

Business Skills Laboratory in Action: Combining a Practice Enterprise Model and an ERP-Simulation to a Comprehensive Business Learning Environment

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Abstract—Business education has been criticized for being too theoretical and distant from business life. Different types of experiential learning environments ranging from manual role-play to computer simulations and enterprise resource planning (ERP) systems have been used to introduce the realistic and practical experience into business learning. Each of these learning environments approaches business learning from a different perspective. The implementations tend to be individual exercises supplementing the traditional courses. We suggest combining them into a business skills laboratory resembling an actual workplace. In this paper, we present a concrete implementation of an ERP-supported business learning environment that is used throughout the first year undergraduate business curriculum. We validate the implementation by evaluating the learning outcomes through the different domains of Bloom's taxonomy. We use the role-play oriented practice enterprise model as a comparison group. Our findings indicate that using the ERP simulation improves the poor and average students' lower-level cognitive learning. On the affective domain, the ERP-simulation appears to enhance motivation to learn as well as perceived acquisition of practical hands-on skills.

Keywords—Business simulations, experiential learning, ERP systems, learning environments

INTRODUCTION

FOR several decades, business education has been the target of criticism for becoming too theoretical and distant from the realities of business life e.g. [1]-[4]. Learning business management is much more complex than acquiring a set of theories or individual learning topics [5]. In addition to disciplinary and interdisciplinary understanding, modern employees are assumed to have a wide range of skills, ranging from critical thinking and creativity to organizational and interpersonal skills. Usually these competencies are best acquired through on-job-experience. Yet young managers are expected to possess these skills as soon as they enter an organization [6].

Universities are the hatcheries where the school-oriented students should become knowledgeable, active and competent contributors to work life [7]. This transformation process is challenging in the traditional learning environments where the students are passive recipients of information. There is an increasing need for a large practice component that resembles the activities in the work life [3]. Practical experience can be gained in learning environments that follow Kolb's theory of

experiential learning - a continuous and iterative cycle of concrete experience, reflection, conceptualization and testing the concepts in new situations [8].

Experiential learning activities have been tested and used in business education in a variety of ways, such as case studies and exercises, hands-on laboratory activities, student teamwork projects, and capstone courses [9], [10]. The learning environments vary from classrooms and laboratories to technology driven learning environments such as simulations and games [9].

A challenge with the experiential learning activities is that they tend to be individual, isolated exercises supplementing traditional courses [11]. They lack the feeling of an actual workplace where practical work is a continuous process.

One suggested solution is to borrow the clinical laboratory model from nursing education in the form of a business skills laboratory (BSL) where students work in physical office spaces operated with fictitious businesses, making day-to-day business decisions [11]. The student teams face varying situations created for example with a business simulation, making use of the topics that they have internalized elsewhere in their studies. The key difference between the BSL concept and the earlier experiential business learning environments is that instead of supplementing the traditional courses, it is the foundation on which all the learning experiences are connected to.

Practice enterprise model is a manual simulation for students to run virtual companies without real monetary transactions or physical products [12]. It resembles the BSL, but it lacks the momentum of the computerized simulation that a BSL is suggested to contain [11].

ERP systems are large software packages used by companies to support transaction-oriented business processes. They are also used as experiential learning environments in business education, e.g. [13]-[15]. ERP systems provide realistic hands-on tools, but alone they lack the business context and the interaction with people that the practice enterprise model contains.

The aim of this paper is to validate the BSL concept by presenting a practical implementation of an ERP-supported business learning environment where role-playing takes place in a simulated business environment and an ERP system is the tool for the day-to-day business transactions. We present a case where this learning environment was used throughout the 1st year business undergraduate curriculum as the combining element for all the learning experiences. Bloom's taxonomy is

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used to evaluate the learning outcomes and compare them with the earlier practice enterprise model.

The paper is structured as follows. First, we present related research on experiential business learning environments: the practice enterprise model, the ERP systems and the business simulations. We then introduce our case that compares the manual practical enterprise model with an ERP-supported business learning environment. Next, we review the learning outcomes in both environments. We conclude with discussion, limitations, contributions, and suggestions for further research.

