SAP ENTERPRISE SOFTWARE
LEARNING EXPERIENCE IN CHINA

Hayen, Roger L.
Central Michigan University

Holmes, Monica C.
Central Michigan University

ABSTRACT

The SAP Enterprise Central Component (ECC) Enterprise Software processes more business transactions than any other business software on the planet. Most of the Fortune 1000 companies use SAP software in managing their business operations. Today's students, managers, and other business employees need to become familiar with the software to be more effective in their jobs. A variety of different learning approaches have been utilized, since the introduction of SAP enterprise software into the curriculum of colleges and universities. Frequently, these learning strategies are similar to those used to train employees in a corporate environment. Recent developments in learning alternatives have provided additional approaches to the design and delivery of an introductory course. One learning strategy has been used with junior or third year students in an undergraduate Management Information Systems major within a business college in China. A model course organization is deployed in the delivery of that course. The model course utilizes SAP ECC software transactions with a generally accepted training dataset. The model approach continues with an ERPsim simulation that supports learning of the application of business analytics and decision making. This all occurs within a live SAP ECC software instance. Students were surveyed to obtain their perspectives of this model of experiential learning. The results indicate the overwhelming positive reaction to this model course organization. The paper discusses this model course delivery approach implemented in China.

INTRODUCTION

The SAP Enterprise Central Component (ECC) enterprise software, developed by the German company SAP AG, processes more business transactions than any other business software on the planet. (Word, 2008) Most of the Fortune 1000 companies use SAP software in managing their business operations (Hayen, 1997). This includes a number of companies. Among them are Walmart, Dow Chemical, Delta Airlines, Home Depot, Speedway, and Volkswagen AG. Today's students, managers, and other business employees need to become familiar with this type of software to be more effective in their jobs. SAP ECC is an excellent learning platform as it provides knowledge of the type of automated business processing done with enterprise software in general. A variety of different learning approaches have been utilized, since the introduction of SAP ECC enterprise software into the curriculum of colleges and universities in the late 1990's. Frequently, these learning strategies are similar to those used to train employees in a

corporate environment. SAP AG delivers a large number of training courses for corporations and other entities using its SAP ECC software. Recent developments in learning alternatives have provided additional approaches to the design and delivery of an introductory course at the post-secondary level. The course described here serves as a model approach which may be used in a corporate training environment. The entire learning model may be used or it can be segmented into transaction processing and managerial decision making elements. The model learning strategy is one that has been used with junior or third year students in an undergraduate Management Information Systems major within a business college in China.

This paper considers an alternative delivery approach implemented in China. The Chinese environment provides a technology and cultural challenge (Figure 1). For this course, the SAP software server is located in Australia; the course student materials are located on a server in the United States (US); and the course is delivered in Shanghai, China. During the past two years this has been a unique learning experience in China. While other universities in Southeast Asia have included the SAP ECC software in their curriculum, this is the only instance of the learning experience described by this research that has been delivered in China. The Chinese environment also raises cultural issues (Williams, 2011). As young children, Chinese students learn to help each other with their school work and in playing. This characteristic stays with them through high school and college. They collaborate with each other on their homework and in class (Hayen & Holmes 2013b). It is practically impossible to prevent this scholarly activity from occurring in class. At the same time, that team work spirit should enhance their classroom learning. Chinese students are similar to college students in the US. Digital game playing is very popular among the Chinese students. They often play these digital games on their iPhones or smartphones. This appears to give Chinese college students a general understanding of technology that is equivalent to their peers in the US (Hayen & Holmes 2013b).
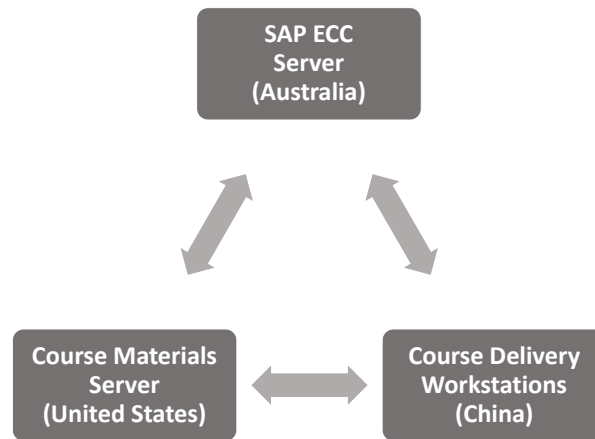

Figure 1. Technology Architecture

The paper addresses the model course learning approach by presenting the underlying course learning architecture; the overall model course organization; the assessment of the course methodology; the research analysis to measure the acceptance of the model course organization; a discussion of the lessons learned from this experience; and a summary and conclusion of this

research effort. The results will indicate the efficacy of the model course organization set forth through this research.

