

Effective Education Using Information Systems as Cognitive Tools

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Abstract: An Australian higher education institution is utilizing the Microsoft Dynamics AX enterprise resource planning application to help educate business students about business principles and practice. The application acts as a cognitive tool for both internal and external students whereby the students establish business processes in the enterprise resource planning application and the application demonstrates operational activities and financial transactions.

A cohort of students has been surveyed and the findings demonstrate that education using an enterprise resource planning application as an interactive learning tool is both practical and beneficial. The conclusion being that the student experience is a positive one.

INTRODUCTION

As noted by Garrison and Vaughan (2008) advances in ICT have enabled significant opportunities for redesigning student learning. These advances in technology prompted an Australian institution to use the Microsoft Dynamics AX enterprise resource planning (ERP) application as a teaching vehicle.

This paper presents a case study relating to the education of a unit (semester teachings of a subject) concerning business operation processes and implementation practices of an ERP application. The paper is in part a response to the many calls to better understand teaching with ICT (see for example Cox and Marshall, 2007). Firstly the teaching philosophy and processes of educating using an ERP application as a cognitive tool are explained, followed by a survey of students studying the unit, the management of the unit is analysed and conclusions are drawn.

COMPUTER TECHNOLOGY

ERP applications are core software used by organisations to coordinate information in every area of business. They help to manage company-wide business processes, using a common database and shared management reporting tools (Monk & Wagner, 2006). The salient and identifying characteristic of ERP applications is their ability to integrate business processes by standardising data and ensuring that this data is accessible to whoever needs it on a real time basis (Strong, Volkoff, & Elmes, 2003). Organisations may adjust their way of working to fit the package although, most implementations are a mixture of existing ERP processes and customisations that support specific organisational requirements (Markus, Tanis, & Van Fenema, 2000).

The Microsoft Dynamics AX application utilises the Microsoft SQL-Server or Oracle database systems. The university PCs situated in laboratories operate as, what is termed, 'fat clients'. That is to say they pass relatively large quantities of data and functions between the PC and a Server. Internal and external students can access the ERP application remotely, using, what are termed, 'thin clients'. Thin clients require minimal installed functions, with data and programs being passed between the students PC, at work or home, and the server.

This was achieved by installing the Microsoft Dynamics AX Application Object Server (AOS) which provides functions to the remote PC as required. The establishing of the AOS is a relatively simple matter, however, it required changes to the institution's firewall which is a procedural matter and was quite an onerous one. When using the application external students experience very similar response times to on campus students. The application topology is shown in figure 1.

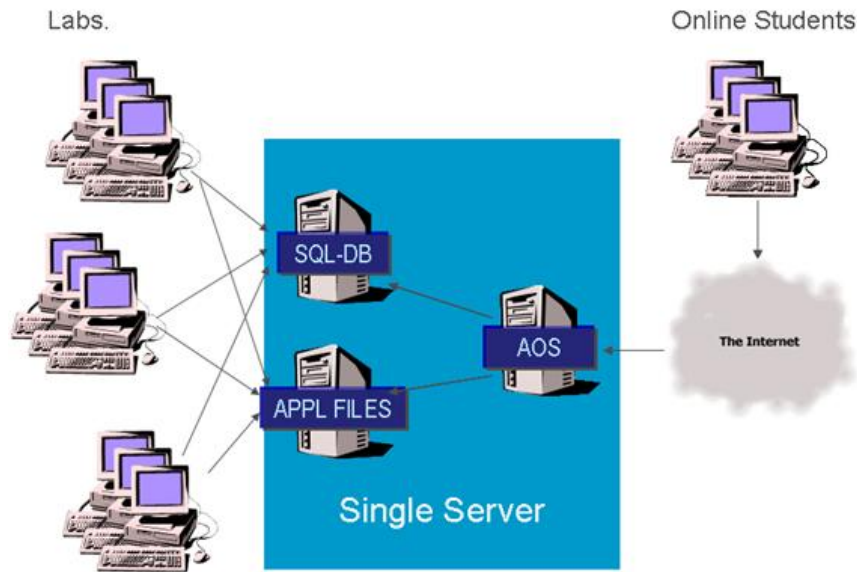


Figure 1. Computing Topology

Herrington and Oliver (2000) espoused that for many students a situated learning framework is not practical with computer-based learning. However, the ease of establishing the ERP educational environment along with the current extensive use of broadband Internet access reveals that this may no longer be the case.

