

Using Problem Based Learning to Teach Future Australian IS Professionals

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Abstract

Teaching Information Systems (IS) to Australian tertiary students has become increasing problematic with many of them relying on a surface level approach to study. This will surely affect their understanding of IS material and in turn affect their effectiveness in the workplace.

This paper examines the issues behind this trend and considers Problem Based Learning (PBL) as an aid to counteract it.

Keywords: Problem Based Learning (PBL), Information Systems (IS) and surface level approach, deep level approach, Information Technology (IT), authentic learning, Small to Medium sized Enterprises (SMEs).

Introduction

Teaching Information Systems to future Australian Information System (IS) professionals has become significantly more challenging over the past few years, for many different reasons, the changing nature of technology, the needs of industry, the student population differentials and government policy (Nelson, 2002).

Australia is going through a period of change and is in the process of developing a national vision for the Australian Information Technology Industry (that also encompasses Information Systems). The vision relates to a number of areas of IT and IS which are described below (NICTIA, 2007):

Vision Statement 1

Australia to have a vibrant, innovative and globally that strategically plans for the future and gains in all other sectors of the economy.

Vision Statement 2

An Australian ICT sector to be well supported by the Australian, State and Territory Governments under a strong national Australian ICT brand that presents a united front globally and is well known for its innovation and quality ICT services in key international markets.

Vision Statement 3

An Australian ICT industry that is a magnet for private investment to support R&D and commercialisation of technology through large, multidisciplinary commercial R&D and product realisation centres.

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Vision Statement 4

Government as a model ICT purchaser of Australian innovation, recognising that as the largest single ICT customer in Australia, its procurement practices have a substantial impact on innovation in the ICT industry and provide reference sites to facilitate global market penetration.

Vision Statement 5

An Australian ICT industry with a leading skill base by world standards with the Australian, State and Territory Governments, industry and education providers working collaboratively to improve skills foresighting, skills development and enhance enrolments in ICT courses.

Vision Statement 6

Australian technology businesses to have the capacity and necessary government market intelligence and support to readily identify and respond to real international business opportunities and consistently convert these to positive business wins. Australia has a competitive investment environment, benchmarked against global standards, which seeks to promote Australia as an attractive destination for ICT investment.

Vision Statement 7

Australian ICT SMEs to be competing successfully on the world stage with the capability and necessary expertise available to access markets, attract venture capital and commercialise their technology solutions.

Vision Statement 8

Our ICT entrepreneurs to possess the managerial, technical and marketing skills to develop their businesses, compete for growth capital and move Forward on national and international business opportunities.

Vision Statement 9

A high speed, affordable national broadband infrastructure and complementary e-security network that puts Australia amongst the leaders in the OECD in terms of its broadband capabilities.

Vision Statement 10

Australia to become a highly ICT literate and truly technology proficient society that adopts, adapts and confidently embraces and exploits technology to its advantage and on an equitable basis.

The research described in the paper relates to Vision 5 and demonstrates how it relates to a university and an educational context.

Another one of the main challenges is that the Australian university structure and style tends not to promote a deep level understanding of the information given to the students, due to time constraints and increased number of semesters of study. This is concerning as students then take this poor approach into their working lives as IS professionals.

To assess whether this assertion is correct and explore possible solutions to it, the authors looked at a particular unit within an IS degree taught at a University within Australia.

The unit was offered as part of the Bachelor of Information Systems and as electives within the Bachelor of Commerce and offered to the wider university population. The unit chosen introduced the basic issues of “Systems Analysis and Design”, the content includes feasibility studies, project management, object orientated modelling and system design approaches.

It is the observation of the students learning styles that channelled the thoughts into conducting an inquiry in an effort to improve the situation, into these areas, whether the content of the unit

needs to be reviewed and also in particular whether the introduction of problem based learning (PBL) in this unit would be an effective teaching aid.

Teaching and Learning Issues in IS Education

With the teaching of large classes within the tertiary sector (as seems more common in the past few years) it is necessary to assess students' needs. It is often the case that some students have less prior knowledge of the subject area and therefore classes have to be designed that will be a fit for both the less experienced students and those students that want to push ahead with more complex work.

Being able to do this is becoming increasingly difficult, but there are ways that teaching methods in this area could be improved and have an outcome that both teaching and learning are more effective for all.

In research it is clear that when it comes to the aspects of learning and particular the maintenance of such learned information, there is two distinct ways, surface level processing and deep level processing. The former being categorised by the reproduction of material and learning the text itself compared to the latter which attempts to understand what the author is saying (Martin & Saljo, 1976). As a student the "learning" system is set up and encourages to some extent the use of surface processing, e.g. cramming for exam study. As quoted in Entwistle and Entwistle (1991), "...a traditional degree does not promote a deep approach to learning".

