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Towards a holistic understanding of business and an applied understanding of information systems: the use of a “scaffolding approach”

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Abstract

Businesses are increasingly indicating a need for business graduates who have an integrated understanding of its operations, and an ability to address the multiple perspectives required in applying technology in a business setting. It is not always easy for undergraduates, with limited world experience, to gain such a holistic understanding. This paper discusses a ‘scaffolding’ approach to help them make the valuable links between one subject and another by deploying business, information/data and process modelling perspectives and their enabling technologies/tools. It proposes a detailed evaluation of this approach as the students progress from one subject to another.

Keywords

Scaffolding, holistic learning, integrated business learning

INTRODUCTION

Recent research in business education in Australia has indicated the necessity for business graduates to obtain a holistic understanding of business operations, in order to operate in a current business environment characterised by the convergence of knowledge, and flatter management structures (BCG 2001). There have been indications that this holistic understanding is often not being achieved (Cecez-Kecmanovic et al 2002). Coupled with the need to gain a holistic understanding of what businesses do, is the need to understand that Information Systems is the study of the application of IT - the interactions between people and organisations - rather than the technologies themselves (Elliot and Avison 2005). Again, there appear to be difficulties: businesses have reported difficulties in finding people who understand the e-business commercial environment, and the need to blend appropriate business and technology skills is not currently being addressed. Whether they are IT professionals or business professionals, interaction with people from other functional areas is now common (Bassellier and Benbasat 2004) and several reports stressed the importance of non-technical skills (other than their own professional/functional expertise) (Gorgone et al 2002). A recent survey of high school students found that 50% of them saw ICT as boring and dry (BCG 2001).

The problem is not limited to Australia, and is not limited to BIS courses. A review in the accounting arena in the USA, for example, makes the point that practising accountants consider knowledge of how typical business organisations work and are managed to be among the most important competencies that accounting students could, but do not, learn in college, and blaming the use of an out of date pedagogical model which is functionally based (Walker and Ainsworth 2001).

A “process-centred” curriculum “to better reflect the trend towards process – managed organisations” (Cecez-Kecmanovic, Juchau et al 2002) has been put forward as a solution to the problem of holistic understanding. However, process centred organisations are more complex than those with a more functional basis; matrix management is difficult and businesses still report the persistence of “silo based” mentalities.

Even if a process centred curriculum is adopted, then, students may find it difficult to integrate the different perspectives that such an approach offers to them. This is particularly likely to be true for undergraduates, with limited world and business experience. Integration means they are constantly having to cope with the blurring at the edges of different concepts, and with multiple perspectives on the same phenomenon – a much more difficult

approach than a functional one where they learn marketing separately from financial accounting separately from database structures, for example.

This paper discusses experiences from a University Business Information Systems undergraduate degree which has adopted a process centred approach, and which makes it clear that technologies are to be studied in terms of their application to business. Anecdotal evidence from lecturers, and informal discussions with students showed that not all students were achieving an integrated understanding; they were not always making the links between concepts in different units of the degree that lecturers were hoping they would make. In addition, responses to questions “what do you think this unit is about” indicated that some students thought that technical competence was a main focus of their learning, rather than application of technologies.

To address this problem, a “scaffolded learning” approach is being implemented. This gives students initial frameworks for integrating their learning, which they can use until such time as they have developed their own frameworks (Reiber and Robinson 2004, Akhunita 2003, Crotty 1998). The different “scaffoldings” being used are described, as they are being put forward in one of the core units of an undergraduate degree. A proposal for evaluating this method is then put forward.

SCAFFOLDED LEARNING

The concept of “scaffolded learning” was first developed by Vygotsky (see eg Reiber and Robinson 2004; Akhunita 2003) “It is an approach to teaching and learning that, while careful to provide an initial framework, leaves it to the learner to establish longer term structures” (Crotty 1998) It is a socio-cultural approach; viewing an individual’s development is a result of his or her culture (Wikipedia 2005). It thus recognises the student’s knowledge base and views as well as that of their lecturers. This approach is expected to be particularly beneficial in addressing a problem the roots of which may lie in the lack of student experience in business and information systems. The emphasis is that the “scaffolding” is there to help them until such time as they have developed their own mental frameworks to integrate their learning.

