be written and implemented for the time and the society that it is intended; that is, it needs to be developed for the present and at the same time move towards the future rather than as a leftover from the past (Bobbitt 1918:1972; Eisner 1992; Peddiwell, Benjamin and Benjamin 1939). There are a number of facets to curriculum development, including determining the underpinning ideology or philosophy, context, its conceptual framework, and the content to be learned.

This paper presents the process undertaken in developing a curriculum framework that could be used as the basis for designing undergraduate curriculum regardless of the discipline. However, the discipline used in this study is Information Systems, in particular the learning of collaborative work skills. The framework is underpinned by sound educational theories and current content requirements as specified by accredited bodies, literature, and industry and graduate feedback.

Keywords

Curriculum design, curriculum development, IS graduate attributes

INTRODUCTION

Many writers about curriculum have argued strongly for a number of years that curriculum needs to be written and implemented for the time and society that it is intended, and that curriculum needs to be developed for the present and be moving towards the future rather than leftover from the past (see, for example, Bobbitt 1918:1971; Eisner 1992; Peddiwell et al. 1939). The catalyst for the establishment of new curriculum or the re-development of existing curriculum can be any of a number of stimuli: for example, preparing the learner for professional work, and the changing nature of work itself and the way it is conducted, to name two. It is workplace change that is the central stimulus for the curriculum development that is the focus of this paper.

Curriculum design has two primary stages: the development of a framework or model to present and organise the curriculum, and identifying the content to be learned. Determining which comes first, is often a dilemma for the educator, however, deciding on the framework first is the preferred option by some educators (for example Anderson and Krathwohl 2001) and the approach taken in this study. Having said this, the study began with an investigation into the needs of Australian businesses who employed early career Information Systems professionals. This was followed by the design and development of a structure or framework to hold the curriculum. Other than discipline knowledge and skill, IS practitioners need to be effective and efficient members of collaborative teams (for example Anon; Hawkings and Stein 2001; Snoke and Underwood 1999: 2000: Snoke, Underwood and Bruce 2002; Sudweeks, and Allbritten 1996; Thomas and de Villers 2002; Trauth, Farwell and Lee 1993). Though attitudes are considered as components of the skills required to work collaboratively are listed in government and education reports, little 'genuine' attention is given to developing these skills in IS undergraduates. Soft skills, graduate attitudes or an one of the many other names these skills are referred to, are listed in University's mission and faculty mission or goal statements, however, they are often not a true reflection of what is actually learnt in the classroom - and commonly have very little impact to the curriculum other than a tick in a checkbox. If we, as IS professionals are going to sustain and advance our profession in responding to the rapidly changing IS needs of society, we need to do more to improve the readiness of our graduates for this changing society. The curriculum outlined below, not only contains content examples that reflect the needs of established IS consultancy firms and businesses, but a methodology for curriculum development and improvement.

CURRICULUM CONTEXT

In agreement with Tyler's (1949) continuity, sequence and integration paradigm, integration and implementation of a curriculum (in part or whole) needs to be examined within the context of the learning; its sequencing and

duration, and the cumulative effect the learning experiences have on the on the student's learning situation. Taba (1962) states:

> The task of selecting and organising learning experiences involves more than applying certain principles of learning. It involves ideas about such matters as strategies of concept attainment and sequences in formation of attitudes and sensitivities … the extent that learning activities are used to implement some objectives … becomes a part of a major strategy of curriculum building instead of being relegated to incidental decisions made by the teacher at the moment of teaching (pp12-13).

Curriculum, and therefore learning, to be successful needs to meet the needs of the situation in which it is being delivered. Failure to situate the curriculum in this context and to accommodate substantial changes that may be required in the curriculum, risk being entrapped by a *Sabre-tooth tiger* curriculum (Peddiwell et al. 1939). [The Sabre-tooth tiger curriculum is a satire that tells the story of a Palaeolithic school curriculum that became obsolete with the coming of the Ice Age where new conditions demanded new curriculum. The elders of the tribe decided that the old traditions (or curriculum) were best and would allow the tribe to grow and prosper as they had always. The end result was that the tribe did not acquire the required skills, attitudes and knowledge for the changing times, and therefore perished]. The story has not changed significantly in respect to IS curriculum. Tyler and Bobbitt (reported in Jackson, 1992) claim that curriculum needs to respond to 'local conditions', and 'to the demands and expectations of the larger community' (p.26).