RELATED RESEARCH

We view the learning outcomes through Bloom's taxonomy, a generic classification of learning objectives [16], which widely used for example in assessing business simulations [17]. The learning objectives are classified into three domains: cognitive, affective and psychomotor domain. Cognitive domain refers to knowledge and comprehension, affective domain describes attitudes, emotions and feelings, and psychomotor domain considers skills. These domains are subdivided into different levels of learning. Cognitive learning begins with remembering, and continues through understanding, applying, analyzing and evaluating to creating [18]. Affective learning ranges from receiving phenomena, responding, valuing and organizing to characterizing [19]. Psychomotor domain starts from perception and continues through set, guided response, mechanism and complex overt response to adaptation [20]. We will use Bloom's taxonomy as a framework to evaluate the learning outcomes of the business learning environment.

Learning is a collaborative process to which the learners bring their own needs and experiences. Instead of attempting to transfer knowledge from teachers to students, learners need to be put in the center of their learning experience in rich complex learning situations where they take an active role in the construction of new understanding [21]. We will next review earlier research on experiential business learning environments.

A. Business Skills Laboratory

Clinical laboratories are among the major reasons why nursing education is able to produce graduates with practical skills [11]. Benchmarking to nursing, a BSL is a combination of physical office space and a business context that is provided for example by a computerized simulation [11]. The simulation can be a commercially available one or specifically developed for BSL. The students work in fictitious companies and are observed and advised by teachers. It incorporates face-to-face role-playing with simulated business scenarios. Ideally, there would be specifically designed business situations that are well aligned with the curriculum and supplemented with appropriate learning materials. The students learn hands-on work by doing day-to-day activities and solving different crisis scenarios or ethical dilemmas. In other words, they learn daily business life. This type of a learning environment provides learning experiences that expose students to integrated business operations and

processes. It creates a context for classroom topics, and moves the students from knowledge to applying comprehended knowledge. It also enforces curriculum designers to keep it relevant and current, as the learning environment should reflect the changes in the actual business life. In addition, the learning environment breaks the boundaries of disciplinary structures and creates an integrated learning experience [11].

B. The Practice Enterprise Model

The practice enterprise model is an example of the role-play-oriented learning environment. It is also known as practice firm, training firm, virtual enterprise, or virtual business [22]. It is a non-computer-assisted simulation, similar to the role-play part of the BSL. A practice enterprise is a student-run virtual company that resembles a real one in its form, organization, and function but without monetary transactions or the exchange of physical products. The practice enterprise trades with other practice enterprises and manages its internal activities and processes [23]-[25]. In several countries, there are central practice enterprise offices playing the role of the bank, the tax office and the external service providers. The practice enterprise model aims at business and entrepreneurship learning through interactions between real people [12], [26], [27].

The research on the practice enterprise model has focused on attitudes and perceived learning by using surveys, focus groups and interviews [28], [27], [32]-[35]. The practice enterprise model appears to have positive effects on the affective learning on teamwork, communication and motivation as well as the use of office information technology, but cognitive, disciplinary oriented learning on business domains and their integration leaves room for improvement [36], [37]. There are indications that low performing students benefit the most from the practice enterprise activity [35], [38].

Despite its' many benefits, the practice enterprise model is criticized for artificiality and being too static [27]-[29]. It is missing the context, or the "story" of the business environment. It does not contain business scenarios. The market situation is distorted because it depends on what kinds of practice enterprises other students have set up. The majority of practice enterprises are retail companies and they don't always have customer companies to sell to, or some may be in a monopoly situation [29]. The practice enterprise also lacks hands-on tools that modern companies use in their day-to-day operations [30]. The practice enterprise model should be developed to better utilize information technology [31] and increase the level of activities [28].

