ERP-BASED SME BUSINESS LEARNING ENVIRONMENT

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Keywords: Business Education, Business Simulation, Learning Environment, ERP, SME.

Abstract: Small and medium size enterprises are an important and growing part of the economy. They lack an adequately skilled workforce. Higher education is claimed to provide students with theoretical knowledge rather than skills. Enterprise resource systems, business simulation games and the practice enterprise model are all practical, experiential learning environments. Each of them solves different learning challenges but does not provide a comprehensive learning environment. This paper presents a simulated learning environment that merges the three environments together, allowing students to learn the daily operations of SMEs in a practice-focused manner. In addition, the instructor can create learning situations appropriate for the learning objectives at hand. The paper describes experiences of the first pilot from both the student and the teacher perspective. An initial evaluation shows positive learning outcomes on the long-term memorizing of declarative knowledge among the low and average students.

1 INTRODUCTION

Small and mid-size enterprises (SMEs) are an important and a growing part of the economy. They need skilled employees that are work-ready when they are hired (Woods and Dennis 2009). Higher education is claimed to produce graduates who have good theoretical knowledge but lack practical skills (Martin and Chapman 2006, Holden, Jameson and Walmsley 2007). Regardless of the long term efforts to bring education closer to the business, there still seems to be a gap between the skills of the business graduates and the requirements of business life (Jackson 2009).

"Rich environments for active learning" are broad instructional systems that stimulate study within authentic contexts and create a feeling of knowledge building communities (Grabinger and Dunlap 1995). They utilize interdisciplinary learning activities with realistic tasks.

This paper presents an active learning environment that supports the learning of the skills needed in SMEs. It is based on experimental learning theory that views learning as a continuous and iterative cycle of concrete experience, reflection, conceptualization and testing the concepts in new situations (Kolb 1984).

Enterprise resource planning (ERP) systems are used for acquiring the practical experience (Targowski and Tarn 2006). Business simulation games are also experiential learning environments (Lainema 2009). Another, less IT-focused learning environment is the practice enterprise model, which aims at teaching entrepreneurship skills through a business-to-business network where student teams run simulated SME companies (Kallio-Gerlander & Collan, 2007).

These learning environments are used to accomplish different business learning objectives (Nisula and Pekkola 2011). ERP systems focus on IT skills and business process understanding (Jaeger, Rudra, Aitken, Chang and Helgheim 2011) whereas business simulation games focus on strategy and decision-making (Faria, Hutchinson, Wellington and Gold 2009). The practice enterprise model emphasizes entrepreneurship, teamwork and communication (Kallio-Gerlander and Collan 2007).

This paper argues that the learning environments should be combined into one to promote all skills at the same time. The paper presents the new combined SME business learning environment, and reports an initial evaluation of its success.

2 SME BUSINESS LEARNING ENVIRONMENT

ERP systems give a good technical environment for

Nisula K..
ERP-BASED SME BUSINESS LEARNING ENVIRONMENT.
DOI: 10.5220/0003893202330238
In *Proceedings of the 4th International Conference on Computer Supported Education* (CSEDU-2012), pages 233-238
ISBN: 978-989-8565-07-5

hands-on learning of different disciplines and business IT-systems. They illustrate the integration between different business processes in practice. On their own, however, their pedagogical benefits are limited (Seethamraju 2011). They remain only a tool and need a case study to work on (Markulis, Howe and Strang 2005).

Business simulation games contain a dynamic and interactive case. They are widely used for learning active decision-making and teamwork (Faria et al. 2009). They typically focus on top management strategic decision-making or a specific business operation. They lack the SME perspective and a view of day-to-day operations. Many business simulation games utilize the ERP mindset or ERP-like system and some are even built on a commercial ERP system (Léger 2006, Ben-Zvi 2007). The challenge of business simulation games, however, lies in modelling the real life situations without oversimplifying them (Hofstede 2010, Goosen, Jensen and Wells 2001).

In the practice enterprise model, the students work in a virtual SME company without actual transfer of goods or money. Unlike business simulation games, the practice enterprise model does not have pre-planned scenarios or contain an element of competition. The business environment is provided by an administrator who acts as the authorities, the bank, the insurance company, etc. The students trade with other similar student-run enterprises (Kallio-Gerlander and Collan 2007). The aim is to form customer-supplier-relationships, negotiate agreements and market to other virtual companies run by students.