LEARNING ARCHITECTURE

The course learning experience is organized in a bottom-up and top-down arrangement (Figure 2). In the SAP ECC software environment, bottom-up is learning individual transaction sets to process a related series of transactions such as those for processing a customer sales order to cash or a purchase order to payment. These are sometimes known as cash-to-cash processing in this learning environment (See customer order to cash processing in Figure 2). Top-down is learning the use of data output by various SAP ECC detail and summary reports. Data from the reports are analyzed external to the SAP ECC software and from that decisions are formulated for subsequent input into the SAP ECC software (See strategic decisions in Figure 2). This is the analytics and decision making processes of managers and others. The external evaluations are done using the Excel spreadsheet software. Excel is used because of its popularity as a desktop analytic software tool. SAP ECC report data are easily exported to an Excel workbook for subsequent use in an analytic Excel spreadsheet.
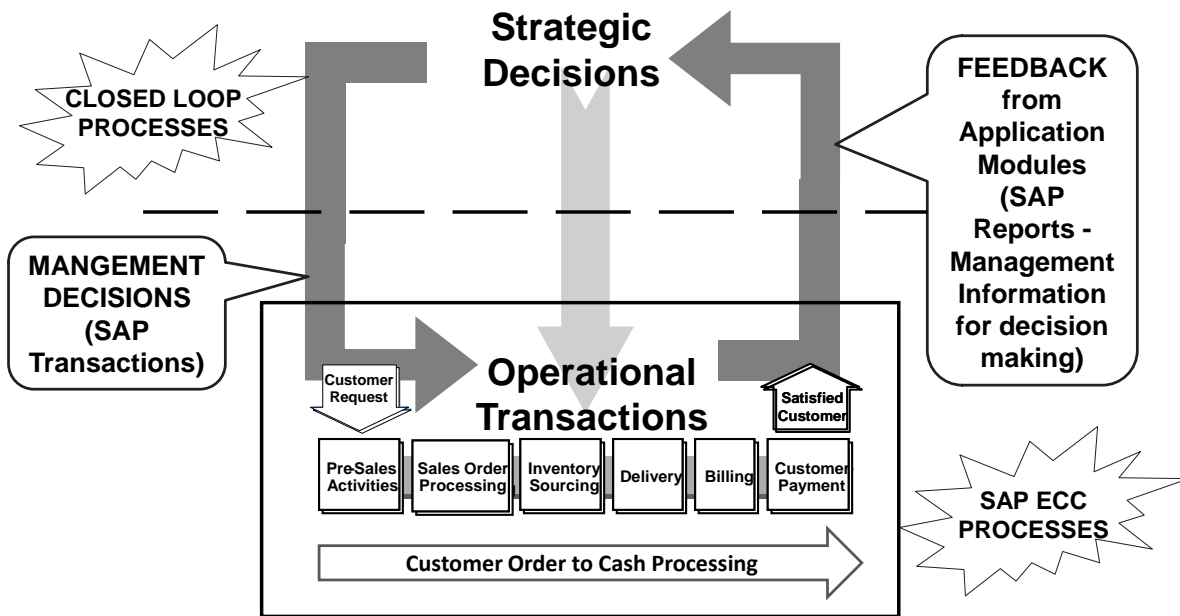

Figure 2. Learning Environment

A closed loop business process (Figure 2) is achieved with an ERPsim simulation (HEC Montreal, 2013). The ERPsim simulator generates and sends individual customer sales orders together with other transaction data to the SAP ECC system. They are processed for each day of the simulation. That is, ERPsim uses simulated days with blocks of individual transactions processed for that day by the simulator. The breadth of the decision making requires that teams are used in working with the simulator. This emulates mainstream business organizations which are run by managerial teams. Typical team sizes are from four (4) to six (6). However, they can be adjusted for different learning environments. For the occurrence of the course describe here, student participants are organized into teams of size four (4).

