Enhancing Student Learning of Enterprise Integration and Business Process Orientation through an ERP Business Simulation Game

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ABSTRACT

The sophistication of the integrated world of work and increased recognition of business processes as critical corporate assets require graduates to develop 'process orientation' and an 'integrated view' of business. Responding to these dynamic changes in business organizations, business schools are also continuing to modify their curriculum and introducing innovative teaching and learning strategies. An ERP business simulation game is one such initiative that helps in understanding business processes and enterprise integration and develops process orientation among business graduates. This paper reports on a study investigating the influence of ERP simulation game on learning effectiveness, skills development and decision making. Its impact as a teaching and learning tool on the students' ability to develop an integrated view of business is assessed and their generic attitudes towards the learning of SAP analysed. The results reveal the significant impact this game had on students' abilities and points out the challenges in the process and pedagogy. The study found that the game contributed to deep learning in addition to resulting in significant improvement in their process orientation and integrative skills. The study, based on feedback from participants and the experience of academics, recommends further improvements to the deployment and curriculum design of the game.

Keywords: Enterprise Resource Planning, Simulation, Pedagogy, Business Process Management

1. INTRODUCTION

Understanding the concepts of cross-functional business processes and their management are key graduate requirements today in process-centric organizations. In general, it is difficult to teach these concepts to business students using traditional teaching and learning methods. In particular, it is challenging to teach post graduate students who have limited or no business experience. Enterprise Resource Planning (ERP) systems and the industry-standard ERP software solutions are considered a powerful tool for teaching these concepts. With strong encouragement and support from leading ERP software vendors, such as SAP, Oracle, Microsoft and others, several university business schools have incorporated ERP systems into their curricula. While these initiatives have helped immensely in teaching these concepts and imparting much needed SAP and other software skills to students, the pedagogical benefits are limited. Introducing innovative teaching and learning models is considered necessary in order to improve the learning effectiveness and deep learning of these skills and concepts.

The ERP simulation game is one such initiative that exposes students to an authentic learning experience in a simulated, yet complex business environment and offers an exciting and stimulated learning environment (Leger 2006). By exposing students who typically specialize in one discipline and have limited or no understanding of business operations and practical experience in industry-standard ERP software, this game is expected to impart necessary business process orientation and retainable SAP skills to business students in a dynamic and stimulating learning environment.

This paper reports on the effectiveness of that initiative and discusses the challenges and opportunities involved. It will first present a review of literature on business process orientation in business education and provide background to the ERP simulation game. It will then explain the initiative undertaken by an Australian business school and the methodology adopted in conducting this evaluation research. It will present the findings of this study and discuss implications and challenges.

2. LITERATURE REVIEW

Business processes are central to the way organizations and individuals interact with one another (Malone et al 2003) and are now considered the most valuable corporate assets (Gartner Research 2006). Organizations of all sizes have achieved, and are still achieving, significant improvements in

quality, cost, speed and profitability by focusing on modeling, measuring and redesigning their customer facing and internal processes (Hammer 2007). The concept of 'process orientation' is almost a decade old, with most of the literature on process orientation from the popular press and industry reports and therefore it lacks an empirical research focus (McCormack & Johnson 2001).

Process orientation refers basically to the awareness of the interdependencies and information sharing between various functional units and business models, with an underlying focus on integration, customer and customer needs. Business process orientation violates, in its logic, a classic management principle called 'functional specialization' (McCormack & Johnson 2001). However, it helps in better understanding the perspectives taken by other functions within a business, developing a collective sense of belonging and facilitating the reduction of cross-functional conflicts (Huang and Newell 2003).

Even though it is considered an important skill for graduates, acquiring this skill is not a one step activity and is an ongoing process. In addition to basic understanding and appreciation of the concepts, it requires a high degree of self-awareness, critical thinking and deep learning (Quinn et al 2003). In addition to helping graduates in their future work environment, pedagogically this process orientation is expected to improve understanding of intersections and interactions in and between traditional disciplines such as marketing, operations, accounting and human resources (McCormack & Johnson 2001; Burrack & McKenzie 2005; Kohlbacher 2008).

The existing pedagogical model of business education embeds functional structure and continues to produce graduates with good technical specialist skills and knowledge in functional areas such as accounting, marketing, logistics, finance and human resources (Cecez-Kecmanovic et al 2002; Karpin 1995). Increasing class sizes, limited availability of resources, diversity of students and changing student demographics are placing demands on higher education to explore new pedagogies. In addition to these, business schools are facing dual challenges – first to make their courses relevant by incorporating industry-relevant skills and knowledge, and second to design and implement innovative learning methods and pedagogy (Mortais et al. 2006).

An ERP simulation game is one initiative that can help academics deal with both challenges simultaneously and successfully. Simulation games are one of the most powerful tools in learning because of their potential to provide a real-world business environment and their engaging active learning experience (Mortais et al 2006; Westernberger 1999). Though most simulation games predominantly focus on functional concepts and are taught in the context of one function (such as logistics, marketing, international business, strategy, IS development etc.), the ERP simulation game featured in this study is different. This simulation game focuses on cross-functional business processes and managing transactions and processes, employing a much needed multi-disciplinary perspective.

Incorporating ERP software solutions into the business curriculum for improving learning and pedagogy is not new and has been in place in several university schools for more than 10 years. In fact, there are several studies that have investigated the impact of deploying SAP software in business and information technology curricula (Seethamraju 2007; Federowicz et al 2004; Peslak 2005). Earlier attempts at incorporating SAP and other ERP software skills in the curricula involved regular lectures and lab sessions. Typically the concepts of business processes, enterprise resource planning (ERP) systems, implementation options and challenges, and the technologies behind these systems are taught using a traditional lecture mode. SAP software skills are taught using lab sessions where the lecturer carries out demonstrations and students are required to perform several activities.