The practice enterprise model lacks extensive raw material and consumer markets. The learning situations arise mostly from the student company cooperation. The practice enterprise model is strong on practical day-to-day SME operations and interaction between real people. But as there is no consumer market to create the initial demand, the trade between student enterprises soon becomes artificial (Santos 2006, Miettinen and Peisa 2002).

Jackson (2009) and Fernald, Solomon, & Bradley (1999) have investigated industry-relevant business competencies. Nisula and Pekkola (2011) compared their findings with the learning goals of the three experiential learning environments to find that an optimal learning environment combines features and benefits of all three.

3 SYSTEM OVERVIEW

The core of the SME business learning environment is an open source ERP system Pupesoft used by commercial SME companies (Devlab Oy). There are three layers in the environment: The external layer is visible to the general public. The internal layer contains the activities inside each company and it is run in the ERP system. The system layer contains the data traffic caused by transactions between the companies.

3.1 External Layer

The external layer of the learning environment is built with web-pages. It is a fictitious market area with providers of basic infrastructure: real estate, electricity, telephones, insurance, transportation and health services. The raw market consists of wholesalers with a wide product offering. The students start and run their companies in this environment.

The media of the market area is a web publication that contains imaginary local news as well as real-life external news. A virtual online banking provides financing. The learning environment's tax authorities are accessed with an electronic tax account which is a replica of the official Finnish electronic tax account (Finnish tax administration 2009).

3.2 Internal Layer

All companies run their internal operations in the Pupesoft ERP system. The system structure is illustrated in figure 1. The ERP systems of the various student companies, support companies, bank and the tax officials appear separate to the end users, but they reside in the same database. Access is managed with user rights and profiles.

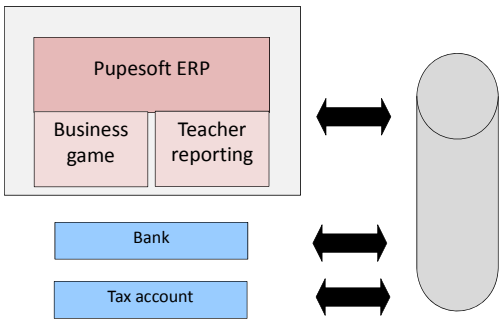

Figure 1: The learning environment database structure.

3.2.1 User Roles and Profiles

There are three user roles in the database: student, teacher and administrator. The profiles assigned to

these roles define which activities are available to each user.

The student profile is adjusted to the students' skills and learning goals. The profile grows as the student's learning increases.

The teacher profile enables monitoring the students' learning process through standard ERP reports and user statistics.

The administrator sets up the companies and the user accounts, sets the ERP parameters and acts as a help desk on technical problems. In addition, he/she runs the learning environment acting as the banker and managing the support companies. He/she communicates through different e-mail aliases to create the illusion of communicating with several companies.

3.2.2 The Business Game Element

The business game element is administered in the ERP system. It e-mails automated consumer purchase orders to the student companies. The frequency and intensity of the purchase orders can be adjusted to emulate the market fluctuations of the consumer market.

The business game element produces two types of purchase orders: Random orders are created regardless of the student company's business performance. The amount of work and profit are equal in all student companies. Routine orders are related to how professionally the student company is running its business operations. A well performing student company gets financially more valuable orders than another company with a lower performance.

3.3 System Layer

The system layer transfers financial data between ERP and bank systems. The data transfer creates a closed ecosystem with double-entry book-keeping. Every external transaction is recorded in two companies. This provides the basis for the business game indicators as it populates the companies' ERP systems with income and cost data. It also enables the administrator and the facilitating teachers to stay up-to-date on the student companies' activities. The facilitating teachers get company reports based on transactional data rather than the students' interpretation of the situation.