C. Business Simulations

Business simulations can be defined as an exercise in an artificial environment – a case study where the participants are inside [50]. They consist of open-ended, changing situations that have many dependable variables. Business simulations can be divided in four categories [39]: Micro-world simulations represent functional business areas and take place within one or only a few companies. Macroworld simulations

tackle complex systematic problems with horizontal learning across industry and deal with the entire organization and competing companies. Interpersonal skill simulations focus on specific training needs, learning taking place in interpersonal scenarios. Business acumen simulations aim at skill development on strategy formulation, product development, financial management and running competitive operations.

From Bloom's taxonomy perspective, cognitive learning has been the subject of most studies on business simulations [17]. They have shown to improve learning particularly on lower cognitive levels whereas objective support for higher level cognitive learning has not been found [17]. For example, Fowler compared two groups and their group learning, one using a simulation, and the other without it, just having traditional lectures [43]. Her comparison revealed that the simulation group learned better at low-level cognitive levels while at higher cognitive levels, the results were similar to both groups. Washbush and Gosen used pre- and post-tests with multiple-choice questionnaires and short essays in 10 data sets over six years [44]. They found clear evidence that cognitive learning occurs as a consequence of participating in a simulation exercise, but no evidence to support that performance in the simulation correlates with learning. Palmunen et al. found that the business simulation contributes to novice business students' cognitive learning by enhancing their comprehension of complex, indirect, and sequential dependencies between different business functions [45].

The results on the affective learning have been predominantly positive throughout the business simulation research [39], [17]. Studies have increased motivation, improved problem solving and analytical skills, transferred knowledge to real business situations, improved decision making and cross-functional skills, increased retention of knowledge and learning ability; and activity to engage in situations [39].

Research on psychomotor or skill-based learning has focused on the progression in the simulation performance, not the business task performance. Several studies indicate improvement between the beginning and the end of the simulations [46]-[48]. Pasin and Giroux analyzed mistakes during an operations management simulation and detected that the simulation provided significant help to those who did not master all the areas from the lectures [49]. Thavikulwat studied behavioral learning by analyzing the development of the company life cycles in the simulation [50]. He found that the more company life cycles the student completed, the faster the life cycles became, indicating a positive learning curve.

Even if the learning results have mostly been positive, the business simulations also have their shortcomings. One challenge is their particular focus [39]. They concentrate on a specific area of business management rather than tie the different areas together. They often tend to be overly simplified models of reality containing pre-planned scenarios [40]. They simplify the management of time to business episodes [41]. Business simulations are also often used as stand-alone or supplements to capstone or strategic courses towards the end of the studies [42], instead of being the

combining element for all studies suggested in BSL [11].

D. ERP Systems and Simulations

ERP systems are used in teaching business operations, such as supply chain management, marketing, HR, accounting, and information systems [39], [51]-[57]. The main learning objectives are business process orientation, ERP system skills, and understanding of business functions and their integration [54], [58].

ERP systems typically focus on internal operations, systems, and processing [58]. Learning situations tend to be static pre-planned cases and exercises [59]. ERP-simulations, on the other hand, use the ERP system as the student interface into scenarios, mediated by a simulation. An example of such business simulation game is ERPSim, where students operate a full business cycle in a manufacturing company [60]-[62]. The ERPSim game has been used for a short period of time as a supplement to other studies.

Research on ERP systems has emphasized cognitive and affective learning. Monk and Lycett compared three student groups' cognitive learning on a business process domain [15]. Throughout the learning process, one group had hands-on exercises in an ERP system and two groups had not. For assessment purposes, the students completed a round of the ERPSim game in the beginning and the end of the courses. Improvements in the game scores indicate that poorer students benefited from the ERP exercises. In a similar manner, Noguera and Watson found a significant difference between two groups; one using ERP system and the control group without it [63].

Several studies using self-assessments have found indicative improvement in perceived learning [58], [64], but the objectivity of the self-assessed measures has often been questioned [15], [17]. On the other hand, significant correlation was found in the objective and subjective cognitive learning results from the ERPSim game, suggesting that even the subjective measurements do provide accurate perceptions of learning on the cognitive domain [60]. Positive affective learning outcomes, including increased motivation, attendance, and engagement, have been found both in ERP system environments and ERP-based simulation environments [58], [65]. Similar results have been found on the ERP-simulation game [60], [62], [66].

