Enhancing Student Learning of Enterprise Integration by Deploying SAP R/3 into Curriculum

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Abstract — **Though the ability of enterprise systems (ES) software solutions in teaching concepts of cross-functional enterprise integration and process orientation are well recognised and discussed in the academic literature, many business schools/faculties, for different reasons, are slow in incorporating these latest software products in their curricula. This paper reports on one curriculum development project that extended the deployment of SAP R/3 into the business curriculum for enhancing students learning of enterprise integration. Employing questionnaire survey and self-assessment of the knowledge and skills gained in the course, the effectiveness of the curriculum design and delivery are reported in this paper. This study demonstrates the powerful role played by the ERP system in developing business process orientation and cross-functional perspective to business students.**

Keywords—**Enterprise integration, SAP, Business curriculum, process orientation**

I. INTRODUCTION

The sophistication of the new, integrated, ever changing world of work requires the ability to critically evaluate situations from multiple perspectives. Business graduates must be able to apply the knowledge of concepts, principles and methods learnt during the university education to the work situation and not being shackled by the discipline-centric narrow view of the business. These integrative skills and cross-functional perspectives not only help the graduates to function effectively in a work environment later on, but also encourages deep learning from pedagogical perspective in the class room.

This paper reports on the extension of the deployment of SAP R/3 an enterprise resource planning software solution, to teach enterprise integration to business students. It will first provide a review of the literature on the deployment of SAP R/3 in business curriculum and discuss its extension to other units and its pedagogical benefits. It describes the approach taken in incorporating SAP R/3 in teaching and learning. Employing a questionnaire survey and focus group discussions in data collection, this attempt is analysed and reported in this paper.

II. BACKGROUND AND LITERATURE REVIEW

A. Inadequacies of Business Education

The pedagogical model of business education that was based on disciplines/fnctions was developed at the beginning of the 20th century. These functionally specialized schools/disciplines were designed to meet the needs of large, highly bureaucratized organizations. Many business schools still have this model and are typically organized into functional departments such as accounting, marketing, human resources, logistics/operations etc. With its strength in developing specialist technical professional in accounting, or operations, or finance, business schools are criticized for their inability to produce a well-rounded business graduates.

By mirroring the traditional business organization's functional silo structure in their teaching and curriculum, business schools are criticized for producing narrowly trained individuals who hold a compartmentalized approach to the way business is conducted [1], [2]. [3]. These functional silos in a business organization restrict their ability to respond to dynamic customer needs and environment, and are inconsistent with the idea of integrated processes [4].

Several reviews of higher education by practitioners as well as experts have been highlighting this lack of a multidisciplinary view of business graduates. These reviews have strongly recommended incorporating cross-functional perspectives, business process orientation and integrated view of business in business curriculum [5], [6], [7], [8], [9] and [10].

Stimulated and led by the employer groups such as Business Council of Australia and Australian Chamber of Commerce, these employability skills, if effectively incorporated into the university business schools curricula will provide a bridge between education and work [11]. The Federal Government, through the Department of Education, Science and Technology, has been encouraging development of an overarching strategy to embed such 'employability skills' in the universities that include integrated business view, business process orientation and several generic graduate attributes.

With the Just-in-Time (JIT), Total Quality Management (TQM), and reengineering movements in the 1980s and 1990s, many business organizations have shifted their focus towards cross functional processes and emphasized management development away from specialization and towards the integration of different disciplines and functional departments [12].

University business schools, however, have not adopted the same approach, even though businesses increasingly seek graduates with ability to analyze problems by drawing cross-disciplinary knowledge [13]. This has resulted in gap between what businesses want and what university business schools offer. Business school graduates view their career from a functional perspective (e.g. as accountants, marketers or financial analysts) and cannot see an integrated view point until they are well into their careers.

B. Past Pedagogical Strategies

In the past pedagogical strategies such as integrated case study, team teaching, capstone group projects and simulation games were used to teach multidisciplinary perspective to business students. The effectiveness of these strategies, however, were not empirically measured and not known widely. It, is however, argued that these strategies would help students to develop these cross-functional perspectives [14].