4 EVALUATION

The first version of the learning environment was piloted in the Tampere University of Applied Sciences (TAMK) School of business and services in 2010-2011. Before this pilot, the practice enterprise model had been in use since 2005. The pilot was run with 170 business students in 17 simulated companies. 12 teams were first-year BBA students and five teams were second-year BBA students. The student teams started a simulated business-to-business company and operated it for a year. In addition to their other business studies they worked 4-8 hours a week in their companies. The curriculum integrated disciplinary lectures into the student company life cycle. The teams had supervising teachers who coached and mentored them in the learning environment.

The learning process was based on Kolb's experiential learning model. The student companies were divided into three departments of 3-4 students: marketing, logistics and accounting. Each student worked in a department for a period of time to gain practical experience and reflect on that. They also followed lectures, which helped them to conceptualize their experiences. At the end of each period, the department roles rotated. The students taught each other the tasks of their new departments. They were able to test their skills in new situations, which, again, completed Kolb's learning cycle. Each student worked in all the departments during the academic year. This gave them a full overview of a company's business processes (Nisula and Pekkola 2011).

The pilot was evaluated through the learning outcomes as well as student and teacher feedback. The evaluation was done with two groups of first year students, each containing 117 students. The first group, class of 2009, used the practice enterprise model. The second group, class of 2010, used the SME business simulation.

The learning outcome was evaluated through the acquisition of declarative, disciplinary knowledge. It was measured with open-end and multiple-choice questions. The evaluation had three phases: a pre-understanding, a mid-term and an end test. The end test was given 3 months after the end of the academic year in order to measure longer term learning effects.

Feedback from the students and the teachers was collected through web questionnaires at mid-term. The teachers also had a face-to-face feedback session in the end of the academic year.

4.1 Effects on Learning

Both the practice enterprise group and the simulation

group gained similar average scores in the pre-understanding test (62%) and the mid-term test (70-71%). In the long-term efforts the simulation group scored slightly higher with 62% against the 58% of the previous practice enterprise model group.
When looking at the distributions of the scores, however, some more distinctive results can be found. Figure 2 shows the score distribution for the pre-understanding test in the beginning. On both groups the score distribution follows approximately the same bell shaped curve.

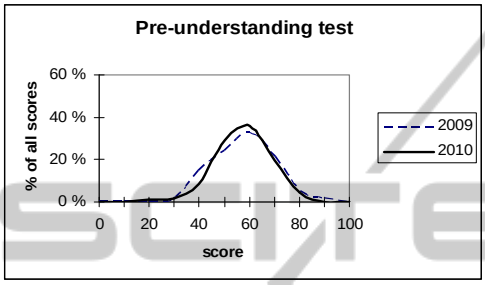

Figure 2: Score distribution on the pre-understanding test.

Figure 3 shows that at mid-year the same trend continues. The practice enterprise group has a slightly wider range of scores in both highs and lows whereas the simulation groups' scores were more focused on the average 60-70% range.

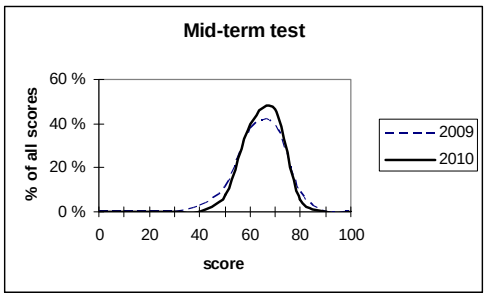

Figure 3: Score distribution on the mid-term test.

In the figure 4, at the year end, there is a difference between the groups. The curves are identical in the high scores, but the low and average scores are better in the simulation group. This seems to indicate that the high performers score well regardless of the learning environment where as the low and average performers benefit from the simulation environment.

This evaluation shows some promising signs of improvements in the long term memorizing of the low and average performing students. However, alone it does not provide enough evidence to show the SME business simulation's superiority to the practice enterprise model.

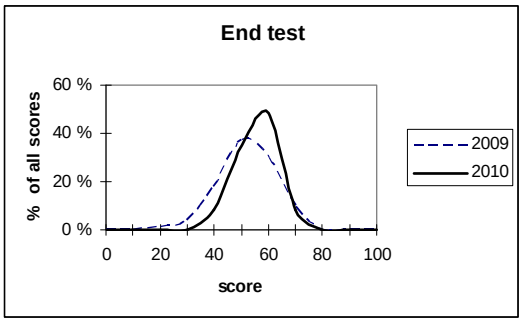

Figure 4: Score distribution on the year-end test.