TEACHING PHILOSOPHY

The practice of students relating the setup of an ERP application to organisational processes provides a substantive learning experience. The ERP application acts as a cognitive tool, which has been defined by Reeves (1999) as one that empowers students to design their own representations of knowledge. The teaching philosophy has its roots in the cognitive domain of Bloom's taxonomies of human learning, where students gain the ability to analyse, synthesise and apply. The aim is to foster critical thinking and to enable students to understand that there is not necessarily a correct answer to business matters, but an array of possibilities with risks, advantages and disadvantages associated with them. The teaching environment enables students to comprehend at different speeds and in varying ways, providing an educational outcome of "deep learning" (Chapman, Ramondt and Smiley 2005).

The extent of ERP functionality and the diversity of the organisations they support creates a number of complexities for teaching; (1) students require some knowledge of business functions, including financial procedures, sales, procurement, inventory control and production, (2) without broad analysis and examples students may become prescriptive about business process and implementation principles, (3) students might associate with the application rather than the implementation and business processes. These difficulties are perhaps more easily supported with on-campus learning than with external students. Particularly because of the inherent difficulty espoused by Herrington, Reeves & Oliver (2005) of educating rather than simply informing external students. To mitigate these problems students are expected to vary the processes they have imbedded in the ERP application to meet a different set of business requirements. Difficulties and lack of knowledge quickly become apparent through the learning activities and are readily resolved by dialogue and remote demonstration of how to properly establish the business processes. Importantly educational material focuses on the processes and principles rather than the application itself.

TEACHING METHOD

Students can learn "from" interactive learning systems and programs and "with" interactive learning tools (Reeves 1999). The unit discussed here uses both of these approaches. The "from" is facilitated by the learning management system Blackboard Academic Suite (Blackboard, 2008), which allows students to access videos, lecture slides, lecture recordings and lab materials. Some of the videos are Microsoft promotional videos that discuss the attributes of the application and the types of organisations that have implemented the application (Giant bicycles is an example). Other videos are edited excerpts of the Australian television program Business Success, which explains some of the features of the application and the benefits to organisations. Lectures are recorded in AVI format and placed on Blackboard. Signposting is used during the lectures to explain questions so that external students are fully aware of what is happening in class.

The “with” is facilitated by the Microsoft Dynamics AX ERP application. Students login to the application and establish a trading company. The application does not initially contain any data or parameters, and the students must establish every aspect of the company. The students create a chart-of-accounts, financial periods, customers, suppliers, inventory components, bills-of-materials, production routes, and associated financial posting parameters. The lectures explain the business principles and how they might differ between organisations. For example, how organisations may manage the production environment if it were upstream or downstream of a supply chain push-pull boundary. The ERP is then used to narrow the potential void in higher education between theory and practice that was recognized by Herrington & Oliver (2000).

The assessments explain business requirements that are different to the ones that underpin the taught activities. The student is required to alter the ERP processes so that the application represents these new principles. This process reaffirms the learning expectations and creates a clear understanding of organisational processes and how to establish an ERP to represent those processes. The lecturer is able to access each of the students companies to check on progress and advise students. Student support for assignments is limited and, therefore, students have to revisit the lab. material to understand the required changes to the application.

If there are problems with the assignments, students must resolve them prior to continuing with their studies. This formative approach ensures that students are coping with each aspect of the increasingly comprehensive business portrayal. This creates the combination of authentic context, authentic activity, and authentic assessment that, according to Herington and Oliver (2000), leads to enduring knowledge. Assessments are marked and feedback given via screens added to the application. Figure 2 shows a screen used for marks and feedback for one of the assignments.

Task	Score	Comment
Setup of Supplier, Customer, Part	3	The part number does not have the correct model group. This will prevent accurate product costings.
Setup of Currency	5	Correct
Purchase Postings	5	Correct
Sales Postings	4	The debit posting for Cost of Goods sold has been allocated to COGS Systems rather than COGS printers. You must adjust the posting set-up to be able to continue with the labs. and assignment 2.

Assignment Completed

Completion Date: 17/03/2008

Total: 17

Figure 2. Assessment Screen

An example of the detailed discussion that students find helpful is the examination of the accounting function early in the unit. The lecture material identifies principles of accounting. The lab. activities establish in the application a general ledger, customers, suppliers and posting criteria for sales invoices and receipt of purchase invoices. These transactions help the students identify how financial postings work in a business and how an information system facilitates those processes. The discussion is then broadened to explore the granularity of information in a general ledger; identifying how to capture sales and costs by region, product ranges and other categorisations.