Positive learning outcomes have been found in all these learning environments, but each of them also has deficiencies. The practice enterprise model provides a flexible, people oriented business laboratory, but it lacks action and real life tools. An ERP system can be the tool but it requires the action. A business simulation can bring the action and momentum. Their combination can form a BSL that connects all learning experiences, but it needs to be used throughout the studies rather than as an isolated course or exercise.

THE CASE

We now present a practical example of a BSL that was used comprehensively throughout a whole year. The ERP-supported business learning environment was developed for

the Tampere University of Applied Sciences (TAMK) School of business and services first year undergraduate curriculum as the successor for the earlier practice enterprise model.

In 2005, TAMK implemented an experiential, team-oriented business curriculum which was divided into four consecutive modules. The modules reflected the life-cycle of a startup company: 1. Setting up a business enterprise, 2. Running the business enterprise, 3. The profitable business enterprise, and 4. Developing the business enterprise. Each module contained studies from different business disciplines related to its theme. In addition, a full year module, “the skills and competencies for working life” was integrated to the disciplinary modules.

In the beginning of the studies, the students were divided into teams of 10, each having their own “company office” with computers and a mobile phone. Six supervising teachers, or coaches, each guided two teams and acted as consultants to the other teams, representing different areas of expertise – business law, marketing, accounting, finance, logistics, and management. The coaches provided a lot of the disciplinary teaching as well as planned each module and its implementation with other teachers. They also held weekly meetings to keep each other updated and to plan the upcoming activities.

The curriculum contained lectures, group work, reports and exams, but the core tying all of them together was a simulated learning environment where the student teams operated a business-to-business company. The students worked 4-8 hours a week in their simulated companies throughout the year. The simulated companies and their life-cycles followed the curriculum and were synchronized with lectures and exercises to create a comprehensive learning experience. For example, when the companies were starting their business, there were lectures on budgeting and financing start-ups. This curriculum utilized the practice enterprise model until 2010 when it was replaced by the ERP-supported business learning environment. To assess whether the ERP-simulated business learning environment was an improvement to the previous practice enterprise model, we now compare the learning results between the practice enterprise model (the PE group) and the ERP-supported business learning environment (the ERP group). Both groups had the same curriculum and approximately 70% of the teachers were the same. The other learning methods remained the same in both years.

E. The Practice Enterprise Model

The PE group used the practice enterprise model that was administered by the national practice enterprise center. The simulated student companies traded with other student companies and with the administrator-run companies. The practice enterprise model had an online bank, but the rest of the business transactions were handled manually and with office automation tools. There was neither a “story” of the business environment nor any business scenarios. Instead, the occasional activities were presented through e-mails from the national practice enterprise center administrator. The transactions with the government authorities were also

handled as e-mails with the national administrator. The environment suffered from artificiality, lack of action and hands-on tools.

F. ERP-Supported Business Learning Environment

In 2010, the practice enterprise model was converted into an ERP-supported business learning environment. It utilized an open source ERP system to support the network of the student teams. Additionally, a customized web-based application was developed to handle input, output and the banking function.

In contrast to the practice enterprise model, the simulation took place in a fictional city, presented in the form of a web-site. There were city facts and links to basic infrastructure providers: real estate, electricity, telephones, insurance, transportation, and health services. The raw market consisted of a set of wholesalers, each having a web-store. A virtual banking system provided financial services. The tax authorities were accessed with an electronic tax account. A web publication represented the media and contained both in-system local news and external news from RSS-feeds. The environment was managed with a combination of simulation-generated transactions and activities managed by a systems administrator at the institution. The goal was to create an illusion of operating with actual people and with realistic resources.