Students are trained to do various activities in SAP, including creation of master data, performing transaction cycles that take students through various application modules such as sales and distribution, production, materials management, accounting, and configuration. While these achieve some benefits and learning outcomes in terms of SAP skills and understanding of the enterprise systems concepts, their pedagogical effectiveness and 'deep learning' outcomes are limited. In fact, understanding and appreciating a business process perspective has been reported as a major challenge (Seethamraju, 2007).

Students have found it difficult to understand the cross-functional perspective of business processes in SAP and the information flows behind the transactions they are routinely performing (Cannon et al 2004). In fact, in one study, some students rated this experience as a 'routine data entry exercise' and did not seem to have experienced deep learning opportunities (Seethamraju 2007). Students, however, value the exposure to an industry-standard ERP software solution such as SAP, during the course. Learning SAP software skills with hands-on work on the industry-standard software was considered a better learning experience than a routine theoretical teaching of ERP systems (Hawking et al 2004).

In these attempts, students' ability to develop a deeper learning objective, i.e., business process orientation and the appreciation of interdependencies, and its potential to internalize that understanding in their managerial decision making and thinking processes was limited. Some of the reasons identified in previous studies include the resource intensive nature of such courses, individually (not as a group) working on processes and transaction cycles, complexity of the software resulting in an overwhelming experience, and undue focus on completing transactions without allowing students to explore the underlying issues (Seethamraju 2007; Hawking et al 2004). In addition, the complexity of the system makes it hard for students to understand the links between information, business processes, and managerial decisions and distinguish between the limitations of the software functionality and key managerial requirements.

The study of business management, characterized by its relatively ill-structured and complex nature, requires interdisciplinary focus and is difficult to teach using traditional methods (Draiijer & Schenk 2004). Simulation using enterprise systems software solutions is expected to facilitate understanding of business processes and impart valuable skills in using industry-standard software solutions such as SAP (Draiijer & Schenk 2004; Leger 2006). Simulations can reduce the complexity of early experiences with business processes (and hence cognitive load), allowing

students to develop process orientation, and in the development of software skills. Even in real businesses, execution as learning will deliver better business performance rather than mere flawless execution (Edmondson 2008) and simulation games with learning in an unthreatened environment will deliver that learning as students are executing and managing several business processes. Even though computer based simulation games have become popular pedagogical tools, research is only beginning to consider how these simulation games impact learning outcomes (Anderson 2005, Seethamraju 2008; Ben-Zvi 2007). For example, Ben-Zvi (2007) has found the simulation game a better method than the lecture and case study method while teaching information systems.

3. STUDY OBJECTIVES AND METHOD

There are several studies on the conceptual basis, strategies for deployment and effectiveness of business simulation games (Anderson 2005; Mortais et al 2006). Similarly, there are a range of studies on the effectiveness of incorporating ERP software solutions in the business curriculum (Seethamraju 2007; Federowicz et al 2004; Peslak 2005). There is, however, only one study reporting on a curriculum model that incorporated an ERP simulation game into a business curriculum (Leger 2006), which not only incorporates a simulation game but also ERP software solutions.

Though Leger's study predominantly focused on the learning model, not much is known about the game's influence on teaching and learning. The current study attempts to evaluate the effectiveness of one such curriculum model that extends the Leger (2006) model and provides insights into the pedagogical effectiveness of the simulation game and the process orientation imparted by the ERP simulation game. This study evaluates the effectiveness of one such strategy that integrates ERP Sim game into business curriculum with an aim to teach business process orientation and ERP software skills at a single university. The findings of this study are expected to contribute to the field of enterprise systems and business simulations. The research objectives of this study therefore are to analyze the design and instructional strategies employed in the delivery of an ERP simulation game as a case study in an organization and provide guidance to other business schools. Thus an in-depth case study approach that incorporates a questionnaire survey data collection method consistent with the case study methodology (Yin, 2003) was employed in this study.

3.1 Learning Objectives

The key learning objectives of introducing this ERP simulation game into a course titled 'Business Process Integration' are: i) to develop business process orientation; ii) to teach ERP and SAP skills; iii) to provide business students with an authentic and exciting student-centered learning experience that is integrative and motivates them to learn. In addition, the aim is to offer students a quality information-rich environment in which graduates typically work in groups and make day-to-day managerial decisions. Importantly, the aim is to encourage effective skill development, a sense of enjoyment in learning and embed process orientation in their thinking and managerial decision making. This ERP simulation game is explained in detail in Leger (2006). This research study employs a modified mdel where students are exposed to six sessions as against the Leger (2006) model of the game. The objectives of this study therefore are to evaluate the effectiveness of this initiative. Details of the methods employed in the data collection and administration of the game deployed is explained below.

3.2 ERP Sim game

The ERPSim – a simulation game originally designed by a team of academics in HEC Montreal and implemented by about 20 leading business schools in the world so far is a team based game with each team operating a firm. Each team interacts with customers and suppliers by sending and receiving orders, delivering their products, determining pricing strategy, cash flows, credit management, using business intelligence and reporting in successive quarters and completing the cash-to-cash cycles. The game relies on the information, transactions and reports provided by SAP, an industry-standard enterprise resource planning (ERP) system. The ERP simulation game offers students the opportunity to reflect, test and find out what works and what does not, and gain insight into business processes, information systems, business strategy, managerial decision making, analytics and team dynamics. This game provides students with process guidelines and tools that enable real-time collaboration and collection of process data and incorporates disciplined reflection, a key requirement for deep learning.