Achieving an integrated view of business is an ongoing process and achieving an expert status requires a high degree of self-awareness, critical thinking and deep learning [15]. Apart from helping the business graduates to function effectively in a work environment later on, pedagogically this cross-disciplinary perspective is also expected to encourage students' deep learning and better understanding of intersections and interactions of the traditional disciplines such as marketing, operations, accounting and human resources [16].

C. Business Information Systems Role

With its focus on business processes and information sharing/transfer, the discipline of business information systems in general, and the enterprise resource planning (ERP) systems software products in particular, provide the most common link between traditional functions such as marketing, operations, accounting and human resources [17], [18], [19]. In spite of such persistent demand for graduates with integrative skills and multidisciplinary perspective, and the powerful capabilities of these enterprise systems software solutions, adoption of these enterprise systems software into the business school curriculum has been relatively slow.

The uncertainty of its pedagogical benefits and non-traditional assessment methods, complexity and challenges involved in designing appropriate assessment tasks and mechanisms, administrative and academic challenges of incorporating and continuous updating of such complex best practice industry software solutions into business curriculum have been affecting the ability and motivation of many business schools [20], [21].

Anecdotal evidence from recent attempts of integrating software products such as SAP R/3 appear to be positive. These initiatives are contributing to the development of integrated cross-disciplinary perspective and deep learning among university business students, and are helping to move the business curriculum closer to the 'real world' environment [22], [20], [21], [23].

In this background, SAP R/3, one of the most popular industry standard ERP software solutions was incorporated into one post graduate unit and one undergraduate unit in the year 2004 as a pilot in the business school at the University of Sydney. Based on anecdotal feedback from students and graduates, the course so far proved to be the "most useful at the workplace" and appears to have "significantly enhanced their multi-disciplinary perspective and employability."

Considering the successful pilot, it is proposed to extend its usage in the design and delivery of integrated curriculum that spans the disciplines of Business Information Systems (BIS), Accounting and Work & Organizational studies in the Business School. Embedding this key employability skill more deeply into curricula and student assessment will assist the business school in strengthening the linkages between education and the labour market [11]. With this objective, the usage of SAP R/3 as a teaching aid is extended and to other units as explained in the following section.

III. RESEARCH FRAMEWORK & METHODOLOGY

A. Research objectives and features

The objective of extending the deployment of SAP R/3 into one human resource management subject is to develop an understanding of the concepts of business processes relevant to that functional discipline, and their integration and to impart a cross-functional perspective. Accordingly, two laboratory sessions are incorporated into this unit. The focus of these two lab sessions is on generic cross-functional orientation and integrative capability of the SAP R/3 software, process cycles relevant to the human resources function, master data and configuration.

These SAP sessions are taught in a computer laboratory environment where access to the system is readily available for demonstrating concepts and carrying out exercises. At the end, a small assessment task is given to students. This task involves creation of master data and execution of process cycles relevant to Human resource module.

B. Data Collection and Analysis

A questionnaire with a series of statements was employed as the primary method of data collection. The items in the questionnaire were designed based on the objectives of these laboratory sessions, learning outcomes expected from these sessions and necessary skills and knowledge to be

acquired. The first set of statements measure students' perceived improvement of the knowledge on aspects such as enterprise integration concepts, purpose of enterprise systems in business, inter-dependencies between human resource function and other functions, processes and activities in human capital management and information flows across various activities.

Respondents are asked to make self-assessment of their understanding and knowledge using a 'Likert' scale of 1 to 5 (1 = very low, 2 = low, 3 = neutral, 4 = high, 5 = very high) on specific issues taught in these lab sessions. Other statements are included that seek students' perception on issues such as hands-on experience with SAP software, laboratory learning of SAP Human capital management module and measured on 'Likert' scale of 1 to 5 (1= agrees strongly, 5 =disagree strongly).