Similarly to the practice enterprise model, the student companies traded with each other and with the administrator-run companies. They managed their finances in an online bank and their internal operations in the ERP system. As an improvement, the coach was able to monitor the students’ activities and business success through the ERP system tools. The simulation created a momentum by generating consumer demand. In an ideal situation, automated consumer demand from the simulation launched sequences of events in the student companies’ value chain. For example, a simulation-generated a request of printed t-shirts made the printing company order t-shirts from a retailer, which, in turn, needed to buy the shirts from a clothing factory, which purchased the material from a textile factory. These kinds of chains of business operations enabled the learners to repeat routine operations, consequently training their psychomotor skills required in business management.

EVALUATION OF THE LEARNING OUTCOMES

The cognitive learning objectives in the first year business undergraduate curriculum focused on the basic disciplinary understanding of business management: marketing, sales, logistics, finance, economics, and law. The affective learning objectives included teamwork, responsibility, commitment, critical thinking, creativity, ability to tolerate changes, cooperation skills, and acting in the organizational environment. We followed the earlier research suggestions to assess cognitive learning with objective methods and affective learning with self-reported measures. The same tests and questionnaires were presented to both groups. All the tests were answered anonymously and the students were told that the learning tests do not affect their grades.

G. Learning Outcomes in the Cognitive Domain

Lower cognitive levels, remembering and understanding, can be measured with quantitative methods, such as simple multiple-choice questions [67]. Disciplinary expertise was evaluated during three phases: at the beginning of the year, in the mid-term and at the end of the school year.

The first test aimed at evaluating the students' previous understanding. As the students had no previous business training, open-ended questions were considered more suitable than multiple-choice to evaluate the general understanding. In cooperation with coaches, we created seven questions on different business situations, ranging from starting a company to marketing, production and accounting related issues. The answers were scored based on a priori set of ideal responses.

The mid-year test contained 44 multiple-choice questions on the disciplinary topics taught during the first two modules: marketing, sales, logistics, finance, economics, and law. The respective disciplinary teachers created the questions on their area of responsibility based on the learning objectives of the modules. The online test was carried out in a classroom simultaneously to all the students to avoid information passing between the students. The students had not gotten prior information about the test so they had not been able to prepare for it. Even if the scores did not affect their grade, the students were encouraged to use it as a self-test as they were able to see their score immediately after completing it.

The year-end test was created in the similar manner. Again it was a web-test containing 44 multiple-choice questions covering the contents of the third and fourth module. It was not given immediately after the school year, but at the beginning of the next semester in August to measure long-term learning effects rather than short-term memorizing. The number of respondents decreased from the original 117 students to 73 (PE group) and 60 (ERP group) because of transfers to other universities.

The distributions of the test scores provide some interesting results. Fig. 1 displays the score distributions from the pre-test at the beginning of the year, i.e., before the students were given any education. The score distribution is approximately the same for both groups.

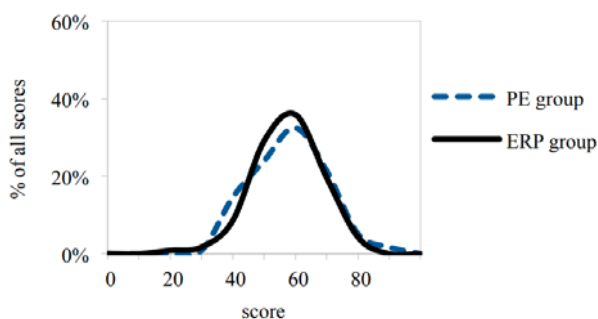


Fig. 1 Score distributions in the pre-understanding test

The same trend can be observed in the mid-year test, shown in Fig. 2. The PE group had a slightly broader spectrum at both ends, whereas the ERP group had scores that were more focused on the average 60-70% range. However, there are no

remarkable differences between the groups.