The SAP Asia-Pacific application hosting centre at Queensland University of Technology (QUT), Brisbane hosts various SAP software solutions for universities in the Asia-Pacific region. The University of Sydney, as a relatively late entrant into the SAP curriculum space, has become a member of the SAP University alliance and accessed the ERPSim game software via QUT. While the QUT application hosting centre hosts the software for the game, HEC Montreal provides a detailed manual for a price and a few aids for carrying out SAP transactions. All the students have used this manual as a resource for understanding company background, transactions, reports and data used in the simulation game. In addition, students also have access to the SAP manual that provides detailed documentation about SAP in general, instructions for the creation of master data, and for carrying out various SAP transactions in order-to-cash processes, procure-to-pay processes and production planning processes. In addition, students have access to generic SAP help and other supporting documentation.

3.3 Schedule and Structure of Simulation

The game is scheduled for six sessions of three hours each during the semester. There were eight teams in the class, with each team having five to six students (a total of 52 students in class). This game can be played differently using different sequences and by choosing to automate some processes. The time line of the simulation game employed is shown in Figure 1.

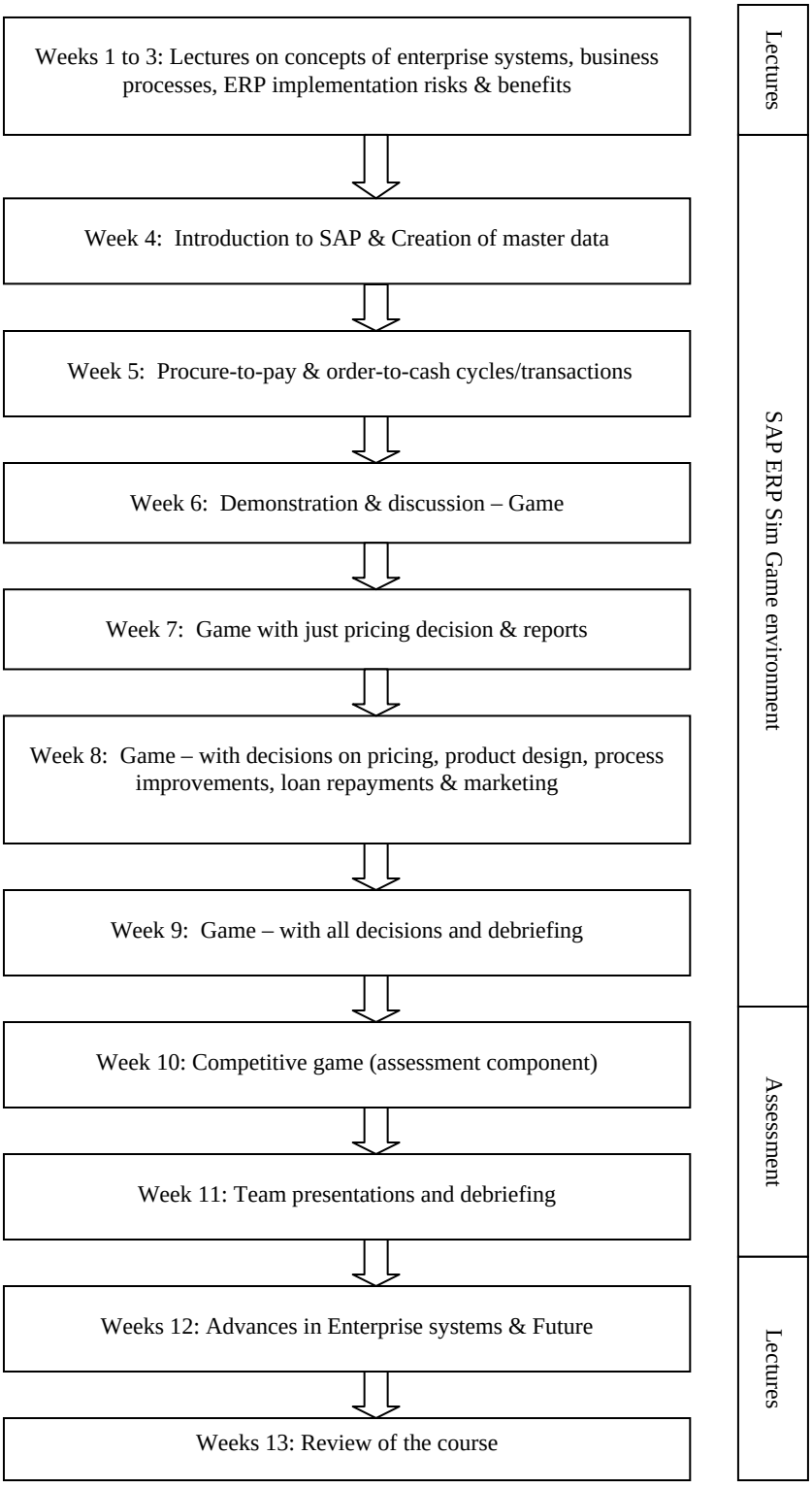

Figure 1: Simulation game timeline

As shown above, in the first three sessions, traditional teaching methods such as lecture and case studies were used to introduce students to the concepts of enterprise systems, business processes, information flows, implementation risks and technologies. According to Knowles et al (2005) adults are motivated to learn when they see the learning is relevant and meaningful and when it is active and has opportunities to practice. Employing these adult learning principles, the program was designed to take students from 'known to unknown'. With a focus initially on the sales process, this game moves on to production and then on to other strategic issues such as marketing strategy, product design, capacity expansions and cash flow management.