This evaluation was restricted to the learning goals of the disciplinary expertise which is just one learning objective among many. A study on the efforts on other learning objectives is an interesting area for further research.

4.2 Student Feedback

At mid-term the students were given a web-questionnaire with a set of statements as well as some open end questions. There were 101 responses.

The best average scores on a Likert-type scale (1=strongly disagree, 5= strongly agree) were on applying theory to practice and making studying versatile (4,1). Integration between the simulation environment and the curriculum also scored well (3,8). Moreover, students appreciated the simulation in creating the big picture of the business processes (3,8). The poorest scores were on the motivational aspect (3,2) and the uneven distribution of workload (2,8). The uneven work load is a typical challenge in a team-oriented learning method.

In the open-end questions the most frequently mentioned positive sides reflect Kolb's learning cycle: practical, hands-on approach, combining theory with practice and versatility, variation and change to traditional studying methods. Also, team work was seen as a positive factor. Critical feedback focused mostly on the uneven distribution of work load, simplification vs. reality, technical problems and communication challenges.

4.3 Teacher Feedback

The supervising teachers' feedback reflected the students' reaction. According to the teachers the students had learned to use the systems quickly. On the other hand, this learning environment seemed to require more intensive coaching and guiding.

The teachers felt more uneasy with the IT orientation than the students. They also found the

new environment challenging because it required a lot of general business and IT knowledge. Most of them, however, found it motivating to learn new things together with the students. They appreciated the increased opportunities to combine theory with practice by using examples of the learning environment in their lectures. The increased visibility to the student teams' activities was also mentioned as a benefit.

5 RELATED SYSTEMS

ERP systems have been used as a teaching tool for approximately 10 years (Targowski and Tarn 2006). ERP systems can provide a nerve system to integrate different disciplines and remove redundancies between them (Joseph, George 2002). Yet ERP systems remain mechanical tools for training rather than a comprehensive environment for deep learning (Seethamraju 2011).

Business simulation games are widely used in strategic management courses (Faria et al. 2009). INDUSTRYPLAYER (Faria et al. 2009) is a global online multiplayer game. INTOPIA (Thorelli 2001) focuses on international business. MICROMATIC simulates a small manufacturing company (Washbush and Gosen 2001) whereas CYCLOAN runs a branch office of a service company (Scherpereel 2005). These are only a few examples of the wide range of business simulation games.

RealGame is an example that contains some ERP-like functionality even though it is not based on a commercial ERP system (Lainema and Makkonen 2003). ERPSim is a combination of the SAP environment and simulated events caused by student teams' business decisions (Léger 2006).

An ERP-based business simulation game is a good learning environment for diverse simulations that resemble running real-life operations. However, the business simulation games tend to focus on the top management decision making or a specific functional area. They are not optimal in learning the day-to-day SME operations.

6 CONCLUSIONS AND FUTURE RESEARCH

The main difference between the new SME learning environment and the related systems is twofold: First, the new SME learning environment excels the related systems because it combines their specialized features for an improved result. Second, it is a flexible, comprehensive environment where the instructor can choose how to incorporate it into learning.

The learners become active participants in the learning process. They repeat Kolb's learning cycle several times and have opportunities to reflect their experiences. In addition to simple task delivery, the learners face unexpected, instructor created problems that do not always have simple solutions.

The first evaluation on the learning results indicates improvements in the long-term memorizing of disciplinary declarative knowledge. It is particularly interesting that the improvements were found amongst the low and average scoring students. However, more research is needed to study the learning outcomes on other business skills.

Based on the feedback the new learning environment appears to be a motivating environment to students and teachers alike. The learning environment requires the teachers to expand to outside their comfort zone both professionally and mentally. A deeper research into the effects on the teachers' work would be of interest.

The learning environment is still only a tool for teaching and learning. The teachers and students give it meaning. It is crucial that it is integrated into other teaching and the whole curriculum. Curriculum integration of the learning environment is another interesting topic for future research.

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