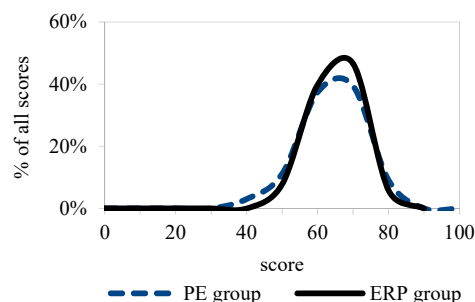


Fig. 2 Score distributions in the mid-term test

At the beginning of the second school year, some differences between the groups emerged (Fig. 3). The curves are identical at the higher end of the distribution, while low and average scores are significantly improved in the ERP group. This pattern indicates that better students perform well regardless of the learning environment, whereas lower and average performers seem to benefit from the ERP-simulation. This also suggests some improvements in the long-term learning. This concurs with earlier research indicating the ERP systems and simulations benefit the lower performers [15], [49].

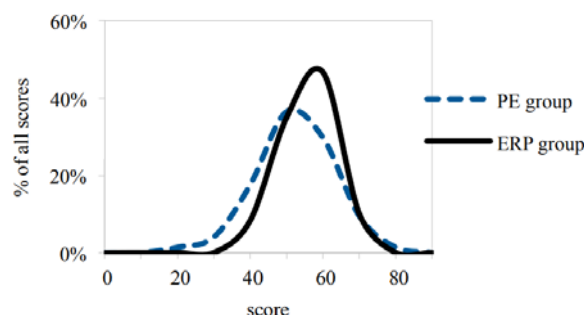


Fig. 3 Score distributions in the year-end test

H. Learning Outcomes of the Affective Domain

The affective domain was measured with a web questionnaire. The students were asked for feedback on the learning environment in conjunction with the mid-term learning test, teamwork, responsibility, commitment, critical thinking, creativity, ability to tolerate changes, cooperation skills, and acting in the organizational environment. They were presented with arguments and asked to evaluate them on a Likert-type scale 1-5 (1=strongly disagree, 5= strongly agree). The average scores are presented in Table I.

The results in both years were quite similar. The best scores were on applying theory to practice and making studying versatile. This provides encouraging evidence to the practical nature of both learning environments. Integration between the learning environment and the curriculum also scored well. Moreover, the students appreciated the learning environment in creating the big picture of the business processes. However, there is no significant different between the practice enterprise

group and the ERP-supported business learning environment group.

TABLE I
STUDENT EVALUATIONS ON THE LEARNING ENVIRONMENT

Argument	Average score (1-5)	
	PE group (n=100)	ERP group (n=101)
The learning environment makes studying versatile.	4.2	4.1
The learning environment enables applying theory to practice.	4.1	4.0
The learning environment is well integrated to the rest of the curriculum.	3.9	3.8
The learning environment helps understanding the big picture.	3.8	3.8
It is motivating to run the student company.	3.6	3.2
Work is distributed evenly between the student team members.	2.5	2.8

In the questionnaire, the students had to answer two open-end questions:

- What works well/what are the positive sides in the simulation?
- What does not work well/what are the negative sides in the simulation?

TABLE II
STUDENT FEEDBACK ON THE LEARNING ENVIRONMENT

Discussed topics	number of times mentioned	
	PE group (n=100)	ERP group (n=101)
1. What works well?		
practical hands-on approach	27	55
team work	42	49
combining theory with practice	34	31
connections to real work life	20	20
versatility, variation and change to traditional studying methods	12	16
2. What does not work well?		
uneven distribution of work load, free riders	28	30
technical problems	29	23
difficulty to draw the line between the simulation and real life	16	20
scheduling challenges between the simulation and substance teaching	14	17
problem-based learning orientation	15	16
lack of instructions from teachers		10
poor communication by the teachers		9

Table II presents the most frequently mentioned issues and the number of responses.

Practical, hands-on approach and combining theory with practice can be seen as a combination of cognitive and psychomotor domains. Versatility, variation and change to traditional studying methods indicate motivation in the affective domain. Also, teamwork is seen as a positive factor promoting the competences of teamwork, interpersonal skills, and leadership.

The results in the PE group and the ERP group were again close to each other. The biggest difference was on the practical hands-on approach that was brought up twice as often in the ERP group than in the PE group. This indicates that the

practical tools, provided by the ERP system and the business game functionality increase the sense of hands-on work. Yet it remains unknown whether these skills are really transferrable or identical with real work-life skills, as we did not follow-up the students after graduation.