From week four onwards students were introduced to the game in a step by step manner for another three weeks. Students were first introduced to SAP in a generic environment where they performed activities such as: i) creation of master data for work centers, vendors, Bill of Materials, customers and materials; ii) carrying out procure to pay and order to cash transactions that include accounts payable, procurement/materials management, sales and distribution, accounts receivable and general ledger components of SAP; iii) financial, production, sales, material and cost reports and analysis. Subsequently, students were exposed to the game where most of the business transactions that involve procurement, selling and accounting are completely automated. The game organizers (academics) have managed all eight teams for the first two quarters by carrying out initial financial transactions automatically and by creating initial stocks of 100,000 units to start the selling process in quarter two.

Thus, in week seven, students were exposed to the cash-to-cash business process cycle through explanation and demonstration of basic SAP transactions and by playing the game for four quarters. During this period, each team was required to make business decisions on pricing based on the real-time business intelligence and reporting functionality in SAP. In addition to the HEC Montreal Simulation manual, students were given a one page 'job-aid' that explained the transactions they were required to carry out and the reports they needed to check for making pricing decisions with the objective of maximizing their profit. Teams played the game for one quarter in which they varied the price and developed an understanding of the price and demand sensitivity of the market, as well as learning to read various reports.

Typically by the time the third quarter was completed, teams would face a stock out situation having sold all their stocks. At this point, a pause was given and students were given an explanation and demonstration of the various steps in the production process. At the end of the second quarter, the simulator published the overall financial performance of all the companies. Teams would then realize the stock-out situation and start producing for the third quarter. They would then do the demand forecasting, carry out an MRP (Materials Requirement Planning) run, convert purchase requisitions into purchase orders, and convert planned orders into confirmed production orders. With appropriate time lags built in the system, and considering the production schedules proposed by the teams and capacities, finished goods stock is built for selling in the subsequent quarters.

In the eighth week, initial financing of the companies was carried out by the administrators and all teams had started with initial cash to buy raw materials for production and to incur other direct and indirect expenses. In addition, at this stage they could change the product design and pricing and develop niche markets for their companies, suggest process improvements through setup time reduction, do loan repayments and plan marketing/advertisement strategies/expenses.

The game then continued for another four quarters in week nine with students continuously evaluating their strategy after every quarter. At the end of every quarter, quarterly financial statements and performance results of each team were displayed to students. During this process, teams would continuously check their stocks, the average price of the products in the market place, production schedules, financial statements, costing and other reports. A debriefing session was conducted at the end of the session wherein students were asked to discuss their decisions, reasons, consequences and the role of information and the integrated nature of business with the class.

In weeks ten and eleven a competitive business game was played wherein students as a group were assessed based on their performance in the game, their logical explanation of the results and justification of their decisions, and importantly on their ability to establish and explain the links between their decisions, the results and the learning value. In addition, each team was asked to reflect on their team's performance and, in terms of their working strategy, their organization of the work, communication/collaboration methods and techniques employed and the effect those strategies potentially had on their performance.

3.4 Data Collection

Data was collected twice – before and after the experience with the help of a questionnaire designed for this study. The questionnaire consisted of some basic demographic details such as gender, course they are currently enrolled in (IT or business related), whether they have any previous experience, and previous knowledge/experience of working with SAP. In the second section of the questionnaire, students were asked to make a self-assessment of their knowledge on specific dimensions/concepts and the competence gained before and after this game using a 5-point Likert scale (1 = very low, 5 = very high). This questionnaire was administered before the introduction of the game to the students in week three and again in week twelve when they had successfully completed their game based assessment task. The statements in the questionnaire were developed taking into consideration the learning objectives of the game.

The questionnaire included questions that measure 'business process orientation' and 'integrated view of business' developed through this game, signifying underlying concepts such as standardization, integration, customer centric nature, interdependencies, information flows, collaboration, communication, broader perspectives and effects of individual tasks.

In addition, a series of questions that were designed to measure the perceived SAP skills such as master data creation, transactions, production of reports, analysis and interpretation of reports and data, functionality of the system etc. were included in this section. As shown in table 1, all 40 variables employed to collect data in this section were

grouped into four factors – Process Concepts & Terminology, Process Significance & Awareness, Process Management & Analysis, and SAP Skills. This section was administered twice – once in week three before students were exposed to the game and once in week twelve after students have played the game and completed the related assessment task. The following table gives the definition of the constructs/dimensions.

Knowledge dimension	No of items	Definition
Process concepts & terminology	9	Refers to the knowledge/understanding of the basic concepts of process, its terminology and the underlying aspects such as integration, standardization, customer centric nature, interdependencies, and terminology that relate to various functions – sales, production, procurement & accounting.
Process significance & awareness	13	Refers to the understanding of the significance of process, and awareness of issues that deal with broader perspectives, inter-dependencies, integrated processes, information visibility, information flows; and consequences of sub-optimization of tasks in process and customer focus.
Process management & analysis	10	Refers to the understanding and ability to analyze the information/reports in managing the processes – includes analyzing reports, cause-effect relationships, monitoring performance, links between strategy and process outcomes, information quality and significance of communication and collaboration.
SAP Skills	8	Software skills – ability to carry out basic SAP transactions including creation of master data, transaction cycles in planning, production, procurement, sales and accounting processes; and interpreting the information on SAP screens and analyzing the links between transactions, master data, reports and functionality of the software in the game
Total	40	

Table 1: Knowledge dimensions – definition of constructs

In the third section of the questionnaire, students were asked to give their perceptions and attitudes towards the simulation game, its delivery, organization and its generic benefits to them. On a scale of 1 to 5 (1 = strongly disagree and 5 = very strongly agree on a continuum), participants were asked to rate their perceptions. Sixteen variables were grouped into four headings – administration (5), benefits at the workplace (6), organization of work (3) and learning environment (4). The objective was to measure the perception of students on the benefits this game has realized, the way the game was administered, the learning value delivered by the game, and their views on the successful organization of work among members while playing the game.