Further, Wheeler (1967) stresses the importance of curriculum development in supporting behavioural and social change, with an important caveat that "Change for the sake of it, is not a good reason to change" (p12). Educational theorist such as Tyler and Bobbitt (reported in Jackson 1992), and Lincoln 1992 rightly claim that curriculum needs to respond to local conditions, the demands and expectations of the community, and be situated within the needs of society at large. Preparation for this change can be conceived through changes in the intentions of formal education, that is, through curriculum design and its development, and is realised through teaching the curriculum.

The curriculum framework and it associated content presented here, has been designed within the Australian Information Systems context in the first decade of the 21st century. The curriculum is flexible and guided rather than rigid and dictatorial, and been designed to be integrated into the broader IS curriculum.

CURRICULUM DESIGN

Central to the design approach adopted in this study has been the ideologies, theories and practicalities of work by Schon, Dewey, Bloom, Vogysky and Taba and their associated claims to fame (reflective practice, human behaviour, learning domains, constructivism, scaffolding, experiential learning and curriculum design).

Taba (1962) claims that curriculum planning needs to be done wisely, rationally and scientifically, rather than on an ad hoc or as knee jerk reaction (p 444). If well formed ideologies are followed (though not necessarily blindly followed), then there is a greater chance that the curriculum's design will be meaningful, enabling it to be understood and therefore implemented as intended rather than in a more ad hoc mis/interpretation. Following on from Taba (1962), Eisner (1992) claims that at least six ideologies influence curriculum design; one being progressivism, an ideology held strongly by Dewey. Progressivism in curriculum design relates to human behaviour, adaptation to the environment, and social reform – all of which are key issues in the educating the IS/IT workforce. Dewey (1938) believed that overt experience is the first step in learning; this is then followed by a progressive experience – which is commonly referred to today as experiential (and authentic) learning.

Experiential learning places a greater emphasis on the "cognitive principles applied to methods of learning or to the understanding of content" (Taba 1962 p125) rather than drill and practice and rote learning, both of which have shown to be inappropriate in the development of a deep understanding (Biggs 1999). The impact of experiential learning is that the learner not only learns by the experiences encountered, but though the generalisations, ideas and concepts that are generated and developed through the direct experience (Taba 1962). The framework presented in this paper is one which leads to a curriculum that is flexible, self forming under recommendations, and unambiguously implies experiential learning.

Tyler's (1949) work is generally regarded as the beginning of systematic consideration of curriculum development: his model for curriculum development is commonly referred to as the 'objectives model'. Numerous educationalist, for example Wheeler (1967) and Brady and Kennedy (2003) and have modified Tyler's objectives model, however, the key questions (or phases) that need to be asked or addressed in development are:

- What educational purposes should the 'school' seek to attain (that is the aims, goals and objectives)?

- What educational experiences can be provided (selection of learning experiences)?
- How can these experiences be effectively organised (method and content)?
- How can we determine whether these purposes are being attained (evaluation)?

Extending on Tyler's questions/phases, Anderson and Krathwohl (2001) made the addition of the requirement to have an 'alignment' between objectives, instruction, and assessment to ensure that they are consistent with one another. Their work builds on the vertical/horizontal integration postulates by Nicholls and Nicholls (1972). This alignment not only benefits the learner, but brings integration between components across and within curriculum content.

Regardless of the model used, the curriculum developer is required to make decisions about the appropriateness of the curriculum elements (objectives, content, method, evaluation) within the context of where the curriculum will operate (Brady and Kennedy 2002). The models act as a guide and a focus in the development of meaningful and valid curriculum, and bring about order in the management of tasks (Jackson 1992). One way of achieving this order is through the development of a framework or matrix to house the curriculum.