The arrangement between the SAP ECC software and the ERPsim simulator is illustrated in Figure 3, where each component runs on a separate server. The simulator is structured in quarterly time periods where each quarter consists of 30 simulated working days. The simulator sends blocks of transactions to the SAP ECC software for the processing of the individual transactions for each simulated day. In the simulation environment a quarter usually occurs over an actual clock time of 40 to 60 minutes, which is a duration that can be set by the course instructor.   This means that with the simulator students do not actually carryout the individual transactions as the simulator does that for each day. This feature allows students to focus on the analytics and decision-making activities.   Using simulations such as this in the classroom is known to enhance learning (Xu & Yang, 2010).
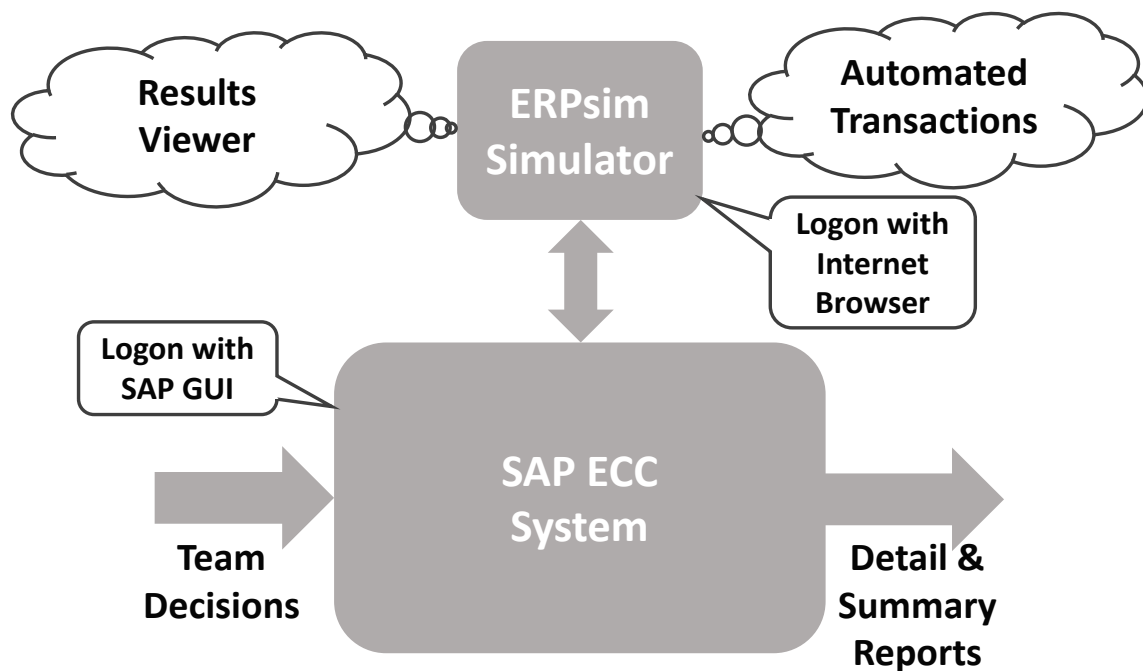
Figure 3. Technology Architecture

The ERPsim simulator is available in three different flavors of distribution, manufacturing, and logistics (HEC Montreal, 2013). Course instructors select the simulation flavor based on its use within a particular course. Within manufacturing and logistics, different levels of complexity are provided.   For manufacturing, the levels of complexity are introduction, extended, and advanced. Each of these levels adds to the decision-making requirements for students. For example, in the extended manufacturing version, teams can increase their production capacity and use a loan to finance that expansion. The desired level of complexity is selected to match with the length of the course and whether this is the first course with the SAP ECC software. The more advanced levels of complexity are designed for use where students are taking their second or third course using SAP ECC software.

MODEL COURSE ORGANIZATION

Over the past 20 years, a variety of datasets have been used in SAP ECC education and training (Antonucci, et al, 2004). The Interactive Demonstration and Evaluation System (IDES) is the SAP ECC dataset that is used by SAP AG in delivering its various training courses. The courses are most frequently provided to SAP AG's corporate customers who deploy this software in the ongoing operation of their businesses. The IDES dataset is designed for use with most of the training activities delivered by SAP AG. This results in a large and comprehensive dataset. To simplify the learning environment, faculty at several universities have developed simplified datasets which are tailored to be more focused learning activities. Of the available training datasets, Global Bike Incorporated (GBI) 2.11 is the current dataset version used in this learning experience. The dataset is created with the support of SAP AG under its University Alliance Program (UAP) (SAP AG University Alliance, 2013). This effort provides a broad, comprehensive development of a common dataset for use in teaching courses while limiting the ongoing maintenance of this dataset. The keystroke transaction level instructions of the dataset were simplified and expanded to meet different perceived approaches to teaching various transactions. However, the GBI tutorials are a transaction-keystroke approach learning level. Recent developments include the use of different case study data which students use in the transactions so that this is more than just following the keystrokes and requires more critical thinking. This improves understanding but still emphasizes individual transactions such as customer sales order to cash or purchase order to payment.