Perception constructs	No of items	Definition of construct
Administration	5	Refers to the way game is administered and deals with the pace of the game, debriefing session, value added by the academic and basics taught before the game
Benefits	6	Refers to the perceived potential benefits at the workplace after playing the game and includes help in ES implementation, better understanding of the role of SAP in business, and dealing with exceptions in processes, overcome frustrations with existing processes enabled by ERP system.
Organization	3	Refers to the perception of the way the work is organized while playing the game.
Environment	4	Refers to perception of the learning environment in which students played the game – includes stimulating, exciting, interesting and hands-on work
Total	18	

Table 2: Perception of the game - definition of constructs

This section included questions such as: "*simulation game helped me in the implementation of ES in future*", "*game made me more confident about how I must contribute to successful implementation*", "*this game helped me understand how an ES can improve the business operations", "whether learning through this game is more exciting than traditional teaching", "whether organizing tasks according to function or process is the secret of their success*", etc. This section was administered after students were exposed to the game.

In the fourth and final section, participants were asked to mention the best aspects of the game, challenging aspects of the game and other comments including suggestions for improvement of the design and administration of the game.

4. ANALYSIS, DISCUSSION & IMPLICATIONS

4.1 Demographics

The demographics of the participants in this study are shown in Table 3.

	Details	% (number)
1	Total number of valid responses	52
2	Male respondents	60%
3	International students	58%
4	Respondents from School of Information Technology	24%
5	Respondents from School of Business	76%
6	Respondents that have previous experience	69%
7	Respondents that are currently employed	35%
8	Respondents with some exposure to SAP	4%

Of the 50 valid responses received (from 52 total participants in the course), 60% of the respondents to the survey were male, 40% female, and 42% of the students were local students. Even though this subject was offered by the Business School, 24% of the students enrolled in this course came from the School of Information Technology/Computer Science (the remaining 76% came from the Business School). Business experience and previous knowledge/understanding of SAP are potentially independent variables influencing the students' prior knowledge. Therefore, data on previous work experience was collected. On the employment indicator, data revealed that 69% of the respondents had previous work experience and 35% were currently employed.

Though 31% of the respondents had reported some previous knowledge of SAP, just 4% of the total students had any serious exposure to a SAP system. It appears the remaining respondents (from 31% who claimed to possess previous knowledge of SAP) had limited exposure to SAP, reporting that they had seen SAP screens before in their organizations but with no real experience of working with transactions. The participant population was fairly uniform with practically no significant previous knowledge of SAP. The effect of previous knowledge and experience of working with SAP on their ability to participate in the ERPSim game and achieve learning outcomes could therefore be considered negligible and the potential gain in their knowledge could be attributed to the simulation game.

General reliability and validity of the variables are tested for their psychometric properties. The Cronbach alpha for all the constructs is more than 0.8. All the correlations (Pearson's r) among the factors and the overall construct (summative score of the instrument) were observed to be significant at $p<0.01$ level (2-tailed). The reliability scores for each of the factors and the overall instrument were also good and more than 0.78. The analysis thus confirmed the sound psychometric properties of the data collection instrument in terms of its validity and reliability.

4.2 Impact of ERP Sim game on Students' Ability

The difference between the perceived gain in students' ability (knowledge and skills) before participating in the game and after the groups played the game were computed and used for analysis. This difference was considered a measure of the level of knowledge and skills gained by the students as perceived by them. In addition, total indices for various hypothesized constructs were computed using responses for individual items. Considering that the maximum possible gain in their ability level was 4 (1 before enrolling in this unit, and 5 after completion of this unit), some improvement in their ability was observed across various dimensions. Paired samples t-tests comparing the values 'before' and 'after' as reported by the participants showed that the there is a significant gain in the knowledge and ability across various variables as shown in table 4. Analysis of the data as shown in table 4 suggests that the game has achieved its objectives of imparting process orientation as well as basic SAP skills. Particularly, there was an improvement in the understanding of the Process Concepts and Process Significance and SAP skills and much less on their ability to manage and analyze the processes.

Knowledge dimensions	t-value	Sig.	Std dev	Mean diff
Process concepts & terminology	9.56	0.000	0.78	3.40
Process significance & awareness	12.56	0.000	1.07	2.90
Process management & analysis	11.1	0.010	1.24	1.54
SAP skills	6.45	0.000	1.01	3.22
Overall improvement	12.50	0.000	1.02	3.80

Table 4: Impact of ERP sim game on students' abilities – t-test values

As indicated in table 4, participants reported statistically significant improvements in their abilities. This was particularly so for Process Concepts and SAP skills, while relatively less so for Process Management and Analysis and

Process Significance & Awareness factors. With participants reporting improvement in their business process orientation (typically explained by the first three constructs – concepts, significance/awareness and management/analysis), the objectives of using the ERP simulation game were achieved. High standard deviation though suggests further investigation into the factors that would influence this.