One of the assignments has students alter the configuration of their company to post financial transaction with a greater level of detail and with different attributes, enabling their organisation to be analysed from different perspectives. This helps students not only to understand how the ERP modules interface with each other but how to vary the interface to meet differing

business requirements. The application then becomes a cognitive tool, that supports the deep reflective thinking that Reeves (1999) explains is necessary for meaningful learning. Financial ratios, which have been learnt in previous units, are re-examined and students have expressed that, for the first time, they have a clear understanding of the aims of the ratios.

A text book could not be identified that sufficiently supported the educational aims and therefore, weekly readings are provided from books, journals and other articles. A comprehensive study guide has been created that includes lecture material, lab. activities and a description of business processes. The business processes in the study guide include detailed explanation: two examples are ABC (Perito) stock classifications, and actual versus standard costing methods. The study guide is available via Blackboard as PDF files and can be purchased via the institutions bookshops for a nominal fee that is aimed at recovering production costs.

STUDENT SURVEY

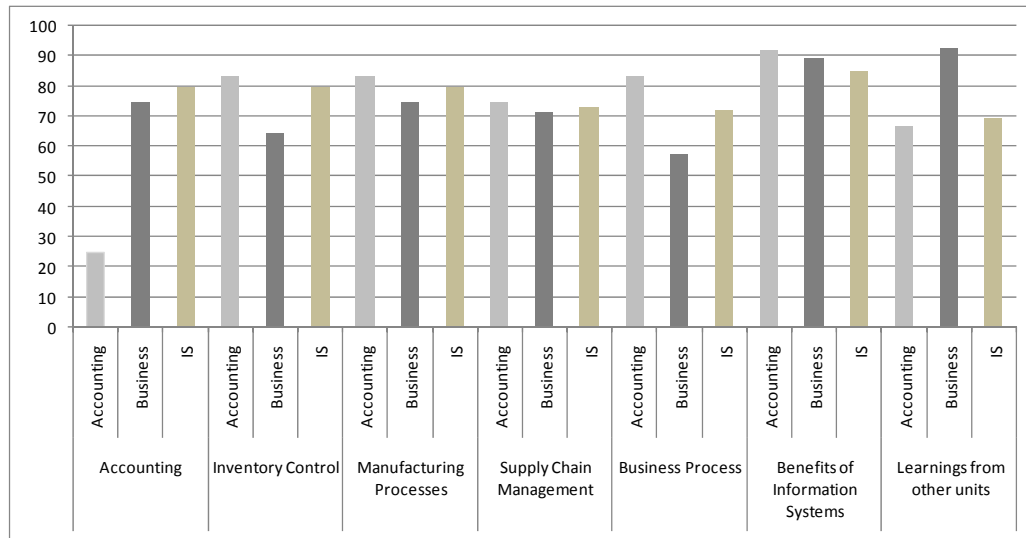
A cohort of students has been surveyed to help to understand how well the learning outcomes are being met and to appreciate the student experience. The survey instrument was designed to identify how the unit addressed the core knowledge domains within the student’s study focus area or course major. The following table shows the survey instrument.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The unit was enjoyable					
The unit improved my knowledge of accounting					
The unit improved my knowledge of inventory control					
The unit improved my knowledge of manufacturing processes					
The unit improved my knowledge of supply chain management					
The unit improved my knowledge of organisation wide business process					
The unit improved my knowledge about the use of information systems					
The unit improved my knowledge about the implementation of information systems					
The unit improved my knowledge of the benefits of information systems					
The unit helped me put in perspective leanings from other units					
The learnings are relevant to my course: Course name:					
My overall satisfaction with the unit is high					

Table 1. Student Survey Instrument

The survey was completed anomalously and either left in a classroom or posted to Blackboard. A total of 74 students responded to the survey. All but one of the students strongly agreed that the unit was enjoyable (the single student being neutral).

The unit is included in a number of information systems courses and may also be selected as an elective by accounting and management students. Only six accounting and 14 business students completed the survey. The survey results have been graded as strongly agree 100%, agree 50%, neutral 0, disagree -50% and strongly disagree -100%. The results by knowledge component across the three cohorts are shown in Graph 1 (results could range from -100% to 100%).