DEVELOPING THE CURRICULUM FRAMEWORK

Taba (1962) states that "a conceptual system for the curriculum is a way of organising thinking about all matters that are important to curriculum development" (p 420). A framework is used as a foundation for building something, for example a mesh frame for a sculpture, a blueprint for a building, a digitally animated frame for a 3D object; or as a matrix to hold separate but related objects: it is not a finished product, but rather a clearly defined and structured means to an end. In the context of curriculum development, a framework is a structure that guides the reader (and implementer) through high level concepts, and visually and holistically represents what is intended in the implementation of a curriculum for a specific situation. This is true for the framework presented in this paper as it has been guided by established curriculum development principles, educational theories and is encompassed by the requirements of society in which it is directed (the IS industry in the beginning of the 21st century). It is also something from which others can build upon.

Anderson and Krathwohl (2001) define a curriculum framework as consisting of "a set of categories related to a single phenomenon. These categories are a collection of 'bins' into which objects, experiences and ideas can be placed" (p4). Once an object is placed in a particular cell (or bin) within the matrix, the learning experiences can be developed: it is important that this sequence is not reversed. This matrix structure is accepted extensively by curriculum developers and is used as a foundation to curriculum development around the globe, for example the IS2002 curriculum model (Gorgone et al. 2002), record keeping curriculum (Iacovino 1998), and curriculum for undertaking collaborative work in business (Monday 2003).

The framework is structured to allow for vertical and horizontal integration of content and experiences, for example, to develop a particular skill attitude or knowledge there needs to be integrated learning experiences within a module/year level. This enables the learner to develop depth across the years of tuition in the program, and to develop breath during each year of tuition.

Vertical and horizontal integration

Tyler (1949) argues that effective learning experiences should exhibit three major characteristics: continuity, sequence and integration. *Continuity* refers to the vertical reiteration of major curriculum elements. *Sequence* emphasizes the importance of having each successive experience build upon the preceding one but to go more broadly and deeply into the matters involved. *Integration* refers to the horizontal relationship of curriculum experiences. The organisation of these experiences should be such that they incrementally and increasingly help the learner to obtain a unified view, and to unify his/her behaviour in relation to the elements dealt (Tyler 1949).

Taking a different approach to integration, Nicholls and Nicholls (1972) prefer to refer to it as *vertical* and *horizontal* relationships. They claim that vertical relationships must take into account the complexity of the learning objectives or outcomes with respect to the learners' abilities, and that the objectives/outcomes build "the level of performance displayed in the previous one" (p66). Other theorists refer to variations of this relationship as integrated learning, spiral learning and scaffolding. Aligning vertical and horizontal integration within a learning context allows for promoting harmony between the learner and the learning (Hopkins 1937); and the development of a "unified experienced based learning with the academic knowledge" (Mills, Auchey and Yvan 1996 p2).

Although, Nicholls and Nicholls (1972) advise that curriculum should be related rather than isolated to avoid 'compartmentalising content', the framework has been written with two levels in mind; intermediate and graduate, and places the intended learning outcomes into the more appropriate of these levels. The *intermediate*

level signifies a stage of learning prior to the completion of the 'module', a stepping stone, with the learning building on previous experiences (Bruner and Piagets' concepts of spiral and constructivist learning), and places skills as 'handholds' or supports from which to learn (Vygotsky's concept of scaffolding). The *graduate* level is self explanatory, in that it is expected that student would have obtained these skills, knowledge or attitudes by the time they graduate.

Chronological organisation of the modules in the framework is limited to the vertical relationship of the intermediate and graduate outcomes. This has been done to allow for scope and diversity in cohorts and institutions. In the same vein, there is no suggested duration for modules or the delivery of the curriculum itself. This is deliberate, and is in recognition of the variable and complex makeup of undergraduate IS cohorts; their different experiences, diversity of backgrounds and cultures, age, maturity and educational background.