Introducing the scaffolding

Before the scaffolding is introduced, students are presented with a visual representation of the units in their degree. Next, the role of information systems in a business degree is discussed with them. This particular emphasis is taken because for many of them Business Information Systems represents their last unit of study. Reference is made to the recent CAIS paper entitled “What every business student needs to know about information systems” (Ives, B. et al 2002). The following questions are presented to the students.

- What are information systems?
- How do information systems influence organisational competitiveness?
- Why have databases become so important to modern organisations?
- Why are technology infrastructures so important to modern organisations?
- What is the role of the Internet and networking in modern organisations?
- What are the unique economics of information systems?
- How do information systems enable organisational processes?
- How do organisations develop, acquire and implement information systems?

It is then explained to them that there are four particular perspectives that will be used to address these questions: business perspective, information modelling perspective, process modelling perspective and technology perspective. The notion of “scaffolding” is introduced to them as “a supporting structure for your learning”. It is pointed out that the structure is not intended to be complete, and they are asked to give feedback as they use it as to whether it is useful. Having introduced all the perspectives at the beginning of the unit, reference is made to them throughout the unit as it progresses. The four perspectives are discussed further in the sections below.

Business perspectives scaffolding

This perspective helps students to understand the issues at the organisational and inter-organisational level and at the business model level. This scaffolding has been designed to allow students to be able to compare and contrast

functional and process based perspectives, intra- and inter-organisational approaches, and the factors to consider in terms of different types of business. Its purpose is to help students to make links which they might make more slowly on their own – for example, without experience it is not necessarily evident that a process based approach is valid both for projects and for cycles, and that there will be similarities in each case. Similarly, the relationship between the supply chain and the individual entity is not immediately evident. It is also designed to help develop an evaluative approach, in encouraging students to think of why they might see a business in a certain way.

<i>Perspective</i>	<i>Importance to organisations</i>	<i>Helping your learning</i>	<i>Examples from your degree</i>	<i>Links with other perspectives</i>	<i>Unit within your degree</i>
Functional	Reporting structures Investment decision making	WHAT organisations do	Simulation of a business for making investment decisions	Process perspective includes WHERE things are done. Matrix management	ACCT
Process within an organisation – project	Making changes to the organisation	HOW change happens	Systems development lifecycle Change management	Changes to functions Changes to process cycles	BISF BIS BPIM
Process within an organisation – cycles	Ensuring processes are well controlled, effective, efficient Ensuring correct financial reports	WHAT organisations do HOW they should do it	Transaction and reporting cycles	Functional parts of an organisation have defined role in process Matrix management	BIS ES
Inter-organisational processes	Negotiating with collaborators	Understanding e-business	Supply chain operations reference model B to B, B to C	Each entity within the supply chain has their own cycles	BIS BPIM ES
Business assurance and control	Managing risk according to the specific nature of the business	TYPES of organisations, and their technical & legal environment Risk profiles	Specific perspectives on risk in organisations	Different part of the cycles will be risky for different organisations There will be specific technology risks	BISAC

Table 1: Business perspectives scaffolding

The information modelling scaffolding

Information modelling scaffolding helps students to understand different types of information (from data to knowledge), the modelling tools and business uses as explained in the following table.

<i>Type of information</i>	<i>Modelling tools</i>	<i>Represents</i>	<i>Business Uses</i>	<i>Strengths and Weaknesses</i>	<i>Unit</i>
Transaction (“hard”) data	Entity relationship models	The relationship between different elements	Forms the basis of the relational data model used by most corporate databases	Rigorous Non intuitive	BISF BIS ES
	Class diagram	Object oriented model of data	Object databases Object oriented software	Rigorous Non-intuitive Part of UML	Technical units
Artificial intelligence	Knowledge based systems	Rules	Diagnosis	No common sense. Cannot learn	BISF
	Neural nets	Patterns	Pattern matching	Basis of pattern matching hidden	BISF
	Genetic algorithms	Combinations	Optimisation		BISF
Knowledge (“soft” ill-structured information)	Information and content management	Strategic information and knowledge management	Managing the information as an asset, and as evidence	Soft, ill structured information	KMS