In addition, respondents are asked to rate their view of the potential impact of the ERP-enabled work environment on employees' (ERP users) broader perspective, cross-functional process understanding and interfacing effect of ERP system. In addition, respondents are asked to give qualitative comments on the SAP lab sessions.

IV. ANALYSIS AND FINDINGS

A. Demographics

All the students enrolled in the post graduate unit titled 'Human resource management processes' are respondents in this study. Out of the 54 students enrolled in this study, 51 responses are found to be valid. Out of the 51 respondents, 58% of the students are employed currently and 53% of them are local students. 59% of them have no previous employment experience.

B. Respondents' Understanding and Knowledge

The following table presents the improvement of respondents' understanding and knowledge of various theoretical concepts after the SAP lab session.

TABLE 1
RESPONDENTS' UNDERSTANDING AND KNOWLEDGE

No.	Factors	Mean	Std. deviation
1	Process and information integration concepts	2.89	1.05
2	What ERP systems are about	3.41	1.06
3	Inter-dependencies between human resource function and other functions	3.45	1.22
4	Processes and activities in human capital management	3.51	0.93
5	Information flows across various activities in human capital management	3.59	0.98

Above table shows that the average level of understanding is relatively high (in a scale of 1 to 5). A significantly higher level of knowledge and understanding is observed with reference to all the dimensions except the process and information integration concepts. Importantly, the respondents have reported a significant gain in their

understanding of the processes, activities and information flows relevant to human capital management, and in inter-dependencies between human resource function and other functions such as marketing, operations/logistics and accounting (more than 3.00).

Respondents have also rated the SAP lab sessions and given their perceptions. The following table gives a summary of respondents' views on SAP lab sessions and the perceived gain in software skills.

TABLE 2
RESPONDENTS' PERCEPTION OF SAP LAB SESIONS

No.	Factors	Mean	Std. deviation
1	Hands-on experience with SAP software (1= very poor, 4=good, 5= very good_	3.76	1.35
2	Learning of SAP software skills in laboratory (1=very easy, 5= very difficult)	3.59	0.94
4	Confidence in improving SAP software skills (1= very low, 5 = very high)	3.71	1.31
5	Ability to become an effective manager in an ERP-enabled work environment (1=very low, 5= very high)	3.24	1.30
3	Performance in the assessment task (1=very poor, 2=poor, 3=average, 4=good, 5= Very good)	3.79	1.15

As shown in the above table (table 2), respondents generally appear to have gained good level of knowledge and software skills relevant to human capital management module (3.59). Given the limited laboratory sessions and the limitations on what can be covered in these two sessions, the respondents felt confident that they can improve their software skills with sufficient training (3.71). Similarly, the respondents also expressed confidence that they have acquired basic skills that will help them become an effective manager in an ERP-enabled work environment.

Importantly, the performance of the students in the assessment task is observed to be good (3.79). This assessment task involves a series of exercises that involve creation of organizational structure, positions, jobs and recruitment of persons and assignment, and maintenance of employee master data.

Teaching and assessing SAP R/3 software skills is a challenge, particularly differentiating between the system errors and students' mistakes in creating master data and performing various transactions. It is also difficult to ascertain whether this assessment task has measured students' knowledge of the processes and information flows relevant to human capital management or whether they have routinely performed the transactions or not. The level of knowledge the respondents appeared to have gained on processes and information flows relevant to human capital management, however, are high (3.51 and 3.59).

Self-assessment of the knowledge and the performance of respondents in the academic assessment task appear to be consistent with each other. Therefore, it is safe to conclude that the students have acquired adequate software

skills and knowledge of processes relevant to human capital management.

Even though the number of sessions are limited, the level of knowledge gained in SAP software skills appears to be good. In general, software based courses are hands-on in nature, and present opportunities to students to participate actively in the learning by doing things in the class. Because of these features, they stimulate learning strongly than other traditional teaching strategies. In addition to these, they expose students' to real-world business contexts, business processes and transactions, and potentially equip students with employable skills. All these features will stimulate students' interest further and enhance their learning effectiveness. Confirming this observation, a large majority of students reported satisfaction with this part of the course and reported improvement in their integrated view of the business enterprise.