The framework's architecture

The structure of the framework is in the form of a matrix, made up of a number of components. Within the *domain* cell is the overall category of the skills, attitudes and knowledge. The *skill* cell holds the individual skills, attitudes and knowledge, followed by a short description of the skill to aid understanding. Following this are the *outcomes* and *examples of implementation*; these are listed according to the student's *progression in the course* – either intermediate or prior to graduation.

At the nucleus of a curriculum are the *outcomes*. Within the literature, objectives and outcomes are sometimes used interchangeable. According to Spady (1994) "Outcomes are high-quality, culminating demonstrations of significant learning in context" (in Willis and Kissanne 1999 p18). An objective is defined by Brady and Kennedy (2003) as a "specific statement of planned learning outcomes … an observable indicator of student achievement" (Brady and Kennedy 2003 p171). Advocates of the significance of outcomes-based education in particular argue that there *is* clearly defined distinction, and that the two terms should not be confused or used interchangeably.

For outcomes (and objectives) to be useful, Brady and Kennedy (2003), amongst others, maintain that they need to be "precise and in terms of what is achievable with respect to the learners' ability, resources and purpose" (p175). Tyler's (1949) seminal work on curriculum and learning suggests that objectives are two dimensional "identify both the kind of behaviour to be developed in the student and the content in which this behaviour is to operate" (pp46-47).

Anderson and Krathwohl (2001) building on their previous work identified three levels of specificity of an objective; global, educational, and instructional. Global in terms of holistic, overarching requirements of the profession and society; educational in terms of curriculum and pedagogy, and instructional in terms of content. Each of these three are important when designing a robust and flexible curriculum that meets the needs of society. Although Anderson and Krathwohl use the term 'objectives', their levels of specificity are relevant, and have influenced the outcomes embedded in the curriculum.

Tyler (1949) describes objectives in terms of overall development, the *learning experiences* and assessment of the learning program - -the final component of the framework. The outcomes are written using the terminology associated with Bloom's Taxonomy of Educational Objectives (Bloom et al. 1956), and encapsulates the cognition, affective and psychomotor domains. These domains are used within the detail of the curriculum as they give a quassi structure to the framework, enabling it to be more readable and focussed on the central theme of each of the skills, attitudes and knowledge. Additionally, using the formality surrounding Bloom's Taxonomy facilitates the construction of the outcomes. The structure of the framework is presented in Table 2.

Table 2 The framework's architecture

DOMAIN:		
SKILL: *Description*:		
	Outcomes The student should be able to ….	**Examples** of implementation and learning experiences
Intermediary		
Graduate		

CONTENT FOR COLLABORATIVE WORKSKILLS CURRICULUM

To re-iterate, the context for the curriculum is the Australian Information Systems beginning professional, with collaborative work skills as the content focus. It is presented using a framework developed during the study, which is outlined in the previous section. Content does not stand alone; it is embedded in a curriculum – one that has learning strategies and intended outcomes, and is organised in a structure or framework, as presented here, to aid understanding of its place in the education of the learner for the society which they will enter.The selection of content for the curriculum has been guided by studies conducted by Anon; Hawkings and Stein 2001; Snoke and Underwood 1999: 2000: Snoke, Underwood and Bruce 2002; Sudweeks, and Allbritten 1996; Thomas and de Villers 2002; and Trauth, Farwell and Lee 1993. Further, the content has undergone refinement by filtering it according to Nicholls and Nicholls (1972) four criteria for selecting curriculum content; validity, significance, interest, and learnablity.

The *domains* are the general themes that emerged from investigations during the study and from the literature. The three domains are:

1. self or intra-personal skills, attitudes and knowledge,
2. skills attitudes and knowledge required to work with others in the immediate work environments (that is inter-personal skills attitudes and knowledge) and
3. skills attitudes and knowledge required to work with others external to the immediate work environment.