Table 2: information modelling scaffolding

The distinction between transaction data, artificial intelligence and knowledge management is fuzzy. As Davenport says “data, information and knowledge aren’t easy to separate in practice: at best you can construct a continuum of the three”. His working definitions are the ones which inform the scaffold: namely: data is “observations of states of the world”, information is “data endowed with relevance and purpose”, and knowledge is “valuable information from the human mind”; its value arising from the fact that it has been given interpretation, reflection, synthesis and content. It is thus hard to represent, despite its importance. (Davenport 1997). For students, this scaffolding is expected to be possibly the easiest to grasp, because of the almost one to one mapping of types of information to units within the degree that present them.

The process modelling scaffolding

The process modelling scaffolding assists students to go beyond basic transaction processing and into communication and coordination across functions that involves resources and business rules. These models differ significantly from the classical conceptual models such as entity relationship models and there is a significant need to be easily understood. Considering its wide usage for a variety of purposes including process documentation, process improvement, knowledge management, process simulation, workflow management, enterprise systems management, software engineering, activity-based costing, quality management and workforce management, this scaffolding approach has been designed to be multi-perspective. Using a simplified version of Curtis’ (1992) taxonomy that identifies objective and views (what, when, how etc.), the modelling tools and their business uses are explained in the following table.

<i>Modelling tool</i>	<i>Represents</i>	<i>Business uses</i>	<i>Strengths and weaknesses</i>	<i>Unit</i>
Process maps	What a process does, places it is done, decisions required	Multiple user overview, OTS s/w implementation, BPR	Widely used, Intuitive Not rigorous	BIS
Logical DFDs	What a process does	Software development BPR	Drill down, Intuitive Rigorous	BIS
Physical DFDs	People, places and things involved in a process	Process auditing	Drill down, Intuitive Rigorous	BIS
Flowcharts	What a process does, where, by whom, using what technology	Multiple user overview Process auditing OTS s/w implementation	High level of detail in one diagram, Intuitive, Not rigorous	BIS
Event process chain	Processes and their starting and ending events	Business Process Reengineering	Rigorous	BPIM ES
State transition diagram	The states of an object, and events that change its state	Object oriented software development	Rigorous, Part of UML framework	Technology units

Table 3: process modelling scaffolding

The “scaffolding” includes process modelling tools used within the degree. It also mentions one tool which is not taught – that of State Transition Diagrams. It is explained to students that this is part of a different framework, also valid, that they may come across, namely the object oriented framework. It is explained to them that this technique is particularly applicable to object oriented software development. Introducing students to what they don’t learn as much as what they do learn is expected to help them understand that what we teach is representative of a large range of options, and to develop a critical mindset when evaluating any other options they may find in the workplace.

Technology scaffolding

Technology scaffolding is deployed to expose students to different information technology tools and software products that are available for different business uses, and to build the knowledge from simple to complex systems across different units in the degree. This approach as explained in the following table has two aims. One is to ensure that students develop early impressions of the technology landscape as having a range of options that vary significantly in scale and purpose. The other is to provide a framework for critical evaluation of technology and product options in the market place. This mindset is further developed within the units by scenario based evaluation exercises. The emphasis on business use is one that is reinforced throughout the degree.

<i>Technology</i>	<i>Business uses</i>	<i>Unit</i>
Spreadsheets MsExcel	Reporting from large databases Small standalone calculations and reports	
End user programming VB for MsExcel	Customising Excel	BISF
End user databases for MsAccess	Reporting from large databases Small standalone systems where long term information storage is not a problem	BIS
Corporate databases eg Oracle	The foundation of most corporate information systems. Used for long term information storage – particularly transaction information	Technology units
Small off the shelf software eg MYOB	Supporting transactions in small businesses	BIS
Integrated process modelling eg ARIS	Business process management, improvement and reengineering in large organisations, Enterprise systems, integration of information and process perspective.	BPIM
Enterprise systems eg SAP	Integrated support for information and processes in large businesses	ES

Table 4: Technology scaffolding

RESEARCH DESIGN AND METHODOLOGY

The main aim of this research is to develop a conceptual framework that imparts holistic understanding of business to business students and evaluate its effectiveness. The framework is developed with the help of a ‘scaffolding’ structure that links various business information systems units from four perspectives discussed above – business, information, business process and technology perspectives and deploys several IT tools as enablers in this process. The objective is to evaluate this approach from the teaching and learning perspective in the student-centred context. The emphasis is to measure the increase in students’ understanding of cross-functional business processes, information/process models and their role in managing business processes, enabling role of technology and evaluative skills for the selection, acquisition and implementation of those systems.