Time constraints, in terms of short semester length, this has a strong influence upon the depth of knowledge learnt by individual students. With only thirteen weeks to embrace a new subject, to focus, study, produce assessable materials and sit a final examination in most instances, it is hardly surprising that students focus on a surface level processing nature which has obviously in turn put far more pressure on educators within these institutions.

The advantage and necessity of deep level processing and therefore greater understanding of a topic has become obviously clear. It is important to be able to introduce and encourage a deeper level of processing and understanding to the students studying "Systems Analysis and Design", by uncovering their learning processes and preferences towards study. It is a proposed solution that Problem Based Learning may be able to assist in achieving this and preparing them more effectively for their working life in industry.

Many of the established teaching and learning practices no longer seem suitable, appropriate or possible and tertiary teachers have been compelled to seek out new approaches and methods (Cameron, Shaw, & Arnott, 2002). This is certainly the case in terms of IS where traditional lectures are a less than effective way of teaching practical materials.

Problem Based Learning

Much educational research in the field of Information Systems has focussed on the students' experiences on the increased use of IT in their courses (Mitchell & Hope, 2002; Neo, 2005).

Researchers from within Australia have commented upon the lack of a deep approach to learning in the area of IT and thus employers' dissatisfaction with IT graduates (Cope, Staehr, & Horan, 2002). Their framework for success based on promoting a deep approach to learning includes:

- Assessment tasks require the demonstration of conceptual understanding;
- The emphasis is on depth of learning rather than breadth of coverage;
- Tackle real world problems.

One of the major initiatives to improve the learning experience in IS degrees is the use of problem-based learning and authentic learning environments. This should enhance the students' judgement's, become better analysts, decision makers and problem solvers (Jennings et al, 2003).

Authentic learning experiences also may assist students to develop appropriate and effective understandings. Authentic learning experiences are those that are personally relevant from the learner's perspective and situated within appropriate social contexts (Stein, 2004). The authors have found in many of the units they teach and chair, that introducing more practical and real life studies, often in the form of case studies can help to promote better understanding of material and therefore potentially a deeper level of processing by students.

Some of the reluctance in field of IS to uptake these sorts of initiatives is the problem with the creation of such tasks and how to create a "good" and "realistic" problem for students to work with. One of the considerations that will be addressed as part of this inquiry is whether the problem based approach is relevant and suitable for the teaching of Systems Analysis and Design. Prior research comments on PBL's usefulness in a variety of situations, but it is important to assess that against the particular students and the subject being taught as the needs of the learners or of the subject may be quite different. Prior research has also determined that it is key to realise that there are many different strategies and styles for using and implementing case and problem based approaches (Bentley, Sandy, & Lowry, 2003; Rae, Taylor G & Roberts, 2007), and these have to be adapted and suited to the cohort of students enrolled in a unit.

Fenwick and Tennant (2004) suggest that there is no such one entity as an 'adult learner' with characteristics that are common to all. There are many differences between learners and they bring with them the experiences that have shaped their lives. Scott (2004) comments that "Teachers should consider the fact that every class needs a program that can be adapted, modified and individualised to meet the different needs of individual students. It is not a matter of devising 30 individual programs for each student in a class. The aim is to provide a program that can be presented in varied ways to allow for individual differences". As much as the learner's have diverse needs it is useful for lecturers to have a wide "bag of tricks" to aid in the students study.

Within IS, often the ways of teaching are limited, e.g. how can group discussion, role playing, etc. be used to teach Visual Basic programming? With less discursive and opinion related work comes more difficulty in broadening the types of teaching methods can be used. Difficulty it is presumed will also be encountered in the "retraining" of students from teacher-enabled learning to student-enabled learning (Bentley et al, 2003).

Method of Inquiry

The inquiry is designed to investigate the following key questions:

- What are the opinions of students as to the content, quality and effectiveness of Systems Analysis and Design at present?
- Can problem based learning be used to improve students' level of understanding of unit material in Systems Analysis and Design?

It was decided to undertake informal interviews with a small set of students studying a Systems Analysis and Design unit in Semester 2, 2005 at an Australian University. To fall in line with ethical expectations and rules (of the Institution), no personal details were recorded from the discussions and no recordings or transcripts were made.

The informal interviews had 2 parts: firstly the researchers asked the students some basic questions, (closed questions) but mostly open ended to elicit the most insightful information from the students. These questions can be found in Table 1.

Table 1: Sample Questions used in Student Interviews

Sample Questions Used
Did you enjoy studying Systems Analysis and Design?
Was the unit material well structured and understandable?
How could the tutorials be more effective for your learning?
Would it be useful to have studied one problem through the unit?
Would you have liked more practical examples?
Anything else to add?