Within the domain cell is the overall category of the *skills, attitudes and knowledge*. These skills, attitudes and knowledge surfaced during the study and the literature. During the study, professionals from the IT industry identified these skills (see Anon), and extended the term skill to include attitudes and knowledge. Like the literature, the industry representatives had trouble separating one skill from the other. This arguably shows the interrelationship and interdependency between the skills. It is these skills, attitudes and knowledge that are included in the curriculum presented in this paper, see Table 3.

Table 3 Domains and skills

The domains are:	The skills are:
Personal	ICT Competence Communication skills Time management Maintain own competence Problem solving Respond to change, be adaptable and flexible Initiative / entrepreneurial
Inter-personal	Shared communication Team functionality Tolerance Professionalism
Beyond the work group	This is the development of an awareness or attitude rather than a list of dependant skills that are required by the team as a whole in its relationship with other teams, the organisations, the client, and others outside the immediate work group. This builds on the intra-personal and inter-personal skills of the team members, though within a holistic or extended environment. The acquisition of this awareness or attitude may begin in undergraduate IT studies, but they do not come to fruition until the student joins the collaborative workforce. This typifies the dislocation of learning between the formal learning process, and what is practical. The formal learning process, no matter how much it may try to mimic the workplace, and in cases it may be a very good mimic, it is still a mimic. Many of these attitudes are not developed until the student is part of a collaborative team in the workforce where they get a sense of the 'big picture' and how their team fits into the organisation's vision, underpinning philosophy and over arching goals and aims.

The required skills, attitudes and knowledge can be successful achieved through the *outcomes* which have been placed in the curriculum according to the learner's *progression in the course*. There is no duration dictated or

suggested for each skill nor at each level, as an outcome at the intermediate level could be within the first few months, by the end of one year of study or before the final semester commences (or completed). This has been done intentionally due to the individual nature of learners and the institutions in which they learn.

The examples column presents samples of either implementation suggestions or ideas for *learning experiences*. It is not the intention of the curriculum to represent best practice or to fully cover all possible activities, nor are these examples of excellent pedagogy or what must be taught. They have been included as examples to elaborate some of the underpinnings of the outcomes, and to "capture some of the complexity, ambiguity, and problematic nature of classroom instruction" (Anderson and Krathwohl 2001 p111). The learning experience examples in the framework have been developed according to Tyler's three major criteria for building effective learning experiences (continuity, sequence and integration) are cumulative and vertical within the overarching skill domain so as to reinforce each other. At the same time, the skill domains are not to be isolated from each other (horizontal) as they complement and develop a more holistic and well rounded IS professional.

An extract of the development curriculum is presented in Table 4 (Due to space restrictions, the full curriculum has not been provided here, however it can be obtained by emailing the author).

Table 4 Extract from the developed curriculum

DOMAIN: **PERSONAL.** These are the skills, attitudes and knowledge required of an individual to function in the workforce. They are specifically related to one's self and own abilities, and are the foundation for effectiveness in the IS workforce. These skills, attitudes and knowledge as identified by industry, and reported in the literature include; Information Communication Technologies (ICTs) competence, oral communication, written communication, time management, maintenance of own competence, problem solving, adaptability, initiative.		
SKILL: **Communication skills**		
Description: Communicate effectively with individuals or groups of people with and without the use of artefacts such as visuals, audio, film and text (words, images, etc).		
	Outcomes. The student should be able to	**Implementation /classroom examples**:
Intermediate	(i) Achieve a professional stance/image/presence in posture, language, speech and choice of artefacts, when orally presenting content. (ii) Actively participate in class discussions. (iii) Appropriately respond to non-verbal communication signals in the context of an oral communication. (iv) Understand the role of standards, use the appropriate grammar and spelling, and the most appropriate format, language and context (/feel/approach) in written documents using a variety of texts (words, images, graphs, audio, video) and formats (electronic, paper). (v) Effectively convey information in a format appropriate to the audience and the situation. (vi) Efficiently transform content into multiple formats or media.	• Topic specific debate, for example "Information Systems are social realities"; or "IS development methodologies are no longer used in 'real' systems development". • Prepare and present an oral presentation to class peers taking advantage of a range of technologies (these could be radio microphone, microphone, data projector + computer/laptop, video conferencing, video/audio, wireless devices, PDA).