Graph 1. Survey agreement percentage by knowledge domain and student major

The data indicates that the unit significantly improved students’ understanding of all of the major aspects of business processes and functions. The overall satisfaction of the unit being 83%. This positive feedback echoes Mc Gowan and Graham’s (2009) view that a vibrant educational experience improves learning outcomes. Not surprisingly accounting students learned less about accounting practices than other students. The course bias of prior knowledge is demonstrated in all categories. Nonetheless, one of the major findings was how the unit reaffirmed learning from other units. Presumably this is because it helps students internalise the information using tasks situated in realistic contexts.

The survey asked students to comment upon the elements they liked the most, the elements they liked the least and to make additional observations. One student commented that they appreciated the “hands on approach and lots of tutorials”, another that they enjoyed the “practical use of Dynamics AX”, yet another that “I have got something new and different which will be very useful for my career” and “I like the assignment which provides practical knowledge”. Pleasingly, one student commented that they “enjoyed the balance of theory and practice” another that “the small activities in the class, helped them understand business processes”.

The negative comments included “confusion early on of which buttons to press and what’s going on” and one student did not like the separation between concept (lecture) and application (lab). Additional comments included “I always like to do practical units rather than theoretical ones. This unit is very helpful and enjoyable”.

A group of students were asked why they had found that the unit reaffirmed other prior learning. They explained that much of university education is concerned with macro business principles, such as strategy processes, and that it is often assumed that students understand more detailed business principles that are not actually fully comprehended.

LESSONS LEARNED

Oliver & Herrington (2001) identified a generic teaching and learning framework that consists of the three elements; learning resources, learning tasks, and learning supports.

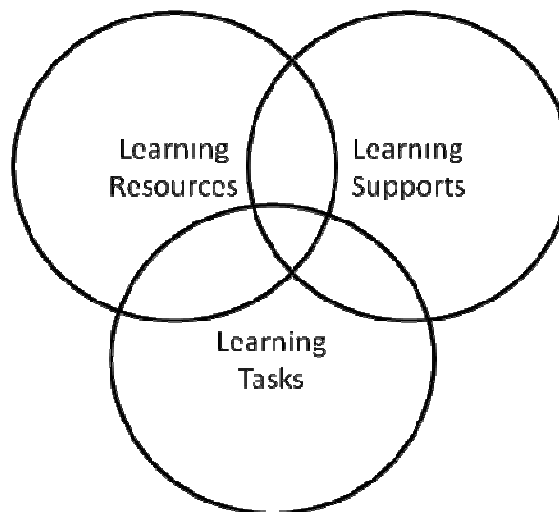


Figure 3. Generic Teaching and Learning Framework (Oliver & Herrington, 2001)

Learning resources are the content and materials which help students to construct their knowledge and meaning of the subject. Traditionally these resources have been available in the form of books and lecture notes. The unit described here uses books, but also the varied material provided via Blackboard. The resources also include the ERP application. The overhead to establishing and, particularly, maintaining an information system resource is much higher than with books. Contingency for time and cost needs to be included for the educator for the many 'known unknowns' and the potential 'unknown unknowns' that seem to occur.

Learning tasks comprise the second element of the design framework. The tasks determine how learners engage with the resource materials. The ERP application has acted as an admirable cognitive tool for business students. This appears to have been facilitated by the step by step approach to establishing the working system. It did give students an overhead of data setup, but also provided an incremental and rich learning experience.

Learning supports are the third element of the instructional design framework and can be thought of as the supports required to help guide and provide feedback to learners. In "traditional" settings such supports have been provided by actively involved teachers (Laurillard, 1993). The ERP application acts as a 'scaffold' (Roehler & Cantlon, 1996) to the learning construction process. As can be seen here the impact of an information system on the education of a subject can be very positive. However, it seems that to be effective a large scale information system such as an the ERP application needs to be the focus of the learning support rather than a minor component, for if it is not the focus, the overhead for the educator and student may well outweigh the benefits.

CONCLUSION

The teaching of business process and implementation methods for ERP applications can be effectively provided by an authentic software learning environment. This supports Mc Gowan and Graham's (2009) view that engagement of students in practical learning experiences creates sound educational outcomes. The unit reinforces Reeves (1999) assertion that "the real power of interactive learning to improve achievement and performance may only be realized when people actively use computers as cognitive tools rather than simply interact with them as tutors or data repositories" (p. 17). However, it seems that, for a large IS such as an ERP, the overhead of providing the environment must be carefully considered, with the benefits understood and evaluated against the cost and time of implementing and maintaining the application.

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