A second recent development is the ERPsim simulator created and supported by HEC Montreal (2013). This brings a focus on entering data that represent business decisions such as product prices and production schedules. The ERPsim simulator runs the underlying individual SAP ECC transactions in a live SAP ECC software instance. It provides summary data in SAP ECC reports with competition among student teams operating different companies through the SAP ECC software. That is, ERPsim processes the individual transactions so students can focus their attention on data analysis and decision making. The ERPsim environment is a competitive team-based structure with each team operating a separate company or business entity. The manufacturing simulation uses the Muesli cereal dataset and encompasses the production and sales of six different products. At the end of a simulated time period, summary results data can also be downloaded to Excel spreadsheets or database software such as Access. The data is then analyzed by students and new decision values are entered. This development engages students in a more managerial decision making use of the SAP ECC software. The decision making requires critical thinking (Reid & Anderson, 2012) with the reports providing information to support this decision making. The introductory SAP ECC course is designed around the ERPsim simulation with this higher level application for decision making.

The operational transactions (Figure 2) are the day-to-day interaction with the SAP ECC. Student learning for this is the application of the GBI dataset directly in the SAP ECC software. The strategic decisions result from student analytics with decision values input to the SAP ECC software. These are managerial level decisions such as product prices and production schedules. The Results Viewer (Figure 3) provides the report of the financial statements at the end of each quarter of the simulation (Figure 4). The ERPsim simulation is arranged in quarters with a typical course timeframe of up to eight quarters. At the end of each quarter, the simulation is paused to

allow students time to undertake an in depth analysis of the prior quarter's performance and to formulate changes in their strategy before the next quarter. Students are organized as teams where each team is assigned a unique company identification code letter for use within the ERPsim.

The analytics include both company (team) and market (all teams) reports that comprise quantity sold by product by sales region; average price by product by sales region; and revenue by product by sales region. Each team can determine the analytics they will use and develop those evaluations. A summary financial statement report is available to students from the ERPsim simulator (Figure 4). For each company (team) in the simulation, this includes cumulative values for net income, total expenses, gross margin, net margin, and return on equity (ROE). This is the most comprehensive comparative results available to all teams and shows their team's performance relative to all other teams.
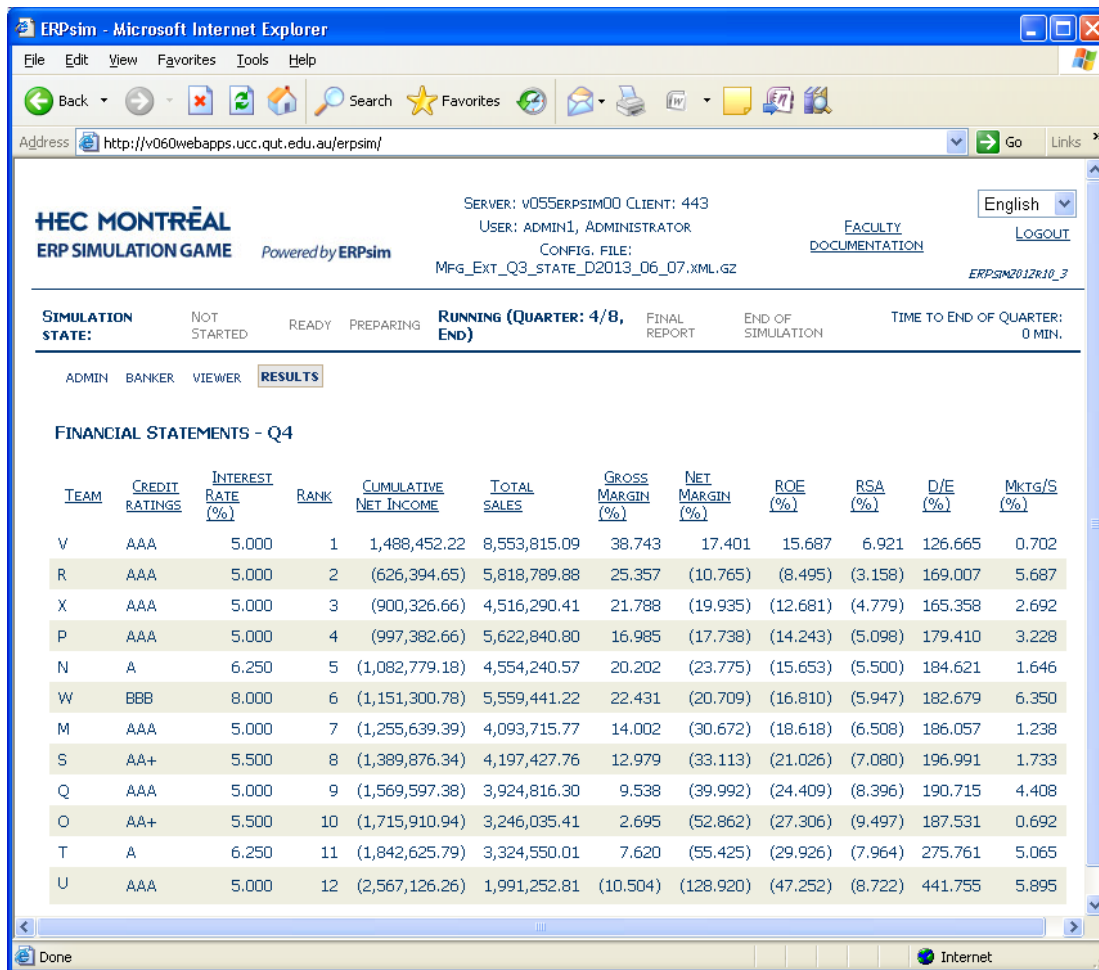