Graduate	(i) Synthesise content from numerous sources and media, and orally present it to a variety of audiences. (ii) Professionally respond to the atmosphere generated by an audience. (iii) Use technology to effectively communicate with a variety of audiences. (iv) Develop coherent, accurate and succinct professional documents. (v) Create summations and present in the most relevant format or manner. (vi) Create un-plagiarised text.	• Research a complex topic and present it orally to an audience other than peers. Topic examples; The role of metadata in web development; SQL and dynamic web content; XML, SOAP and UDDI and their role in B2B; Collaborative work technologies across special and temporal dimensions; Continuous integration as a method for information systems development. • Using a modelling tool, represent a process map for a given case study. Present this model from at least two user perspectives. • Write a critique on the development process undertaken by the team in an Information Systems development project scenario.

CONCLUSION AND FUTURE WORK

The stimulus for the study reported in this paper was informal conversations with IS practitioners who have worked on numerous team-based projects. These practitioners have frequently been disappointed with recent IS graduate recruits as these recruits generally do not know how to work as part of a collaborative team. The graduates have a theoretical understanding of what teamwork is and the characteristics of an effective team, but they are ill prepared and naive about working collaboratively. The recruits' understanding of collaboration was seen by practitioners often to be shallow and uninformed: they relate collaboration to working on individual tasks, isolated work practices, and working towards a project, not to the shared creation and dissemination of information. They then reported that many IS graduates do not have a holistic understanding of a project, a comprehensive understanding of collaboration and how to collaborate, and have little practical experience in working on real collaborative projects. These types of conversations are common, however, they often do not include those responsible for curriculum development.

Information systems academics have been redesigning IS curriculum for a number of years (see for example IS'97; IS2002), but it is evident that the skills required to work effectively in a collaborative work environment have been only superficially considered, and often assumed to develop through some form of 'hidden' curriculum. It is often presumed, that the students will gain these skills through osmosis. The latest revision to the international IS curriculum (IS2002) focuses on a number of these skills and has brought them to the forefront of the curriculum by extrapolating them from hidden areas of previous iterations of the IS curriculum. This is a great step forward in the developing of these skills in undergraduate IS students. But is this enough? The author argues that more guidance, especially in curriculum design and development, to IS educators is required as most IS educators have an industry background rather a strong background in curriculum design and its associated principles and theories.

Travers and Westbury (1989) claim that there are three phases a curriculum undergoes – intended, implemented, and assessed or evaluated. This curriculum presented in this study, is an intended curriculum. The implementation of the curriculum followed by its assessment would bring forth valuable contributions as to its success and further modification. The evaluation would need to be conducted with employers and graduates who were working in the workforce on IS collaborative projects to fully establish if the intended outcomes of the curriculum were met. This could lead to modification and further development of the curriculum framework.

As we move through the 21st century, the types of work and skills required by society are changing - skill sets disappear, whist others emerge. Educators need to keep up-to-date not only on the changing technical skills, roles and responsibilities of the discipline, but they also need to keep their curriculum up-to-date and in-tune with what is required now, and be responsive to what will be required 'tomorrow'. There is no 'crystal ball' to show educators what skills, attitudes and knowledge information systems graduates will need to be an effective and efficient member of tomorrow's Information Systems development team. No one could predict the impact technologies such as Google applications, Facebook, Twitter and the iPhone would have on the demand for information systems; however IS educators are responsible for their graduates, and the responsibility to prepare them for what lies ahead in their professional lives. If curriculum is not kept up-to-date through informed discussion and underpinned by sound educational theories and practice, the alternative could be a backward step for society - as it is society that relies on information systems that are designed, maintained and scaled by IS professionals. Something we, as IS professionals, do not want is the re-telling of the Palaeolithic sabre-tooth tiger satire, using information systems as the key actor.

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