4.3 Attitude towards ERP sim game

Students were asked to give their views on the ERPSim game after they played it and completed the related assessment. They were asked to rate their general attitude towards the simulation game with reference to twelve items on a scale of 1 to 5 (1= strongly disagree, 2 = disagree, 3 = agree, 4 = strongly agree and 5 = very strongly agree). Since '3' is mid way and refers to the agreement with the statement, overall value of more than 3 is considered 'good.' These twelve items deal with the learning value, integration and group working concepts. Participants were asked to rate their perception of the learning value derived from this simulation game – whether learning through the simulation game was more exciting, interesting and innovative than traditional teaching methods. Similarly, participants were asked to rate whether this simulation game helped them in their understanding and appreciation of the concepts of integrated information, integrated processes, importance of inter-dependencies between various functions, importance of accurate and current transactional data and information flows across various functions. In addition, students were also asked to rate how this game helped them in understanding the importance of coordination and communication between various functional managers and organization of the tasks while playing the game. A summary of participants' attitude towards the ERP Simulation game is shown in table 5.

Attitude towards the game	Mean	Std dev.
Administration (5)	3.19	0.98
Benefits (6)	3.97	1.01
Organization (3)	3.36	0.97
Environment (4)	4.11	1.12
Overall perception/attitude	3.87	1.12

Table 5: Attitude towards simulation game

As shown in table 5, all the variables were rated good (above 3.00) and the overall attitude towards the game was positive (average close to 4.00). Responses to individual factors, however range from 3.19 (administration) to 4.11 (environment). Confirming that the game was pedagogically effective, an overall rating of 3.87 was recorded. Compared with the ratings of other courses on enterprise systems offered previously where the overall rating was 3.2, this demonstrates a significant improvement. The findings suggest that the participants suggested improvements in the way the game was administered and were able to appreciate the potential benefits of developing process orientation, and particularly recognized the innovative exciting way of teaching and learning enabled by the ERP simulation game. Thus, process understanding enabled by an ERP simulation game was recognized and appreciated by the participants, reinforcing the pedagogical effectiveness of this game

4.4 Best aspects of the game

In order to capture the students' overall perception of the entire experience, participants were asked to identify the best and most challenging aspects of participating in this game and asked to make comments on the game in general. Content analysis of the feedback reveals a generally positive response on the learning experience. These comments are grouped into four themes – pedagogical issues, SAP learning, business process knowledge and graduate attributes.

On pedagogical aspects, participants rated this as one of the most motivating methods of teaching and learning used in this university. As pointed out by one participant, "*I have never ever noticed how the time was moving; it was so interesting and exciting, in addition it is inspiring learning to students*". Competition encouraged teams to actively participate in the game, unlike other group assignments where some group members do not actively contribute.

In terms of SAP learning, participants felt that this had given them hands-on understanding of the concepts underlying enterprise systems. Even though it involved learning and using SAP, the focus is heavily on processes and their management. Rather than focusing on how to use SAP on a day-to-day basis as a technology/tool as in several initiatives in the past that incorporate SAP and other software tools in teaching and learning, this approach keeps SAP in the background. As noted by one respondent, "*the information technology here focused more on the process rather than on SAP, the best way to learn IT*".

This initiative helped students think about business strategies in various functional areas such as marketing, production and finance, and helped them understand their interdependencies. As noted by one respondent, "*I had a vague understanding of the process concepts, financials and SAP before the game, and often I just memorized the points and tried unsuccessfully to connect with real-life examples using text books, articles and others. This game greatly filled that gap in my understanding and helped me bridge the gap between theory and practice*".

In addition, this game also helped students develop some generic graduate attributes such as group working skills, sense of responsibility and control. As pointed out by one participant, "*importantly, we have learnt the importance of cooperation and how to cooperate which is going to benefit us in our further career*". This has given students a sense of responsibility and control over various tasks each member performed in the team and helped them develop mutual trust and confidence. As noted by one student, "*the way other members trusted me and my judgment, made me feel more confident than ever before*".

Participants appreciated the learning value of the game and reportedly gained more significant skills and knowledge than from previous teaching methods. Participants in general felt that the game is fun, exciting and inspired learning with a focus on processes rather than IT, and assisted them in appreciating cross-functional issues and interdependencies. Thus, this game not only contributed to the learning of SAP, it also helped students gain knowledge of process orientation as well as generic graduate attributes in an exciting and interesting way.

4.5 Challenges and Improvements

In addition to their positive comments about the game, students offered feedback on the challenges as perceived by them. These anecdotal comments are analyzed and grouped into four themes – SAP/technical skills, soft skills, subject knowledge and administration of the game.

Some respondents found it challenging to work in groups because of the diversity of their backgrounds, differences in their motivation to win and their varying levels of business knowledge. As pointed out by one respondent, "*organizing tasks among members become challenging for us as we are from different backgrounds*". Motivation of individual team members also played a role and noted by one respondent, "*not everyone in our team cares as much as I do*". Communication and making consensus decisions was also a challenge for some teams and had a detrimental effect on performance. As observed by one respondent, "*the wrong and repeated requests sometimes resulted in more production and wasted effort. Making quick decisions in the given time frame with so much information is a challenge*".

Lack of business knowledge appeared to have hampered the performance of some teams as the game is played mostly from a business perspective and not everyone has a good understanding of all the business functions. This appears to be particularly difficult for students from an IT background. Respondents found it difficult to develop appropriate business strategies and make appropriate business decisions based on the interpretation of information and reports. As the game is dynamic in nature, many participants found it hard to work in a real-world like scenario. As pointed out by one respondent, "*it is hard to know if we made a bad decision or other groups had made better decisions, and … is truly reflecting the real world situation and it was not easy*". Similarly, as noted by another, "*interpreting the sales data, knowing when to modify the recipe, knowing when to change the price, how much to produce, controlling the costs to make profit, responding quickly to changes in the market … etc. all are challenges*".