Figure 4. ERPsim Financial Statements

A new paradigm is the combination of both the individual transactions, such as those of a purchase order to payment, with the analytics and decision making furnished through ERPsim (Hayen, 2013). The result is a course that both allows students to gain an understanding of a

transaction, such as customer sales order to cash, and of the impact of processing a number of customer sales orders to determine the overall impact on a company. Both of these are necessary to gain a sound, broad understanding of the use of SAP enterprise software, or any other enterprise software, within an actual business environment. The course delivered in China is an implementation of this paradigm composition. It is a team-based learning experience with all assignments and projects done in the same team (Xu & Yang, 2010).

The course is arranged into three components (Figure 5). The first is learning business transaction processing at the lowest level in the SAP ECC software. Learning experiences take place for several different transaction sets. At this level if a team has a difficulty in carrying out the transaction processing steps, they have the ability to re-do any steps where a glitch occurs. The second component is learning the processing and decision making of the ERPsim manufacturing simulation through the introductory simulation. This is conducted in a competitive team environment. The teams do not have prior experience with this analysis and decision making, especially the integration of the various business functions. If a difficulty occurs, that team **cannot** re-do their activity to correct the situation, because of the competition that is occurring with the other teams.   The introductory level ERPsim permits students to gain experience with the analytics and decision making of the production and sales environment of the manufacturing simulation. This leads to the third component of the extended level manufacturing simulation. Experience with the introductory simulation is vital in developing the learning skills for the manufacturing simulation, which are subsequently utilized in the competition of the extended simulation. Fortunately, the introductory and extended levels of the simulation use the same Muesli cereal dataset, so the introductory simulation is a most important learning experience in the use of the ERP simulation in this course.
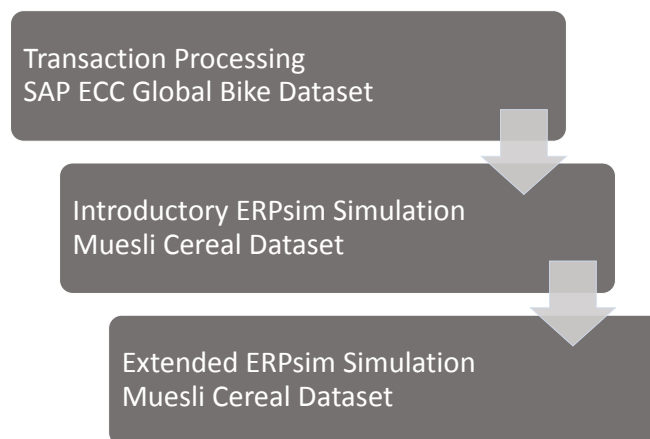
Figure 5. Course Organization

In the course delivered in China, all three components are used in one integrated learning experience. However, in a corporate training environment, these components are sufficiently standalone that they may be used independently of one another. This, of course, depends on the prior knowledge of the SAP ECC software that participants may have.

The Global Bike Incorporated (GBI) 2.11 version is an SAP ECC dataset provided by the SAP UAP to use with student exercises at the transaction level. For this course, the GBI experiential learning modules include navigation, organization structure, customer sales order to cash, purchase order to cash, and production planning. Navigation introduces student to the general execution of various SAP ECC transaction fundamentals. Organization structure is most important with enterprise software as this is the primary manner in which all data are stored and processing occurs within the SAP ECC software. That is, the organization structure furnishes the primary key fields for storing all data with the software. The other three transaction modules provide students with knowledge of the end-to-end activities that occur with those respective SAP ECC transactions.