The study intends to evaluate the usefulness of this framework from a student perspective in terms of students’ academic performance, task performance, self-efficacy and satisfaction (Noguera and Watson 1999). To determine the effectiveness of information system enabled tools and frameworks on learning in a meaningful context, it must take place within a theoretical framework (Javenappa 1995). This study uses experiential learning theory (Kolb 1984), instructional system design (Rothwell and Kazanas 2004), Vygotsky’s Zone of Proximal Development (Reiber and Robinson 2004; Wikipedia 2005), and Sahay’s (2004) approach to the reform of IS education as platforms to analyse the perceptions of usefulness of this framework to the students, and their relationships with other factors such as academic performance and self-efficacy.

The term ‘academic performance’ is defined as the performance of individual students in various assessment tasks that measure their ability to demonstrate the achievement of learning goals. The term ‘self efficacy’ refers to the judgement of individual student’s own capabilities in achieving the learning outcomes. Bandura (1986) defines ‘self efficacy’ as “*people’s judgements of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses*” (pp.391). Along with this, students’ previous knowledge will be measured based on self-assessment and previous academic performance in every stage of students’ journey from one subject to another.

Specifically, this study will investigate the effectiveness of the ‘scaffolded learning’ approach in developing an integrated understanding of business process centred view of the organisation and integrated learning. Particularly, it would analyse the effectiveness of this approach in enhancing students’ ability to link various concepts and techniques across various units. This is a longitudinal study since it requires monitoring the progress and development of integrated learning of students as they move across 5 different units – first year accounting, first year

business information systems foundations, business information systems, business process integration & modelling and enterprise systems.

In view of its longitudinal nature, this study will be conducted in three phases. In the first phase, a pilot study will be conducted to analyse the influence of deploying scaffolding approach to one cohort of students. Two groups of students will be identified, one control group that will be exposed to the scaffolding approach, and the other with no explicit deployment of scaffolding approach. Several statements that deal with the generic content from these four perspectives will be developed with reference to various concepts, tools and their business applications. This instrument will be administered for both groups of students in the last week of the semester. Based on the results, the instrument will be refined and administered again in the second phase. The respondents in the second phase of the study will be monitored as they move from first unit to the second unit. The instrument will again be administered at the end of the second unit and data about their academic performance will be collected. In the third phase, it will be extended across five units as discussed in the literature review. The results in each phase will be analysed to determine effectiveness of the scaffolding approach in enhancing the integrated learning across different units and between the control group and other students. The study will test a number of hypotheses as stated below.

H1: There will be no difference in academic performance scores between the groups that were exposed to scaffolding approach and those that were not exposed to this approach

H2: There will be no difference in self efficacy score between the control group and others

H3: There will be no difference in self efficacy score between two different units (same cohort of students that were exposed to scaffolding approach as they move from one unit to another)

H4: There will be no difference in academic performance scores between students who have high self efficacy score and those with low self efficacy

The findings of this study will have several implications. Apart from demonstrating the effectiveness of the 'scaffolding learning approach' in information systems education across several units of study, this study demonstrates the relationship between self efficacy of the students and their academic performance. The outcome of this study will make a significant contribution to IS education where application of this 'scaffolding approach' is relatively new.

CONCLUSIONS

Business students have to grapple with two difficult concepts. Firstly, they have to achieve a holistic view of business. Secondly, they have to understand that the focus of their learning of technologies should be on the application of those technologies to organisations, rather than the details of the technologies themselves. Current literature indicates that there are problems in both these areas. This paper has defined an approach that has the potential to address the problem, and the early plans to evaluate that approach.

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