C. Potential impact of ERP enabled work environment

As mentioned in the previous section, respondents were asked to express their opinions on the potential impact of ERP-enabled work environment. A summary of their response is presented here.

TABLE 3
POTENTIAL IMPACT OF ERP-ENABLED WORK ENVIONMENT

No.	Factors	Mean	Std. deviation
1	ERP users will have broader perspective of their function	3.71	0.92
2	ERP users will have a broader perspective of their organization and their processes	3.72	1.15
3	ERP users will be more aware of the transverse character of cross-functional processes	3.47	0.84
4	ERP users will be more aware of the effect of their actions may have on the work of others	3.35	1.06
5	ERP users believe that they have a single system of reference	3.53	1.12

In general, it appears the respondents have developed a good understanding of the impact of ERP-enabled work environment (all of them more than 3.00). Even though this is not the main focus of the course, the respondents have identified positive impact of ERP-enabled work environment in terms of developing broader perspective of processes and organization, cross-functional processes, and the inter-dependency aspects.

D. Differences

Previous experience is considered a critical variable that might differentiate the understanding and knowledge gained and the perceptions of the respondents. In order to see whether there are any significant differences between these two groups of respondents, two tailed t-tests for two independent samples at 5% significant levels are considered appropriate and employed. Because of its robustness,

versatility and its general acceptance in the literature, parametric tests such as t-tests are increasingly used with ordinal data [24]. Table 4 gives details of the t-test results analysing the differences between respondents who have previous experience and those who did not have any previous experience.

TABLE 4
DIFFERENCES BETWEEN RESPONDENS – T-TEST RESULTS

No.	Items (Not previously employed = 30, Previously employed = 21)	No previous exp	Prev. exp.	t-value	Signif-cance
1	Integration concepts	3.20	2.40	1.75	0.04
2	ERP systems use in business	4.00	2.50	3.60	0.00
3	Inter-dependencies between HR and other functions	3.90	2.57	2.56	0.02
4	Processes in human capital mgt module	3.90	2.71	3.23	0.01

Respondents with no previous experience have reported higher understanding of the theoretical concepts that deal with integration, ERP systems use, inter-dependencies of functions and processes. It is possible that students with no experience perceived higher level of knowledge gain because of their limited exposure to the concepts. On the other hand, respondents with some previous experience, probably have some basic knowledge of these concepts in practice and did not report as much gain in knowledge.

On other aspects such as potential impact of ERP-enabled work environment, general perception of the lab sessions, SAP software skills, and actual academic performance task (SAP skills), no significant differences are observed.

E. Limitations

This study was designed and administered by the author with the help of research assistants and tutors. The findings therefore may have some inherent bias. Since the study was designed and managed by the author, the findings may have some inherent bias. In addition, general limitations of a typical questionnaire survey and self-assessment of students' knowledge would apply to this study. Possibility of over or under assessment of the perceived knowledge, ambiguity of the statements designed and the variation of perceptions due to previous knowledge and experience are some of the weaknesses in the study. In spite of such limitations, this study will make a positive contribution to the knowledge on the effectiveness of incorporating enterprise systems into the business curriculum.

V. CONCLUSIONS

This is a limited attempt at extending the deployment of SAP R/3 into the business curriculum and particularly to the human resource management related course in a particular university. The specific objectives of this deployment are achieved and respondents are generally satisfied with the outcomes. Some of the key areas of understanding that are typically neglected in the past are business processes and the inter-dependencies of various

business functions. This study demonstrates the powerful role played by the ERP system in developing business process orientation and cross-functional perspective to business students. While the existing course including this attempt generally focused on the integration concepts, and SAP transactional cycles in specific module and the associated information flows and processes, emphasis on the use and management of enterprise systems is necessary in future courses.

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