METHODOLOGY

Using this learning architecture, students in a third year or junior level management information systems course at the University of Shanghai for Science and Technology (USST) in Shanghai participated in this learning experience. A survey of the students' perceptions of the experience was administered at the end of the course. The survey instrument uses a seven-point Likert scale with seven (7) as strongly agree/extremely satisfied and one (1) as strongly disagree/strongly dissatisfied.   The questions are arranged in four general categories: limited student demographics, overall enterprise software learning, decision-making enterprise software learning, and students' other perceptions of the course. The overall enterprise software learning focuses on the individual transactions of SAP ECC with its implementation using the Global Bike 2.11 data. The decision-making software learning focuses on the ERPsim manufacturing simulation within the SAP ECC software processing environment. This uses the Muesli cereal dataset. The other perceptions are open-ended responses for student comments. All 44 students in the course completed the survey. The results of the survey are presented in the next section.

Course assessment is appraised based on four category evaluation dimensions (Figure 5). These are described as follows:
1. **Business integration** is the learning related to the interactions among various business functional areas that include marketing, production, accounting, finance, and management that are included in the SAP ECC software.
2. **Business transactions** is the learning associated SAP ECC transaction sets for the various business functions which is the lowest level of the SAP ECC software.
3. **Teamwork** is the effectiveness of collaborating in teams to complete course activities.
4. **Student satisfaction** is the student perception of how well they liked the overall SAP ECC experience including the ERPsim simulation.
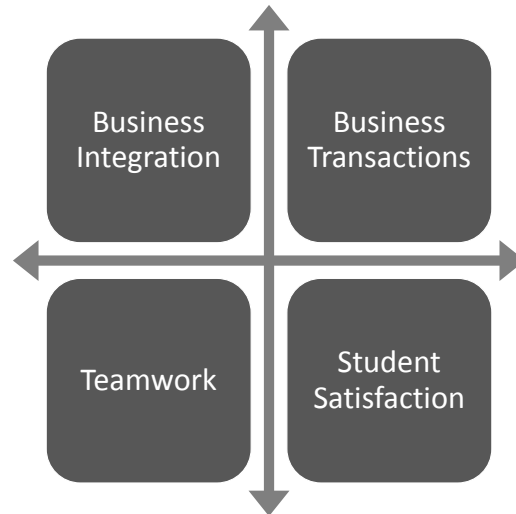
Figure 5. Category Evaluation Dimensions

A survey with 28 questions was administered to the SAP ECC introduction class in Shanghai, China. Although the 44 students were enrolled in a Chinese university, their English proficiency was sufficient to attend this class which was delivered in English and also to respond to this survey. Although the questionnaire had 28 questions, several questions collected demographic data while others were open-ended responses. Those questions asked for suggestions to improve the class and the optimal size of a team. To respond to the questions, the participants were asked to use a 7-point Likert-scale with seven (7) indicating "extremely satisfied" or "strongly agree." A four (4) indicates "don't know/no opinion" and one (1) "extremely dissatisfied" or "strongly disagree."   However, several questions in the survey were reverse coded, which is typically done when surveying students in the US. In this research, it appears the Chinese students are not familiar with this coding of questions. That confounded the results for those questions, so they were eliminated from the evaluation. Table 1 lists the key usable questions in the survey. Also, questions on the demographic data and open-ended responses are excluded. The remaining set of questions is one where there is not a continuous item numbering of the usable questions.

Table 1. SAP ECC Course Assessment Key Questions

Question number (Item)	Questions	Category
3	SAP ERP helped me better understand the integration of the concepts and ideas of the functional areas of business from marketing, finance and management.	Business Integration
4	The SAP ERPsim simulations helped me better understand the relationships of business decision making among accounting, marketing, finance, and management.	Business Integration
5	The SAP ERPsim simulations helped me better understand the issues, concepts, and ideas of data-driven decision making that takes place in business enterprises.	Business Integration
7	Which of the following best describes your overall level of satisfaction with the SAP ERPsim simulations used in the SAP ERP course in understanding integrated business processes?	Student Satisfaction
8	Which of the following best describes your overall level of satisfaction with the number of SAP ECC assignments in the SAP ERP course?	Student Satisfaction
9	Which of the following best describes your overall level of satisfaction with the enterprise software content in the SAP ERP course?	Student Satisfaction
10	The SAP ECC software assignments helped me better understand the issues, concepts, and ideas of transaction processing that takes place in enterprise software.	Business Transactions
12	The SAP ECC software assignments helped me better understand how integrated business transaction processing works to support the actions resulting from business decision making.	Business Transactions
13	Which of the following best describes your overall level of satisfaction with the SAP ECC software assignments used in the SAP ERP course in understanding integrated business processes?	Student Satisfaction
14	Which of the following best describes your overall level of satisfaction with the SAP ERP in learning about the integration of business transaction processing with business decision making?	Student Satisfaction
15	Which of the following best describes your overall level of satisfaction with the depth of learning regarding the SAP ECC system and enterprise software in the SAP ERP course?	Student Satisfaction