Even though the game is designed with a very limited number of manual transactions, some participants found SAP challenging. The general level of complexity of SAP, its screens and user interface, insufficient understanding of SAP transactions and functionality are some of the challenges. Some participants felt that they did not "*get enough technical practice and training"* and "*do not know which processes to use and which processes are automated*". As pointed out by one participant, "*entire team is required to execute an entire business process chain that involves procurement, production, sales, marketing, and accounting and every team member need to understand the business process across different business functions*".

On the administration of the game, participants felt that the explanation must be slower at the beginning and must be in detail, linking the reports, information and processes. Inability of the students to practice the simulation game after the class also contributed to the challenges. In addition, unknown factors in the game, though similar to a real-world business scenario, posed difficulties for some teams. Combining SAP software functionality, theoretical knowledge of business processes and strategies, and reports made it difficult for many teams.

As noted by one respondent, "*we don't know what our customers like, how high the price can be when we are advertising our products; though we know we have to achieve a balance, it is very hard to find out that balance*". On top of these challenges, the relentless pace of the game forced some teams to make decisions faster without full understanding of the implications and without analyzing previous quarters' performance. On a positive note, participants generally felt that the checking of many reports regularly made their job more complex. As nicely summed up by one participant, "*though it is challenging to understand that the business is 'integrated' through the system, once understood, it has immensely helped in decision making*".

The above anecdotal evidence suggests that the challenging aspects are: the fast pace of the game, especially at the beginning; inadequate knowledge of accounting and finance; lack of experience; team work collaboration and communication; complexity of SAP; and general lack of business experience and knowledge. In addition, working in teams is identified as the most challenging aspect of this game. This requires participants to recognize inter-dependencies and manage distribution of tasks, coordinate decisions and actions, and continuously communicate among themselves. All of these aspects typically are required in a dynamic business environment and facilitated by an ERP system. Some of the participants also pointed out information overload. An ERP system produces a large volume of information because of its transactional nature, and requires a discerning manager to look for information that is relevant and useful for particular decision making.

Considering the complexity of the SAP software, it is normal for participants who have had no previous exposure to the ERP system software to feel pressured and view this as information overload and too complex. Interestingly, fewer than 10% of the participants pointed this out as a challenge. Therefore, it is safe to conclude that three weeks of traditional learning that employed lectures, case study discussions and exposure to SAP screens performing some routine transactions has helped students to better prepare for the game. Given the focus of most comments on the decision making and group working, the model appears to have worked well in delivering improved SAP skills and process orientation, without getting bogged down with the complexity of the SAP software. Thus, this model of teaching appears to have achieved a delicate balance in achieving the learning objectives.

5. CONCLUSIONS

Imparting business process orientation and teaching complex SAP software skills in a stimulating environment, and ensuring that deep learning has taken place in this process, is always a challenge. The approach taken in this particular simulation game, however, is found to be successful, where the first three weeks were spent in exposing students to the SAP screens, and providing a general explanation of the process concepts, rather than a previous attempt where students were exposed to the simulation game immediately. Many participants felt that understanding SAP was a critical requirement for students to concentrate on the business side rather than become lost in the complexity of SAP.

Though students seem to have gained a sufficient understanding of SAP as they progressed from the fourth week to the ninth week, some participants failed to move forward and apparently became 'lost' in dealing with the complexity of SAP. Importantly, this study demonstrated the inadequate understanding of the finance/accounting related issues and inability of participants to understand, interpret and react to the various financial ratios that were reported by the game at the end of each quarter. Although the ERPSim participants' guide (which students used as a resource) is clear in explaining the SAP transactions and settings in the system, it is found to be inadequate in providing business knowledge, particularly relating to finance and accounting aspects.

The majority of the participants did not feel threatened by SAP and its complexity as most of the transactions and operations are automated. In the absence of some explanation as to the cause and effect relationships between the game outcomes and the decisions teams make, it has become difficult for the teams to actively learn. Participants also felt that detailed feedback on their group's performance, pointing out their strategies, decision making and the consequent outcomes would have helped their understanding immensely. Though a debriefing session appears to have covered some of those concepts, participants generally preferred written feedback from the academics, especially on the financial reports.

This study was designed and conducted by the author and a research assistant. The findings therefore may potentially have researchers' bias. Moreover, this is the first time an ERP simulation game has been run as a part of the curriculum in this school and may potentially be subjected to the Hawthorne effect. The Hawthorne effect is one of the hardest inbuilt biases to eliminate or factor into the design of the study (Shuttleworth 2009) and may result in students over or under reporting the knowledge gained, simply because they are participants in this study.

Further this study is based on the perceptions and views of the students and their self-assessment of the knowledge gained during the semester. In addition to Hawthorne effect, this also may have contributed to over or under reporting of the knowledge gained. In addition to these, other general limitations of the questionnaire survey method such as ambiguity of statements would also apply to this study. While it may to some extent limit the generalisability of the findings, the author believes that the findings will make a positive contribution to the knowledge on the effectiveness of simulation games in general and the understanding of business process orientation and enterprise integration in particular.