These questions were an attempt to uncover more detailed reasons for the difference and possible solutions that can be implemented to improve the delivery of this unit in the future with particular focus on their opinions on problem based learning. Secondly, the students were shown, through explanation and some materials, what an example of PBL may look like if it was used in Systems Analysis and Design. This was then followed by some informal discussion of their opinions of PBL and what they saw as the advantages and disadvantages of such a style and whether they think it would improve their understanding of materials and prepare them more effectively for working in the IS profession.

Results of Inquiry

Most of the results obtained were qualitative in nature; this of course can be much more complex to measure. The results were analysed using a comparative analysis technique (Glaser & Strauss, 1967), in which each interview of open-ended questions is compared to another to uncover similarities and differences. It was hoped that it would uncover some logical conclusions on ways to improve this unit for future students and therefore comparative analysis seems like the most effective method of doing so. The outcomes of the interviews are shown in Table 2.

Table 2: Sample comments from Interviews

Sample Questions Used	Results
Did you enjoy studying the System Analysis Unit?	<p>Comments</p> <ul style="list-style-type: none"> • Yes, but not related to my major as much as I had hoped • Too high a workload • Lectures and tutorials well connected • Assignments did cover all the material • Not sure yet • Depends on my grade • I am not a programmer so Object Oriented design is complicated to understand.

Sample Questions Used	Results
Was the unit material well structured and understandable?	<p>Comments</p> <ul style="list-style-type: none"> • University On-line teaching systems was a great resource • Structured well into readings, etc per week • Very detailed in parts • More technology than I expected
How could the tutorials be more effective for your learning?	<p>Comments</p> <ul style="list-style-type: none"> • Make them longer, 50mins not enough • Not so many questions • More students do the work before class • Students talked more
Would it be useful to have studied one problem through the unit?	<p>Comments</p> <ul style="list-style-type: none"> • Not sure, it would have been maybe a little boring • Yes, would have given more structure between weeks
Would you have liked more practical examples?	<p>Comments</p> <ul style="list-style-type: none"> • Yes, especially in topics 1-8 • Hard to understand some aspects without them • Yes, would put theory into context
<p>What are your opinions on Problem Based Learning?</p> <p>(Students were shown an example of Problem Based Learning that could be used within the Unit)</p>	<p>Comments</p> <ul style="list-style-type: none"> • Interesting • More effective • Little dull with just text • Links material well • Would keep my interest more • Would attend more tutorials
Anything else to add?	<p>Comments</p> <ul style="list-style-type: none"> • This is better than online evaluations • Hope that our opinions will count

The comments are not explicitly as stated by the individual students', however they are a paraphrased version of their major comments for each question.

Outcome

The student's comments indicate that "Systems Analysis and Design" could require more practical examples, industry links and PBL to improve the students' experiences and to encourage a deeper level of learning in this subject. Based on the inquiry undertaken there were a number of clear findings (in terms of the similarities between student responses):

- There was a shortage of practical examples (students felt that they were unsure as to the "purpose" of some of the material because they could not see how it would work in practice);
- Students wanted to have more exposure to techniques used in the workplace (such as the use of CASE, project management and diagramming computer tools).

Based on these suggestions, a formal plan to introduce PBL has been created:

Background

PBL has been used sparingly in this unit in the past and with little depth or realism.

Structure

Many students reported that the structure of the materials for the unit is well structured and want that to continue. With the introduction of PBL it will continue this trend with a consistency and flow through the practical subject material.

Tutorials

Currently tutorials are purely theoretical and students have no opportunity to use computerised systems analysis drawing packages or CASE (Computer Aided Software Engineering) tools. The theoretical questions also are delivered straight from the course text and are limited in the use of applied knowledge.

It would be beneficial to alter the tutorial component of the unit, to be part theoretical tutorials and part practical laboratory work. As well as this, the use of PBL case studies in which students could apply their knowledge, create practical diagrams, work in groups and present their results would be beneficial to their learning of Systems Analysis and Design and give them some insight into a future career in this area.

Future Directions and Conclusion

Although previous research has been undertaken in terms of tertiary education, this research is still lacking in the area of IS. Within the university context it is difficult for staff to obtain feedback on unit materials and delivery due to short time frames and the lack of a standardised evaluation tool. It is important to use the thoughts, learning styles, experiences and preferences of our students to improve the quality and style of teaching materials for future years of students and for those that will become the future IS professionals. The possibilities offered by the research in regards to PBL are just one of a number of approaches that could be used to improve a learner's experience. Another avenue of future research could be the development of precise guidelines that would allow educators to systematically implement PBL within their training / educational experience for IS professionals.

The research has been undertaken at a single Australian University, further research could explore differences between Australian Universities or even overseas Universities and the way in which they teach IS Professionals.

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Biographies

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