Table 1. SAP ECC Course Assessment Key Questions (continued)

Question number (Item)	Questions	Category
16	Overall, the SAP ECC software and ERPsim assignments helped me to better understand integrated business processes and data-driven business decision making.	Business Integration
17	Working in teams in the SAP ERP course helped me improve my effectiveness as a team member in completing the team assignments in other courses.	Teamwork
18	Overall, the teamwork in all my courses helped improve my communication and other skills in working as a team solving business problems.	Teamwork
19	Our team worked together effectively on the SAP ECC assignments.	Teamwork
20	Our team worked together effectively on the SAP ERPsim simulations.	Teamwork

RESEARCH ANALYSIS

Twenty-three (52%) of the respondents were male while 21 (48%) were female (Hayen & Holmes, 2013a). This breakdown of the students in the Chinese classes is typical of the universities in China at which the authors have been teaching. (Hayen & Holmes, 2013b).

Table 2 illustrates the results of questions 3, 4 and 5 which refers to the impact of the SAP ERPsim on student learning of integration (Business Integration). For purposes of this evaluation, all the category responses for agree or satisfied are combined to provide a single view of student perceptions. All the responses to the questions 3, 4 and 5 indicated that the participants agree with these viewpoints. This strongly suggests that the students really liked using the SAP ECC enterprise software and the SAP ERPsim manufacturing simulation as a tool to learn the integration of business processes. Specifically, these business processes were from the functional areas—accounting, marketing, finance and management. These students also preferred to have activities in class that required them to work together as teams which reinforces their cultural experiences within Chinese education.

Table 2. Impact of SAP ECC on Integration Understanding

Item (Survey question number)	% Agree
SAP ECC helped me better understand the integration of the concepts and ideas of the functional areas of business from marketing, finance and management. (3)	100
The SAP ERPsim simulations helped me better understand the relationships of business decision making among accounting, marketing, finance, and management. (4)	100
The SAP ERPsim simulations helped me better understand the issues, concepts, and ideas of data-driven decision making that takes place in business enterprises. (5)	100

Table 3 indicates student satisfaction with the use of the SAP ERP enterprise software and the SAP ERPsim simulator in their SAP ECC class. More than 96% of the students reported being satisfied with the use of the SAP ERPsim simulator, the number of SAP ECC assignments and the SAP ERP enterprise software content in their course. It is obvious that the students believed that the SAP ECC enterprise software and the SAP ERPsim are appropriate as learning tools to teach enterprise concepts.

Table 3. Satisfaction with the SAP ERPsim in the SAP ERP Course

Item (Survey question number)	% Satisfied
Which of the following best describes your overall level of satisfaction with the SAP ERPsim simulations used in the SAP ERP course in understanding integrated business processes? (7)	100
Which of the following best describes your overall level of satisfaction with the number of SAP ECC assignments in the SAP ERP course? (8)	98
Which of the following best describes your overall level of satisfaction with the enterprise software content in the SAP ECC course? (9)	96

Table 4 lists the students' satisfaction with the SAP ECC software assignments. More than 98% agreed that the SAP ECC software assignments were instrumental in enhancing their understanding of the issues and concepts associated with the way transaction processing occurred in enterprise software. In the typical classroom, the instructor would have to use up plenty of class time to explain the business processes required by transactions. A similar number of students stated that the SAP ECC software assignments also enhanced their understanding of the integrated nature of business transaction processing. This highlights the fact that carefully designed assignments do help with student learning.

Table 4. Impact of SAP ECC on Student Learning

Item (Survey question number)	% Agree
The SAP ECC software assignments helped me better understand the issues, concepts, and ideas of transaction processing that takes place in enterprise software. (10)	98
The SAP ECC software assignments helped me better understand how integrated business transaction processing works to support the actions resulting from business decision making. (12)	100

Table 5 highlights student satisfaction with the use of the SAP ECC enterprise software on several fronts—the learning and depth of learning regarding the SAP ECC system and enterprise software, integrated business processes and data-driven business decision making. More than 98% of the participants were satisfied with the way the SAP ERP enterprise software and the SAP ERPsim simulator were used in the class as well as during their class time. This is an important indicator of the positive reception of the enterprise software and the simulator by the Chinese students as teaching tools. A comment from the students was "the SAP ERP 10 IM course is good for us to learn more about the integration of the concepts and ideas of the functional areas of business from marketing, finance and management." Other students' comments suggested that they learned more with the software and simulator.