In order to overcome some of the limitations of the study, students were asked to give their views on the game i.e. best aspects, challenging aspects and general comments on the design and administration of the game. Measuring the effectiveness of one curriculum initiative in a single course and generalizing its applicability to graduate skills such as process orientation, enterprise integration is complex and challenging. This is especially so when the skills in business process orientation, enterprise integration, decision making and group working are very broad-based and could be learnt on the job. The effectiveness of one initiative in one unit in a degree course cannot be felt immediately and largely depends on the skills and knowledge gained in other subjects and students' ability to apply these skills in a workplace.

Importantly, despite limitations of the study, participants recognized the significance of 'reflection', 'deep learning', 'team work', and 'integrated environment' and the underlying dimensions of 'process orientation' while playing the ERPSim game. This has reinforced the value of experimentation and reflection that is considered vital to sustainable success as suggested by Edmondson (2008). This ERP Simulation game has helped participants recognize the importance of those values and thereby assisted them in developing those skills vital for their success in modern organizations. While it is not straightforward to impart 'process orientation', the ERP simulation game definitely helped students to appreciate the significance of processes and their management, in addition to making it easy and fun to acquire much sought after software skills that could potentially enhance their employability. Students thus can acquire valued skills – process orientation – a key graduate skill industry wants and software skills that will make it easy for them to operate in the business environment. Readers interested in replicating this study may contact the author for the actual questionnaire used.

6. REFERENCES

Anderson, J.R. (2005) "The relationship between student perceptions of team dynamics and simulation game outcomes: An individual-level analysis," Journal of Education for Business, 81(2), 85-90.

Ben-Zvi, T. (2007) "Using Business Games in Teaching DSS," Journal of Information Systems Education, 18(1), 113-124.

Burrack F. and T. McKenzie, (2005) "Enhanced student learning through cross-disciplinary projects", Music Educators Journal, 91(5), 45-50.

Cannon, D.M.K., Koste, L.L. and Magal, S.R. (2004) "Curriculum integration using enterprise resource planning: An integrative case approach," Journal of Education for Business, 80(2): 9-15.

Cecez-Kecmanovic, D,, Juchau, M., Kay, R. and Wright, S. (2002) Australian Business Education Study: Enhancing the quality of Australian Business Education, Australian University Teaching Committee.

Draiijer, C. and D.J. Schenk (2004) "Best practices of business simulations with SAP R/3", Journal of Information Systems Education, 15(3), 261-265.

Edmondson, A.C. (2008) "The competitive imperative of learning," Harvard Business Review, July-August, .60-67.

Fedorowicz, J., Gelinas, U.J., Usoff, C. and Hachey, G. (2004) "Twelve tips for successfully integrating enterprise systems across the curriculum", Journal of Information Systems Education, 15(3): 235-299.

Gartner Research (2006) "Gartner position on Business Process Management," Gartner Research Note, ID: G00136533, http://www.gartner.com downloaded on 1 Feb 2007.

Hammer, M. (2007) "Process Audit," Harvard Business Review, 85(4): 111-123.

Hawking, P., McCarthy B., and Stein, A. (2004) "Second wave ERP education", Journal of Information Systerms Education, 15(3): 327-332.

Huang, J.C. and Newell, S. (2003) "Knowledge integration process and dynamics within the context of cross-functional projects", International Journal of Project Management, 21: 167-176.

Karpin, D.S. (1995) Enterprising Nation: Renewing Australia's Managers to meet the challenges of the Asia-Pacific century, Report of the Industry Task Force on Leadership and Management Skills, Canberra: Australian Government Publishing Service.

Knowles, M.S., Holton III, E.F., and Swanson, R.A. (2005) The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development, Sixth edition, Burlington, MA, Elsevier Inc.

Kohlbacher, M. (2008) "Process orientation of manufacturing companies". In Global Business Development Institute (eds.) Proceedings of the GBDI Tenth International conference, Las Vegas, October.

Leger, P_M. (2006) "Using a simulation game to teach enterprise resource planning concepts", Journal of Information Systems Education. 17(4): 441-447.

Malone, T. W., Crowston, K., and Herman, G. (Eds.) (2003) Organizing Business Knowledge: The MIT Process Handbook, Cambridge, MA: MIT Press.

McCormack, K. and Johnson, W. (2001) Business Process Orientation: Gaining the e-Business Competitive Advantage, Boca Raton: St Lucie Press.

Mortais, L., Hoff, J. and Reul, B. (2006) "A dual challenge facing management education: Simulation-based learning and learning about CSR", The Journal of Management Development, 25(3/4): 213.

Peslak, A.R. (2005), "A twelve step, multiple course approach to teaching Enterprise Resource Planning." Journal of Information Systems Education, 16(2): 147-155.

Quinn, R., Faerman, S. and Thompson, M. (2003) Becoming a Master Manager: A Competency Framework, 3rd edition, New York: John Wiley.

Seethamraju, R. (2007) "Process orientation to business students: Enabling role of enterprise systems in curriculum", Proceedings of the 18th Australasian Conference on Information Systems, 10-12 Dec. Toowomba, Qld.

Seethamraju, R. (2008) "Enhancing student learning of enterprise integration through ERP business simulation game" Proceedings of the AIS SIG – ED IAIM 2008 conference, 10-12 Dec, Paris.

Shuttleworth, M. (2009) Hawthorne Effect, Retrieved on 4 January 2011 from Experiment Resources: http://www.experiment-resources.com/hawthorne-effect.html

Westernberger, H. (1999) Simulation-based training or manufacturing planning and control for SAP R/3, SAPPHIRE' 99, 3rd Annual SAP Asia-pacific Conference, 167-171.

Yin, T. (2003) Case Study Research: Design and Methods, third edition, Thousand Oaks, CA: Sage Publications.

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