Table 5. Student Satisfaction with the SAP ECC Software

Item (Survey question number)	% Satisfied
Which of the following best describes your overall level of satisfaction with the SAP ECC software assignments used in the SAP ECC course in understanding integrated business processes? (13)	98
Which of the following best describes your overall level of satisfaction with the SAP ECC in learning about the integration of business transaction processing with business decision making? (14)	100
Which of the following best describes your overall level of satisfaction with the depth of learning regarding the SAP ECC system and enterprise software in the SAP ERP course? (15)	98
Overall, the SAP ECC software and ERPsim assignments helped me to better understand integrated business processes and data-driven business decision making (16)	98
Which of the following best describes your overall level of satisfaction with the number of class hours for this course? (25)	100

Questions 17, 18, 19 and 20 (Table 6) refers to the students working in their teams. More than 95% of the students agree that working in teams helped with their learning and communication. This finding is not a surprise since Chinese students like to work in teams and prefer to help their classmates instead of just working individually. This reinforces the classroom observations of the cultural aspect of Chinese education.

Table 6. Team Outcome Measures

Item (Survey question number)	% Agree
Working in teams in the SAP ERP course helped me improve my effectiveness as a team member in completing the team assignments in other courses (17)	98
Overall, the teamwork in all my courses helped improve my communication and other skills in working as a team solving business problems (18)	100
Our team worked together effectively on the SAP ECC assignments (19)	95
Our team worked together effectively on the SAP ERPsim simulations (20)	98

When the participants were asked whether the size of the teams should be changed, 71% stated that the size is about right (Table 7). About 27% indicated that it should be increased and only 2% felt that it should be decreased. These results were supported by survey question number 22 which asked the participants for their suggestions regarding the optimal team size for the SAP ERP course. The majority of the participants indicated that their team sizes were optimal for this learning experience.

Table 7. Team Sizes

Item (Survey question number)	% It should be increased	% It is just about right	% It should be decreased
What is your opinion about the size of the teams used in this SAP ERP course (that is, the number of team members) (22)	27	71	2

Overall, students also liked the fact that these learning tools require them to work in teams more effectively and efficiently. They believe that their communications as team members also had improved. Comments from the Chinese students include "It is really an interesting course! Not only knowledge, but also team work. I enjoy this course very much." It is interesting to note that some of the Chinese students would like to learn more about the software and simulator; for example, "Learning more knowledge by SAP ERPsim simulations" and "Whether customer research can be add (sic) to simulations for this may help to make decision and plan better."

DISCUSSION
A number of lessons have been learned through this experience of course delivery in China. Key lessons learned are as follows:
1. The technology environment is not a challenge. The latency of using servers which are widely geographically dispersed does **not** result in any noticeable delays. The response appears to be the same as for servers located in close proximity to the point of the course delivery.
2. The biggest problem with the technology environment was navigating through the security arrangement for the servers located in Australia.

3. The model course organization worked extremely well as is validated by the student perceptions of the course.

4. The goal of the course for students to understand enterprise software and its use in the day-to-day operations of a business organization was achieved.

5. The goal of the course for students to understand the application and use of enterprise software in decision making across the functional business areas was achieved.

6. Chinese students readily accept the delivery of courses in English as this expands and improves their use of English, which is important in their careers.

7. Chinese students are most comfortable with working in teams as this is an extension of their earlier educational experience.

8. Reverse coded questions do **not** work well in this type of international environment as students are not familiar with them and appear to have a difficulty in making the shift from a seven (7) as the best response to a one (1) as the best response.

SUMMARY AND CONCLUSION
These results suggest that using the SAP ECC enterprise software and the SAP ERPsim simulations can enhance the learning of the integration of business processes, their related transactions, and decision making by Chinese students. Overwhelmingly, the students at USST were most satisfied with the model course organization and its delivery using the technological landscape provided to them in China.

The technological architecture and model course organization should be tested in other geographical locations to determine the efficacy of the approach on a broader global scale. Future work should examine the use of only one dataset across the entire learning model organization. This would reduce the requirement for students to shift their thinking from one type of business with its data to another type of business with different data.

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