I. Learning Outcomes of the Psychomotor Domain

An appropriate measurement to assess psychomotor domain learning in both environments was a challenge. During the research process, we found a potential psychomotor measurement within the ERP system: the log files, as they produce large amounts of transactional and log data. However, those do not serve for comparative purposes since the practice enterprise model does not produce such data.

Efficiency, accuracy, and response magnitude are psychomotor learning outcomes [68]. Efficiency is measured in terms of the time to complete a task. Effectiveness can be assessed counting the number of errors committed during task completion. Response magnitude is measured by the complexity of the task completed [68].

We analyzed the efficiency of the sales order process, the purchase order process, and inventory management process. Psychomotor learning *within* the ERP-supported business learning environment was measured by the development in processing times. The sales order processing time declined from 15 minutes to three minutes, on average, during the course of the simulation. The other processes and their analysis showed similar decline.

Even if we did not find comparative learning data between the practice enterprise model and the ERP-supported business learning environment, the decline in the processing times shows a positive learning curve and supports the validation of this BSL model. In addition, the ERP system provides new tools for the teachers to monitor, assess and guide learning.

DISCUSSION

For years, business educators have discussed the challenges in keeping up with business life. To shift away from the theoretical approach to practical business orientation, several changes have been proposed, for example, to curriculum, pedagogies, and learning environments. These efforts have, however, often been isolated exercises supplementing traditional courses. A more holistic change is required. We have taken the concept of a BSL [11] and created a concrete implementation that was used pervasively throughout the first year business undergraduate studies as the combining element for all learning experiences.

As a starting point, we took the practice enterprise model where teams of students operate fictional companies without trading actual goods or money. We set out to improve the points of criticism in the model. The artificiality [27], [28] was tackled by creating a fictional market environment with simulated service providers, supplier web-stores and tax officials resembling their real counterparts. The lack of action and the distorted market situation [27], [29] were improved with a simulation-generated consumer demand and competition. The ERP system was the main tool that the

student companies used to run their operations. This enabled the students to learn modern business IT lacking in the practice enterprise model [31] as well as increase the sense of reality when using the same systems as real companies use.

We compared the learning outcomes of both learning environments in the cognitive and affective domain. We found positive indications that the ERP-supported business learning environment improves the long-term learning of the poorer students on the lower levels of Bloom's cognitive domain, validating the idea that a BSL enhanced with a simulation provides a good training ground for business learning. This also supports earlier research suggesting that ERP systems and simulations benefit the lower performers [15], [49]. A combination of the practice enterprise model and an ERP-simulation appears particularly beneficial, as poor performers also seem to benefit from the practice enterprise model [35].

From the affective learning perspective, both settings were seen as motivating learning environments. This is also in line with the earlier research [17], [28]. The ERP-supported environment was particularly appreciated for the hands-on approach. This indicates that real-life tools increase the sense of learning by doing, which has been noted as a challenge in the practice enterprise model [28], [27].

The psychomotor learning was measured only *within* the ERP-supported business learning environment. We used the log-files to measure the efficiency of psychomotor learning through the time spent in completing the sales order process, the purchase process and the inventory management process. The results showed significant improvements in the processing times, implying that learning had taken place. Even if this measurement does not show learning differences between the practice enterprise model and the ERP-supported simulation, it shows a benefit provided by the ERP-tools: Learning can be measured during the learning process and used for student guidance (anonymized). Reference [36] suggests developing the practice enterprise model by formulating standardized learning objectives, such as ability to perform a sales process and a purchase process. The ERP log-file analysis provides a measurement for those objectives.

LIMITATIONS

This study did not use standard measures to evaluate learning and therefore the results are not generalizable. However, generalizability was not the aim. Instead, the aim was to test the BSL concept by finding potential benefits in comparison to the existing practice enterprise model.

Although the basic settings and curriculum for both groups were very similar, there were some differences: two out of six coaches and some disciplinary teachers were changed between the years, causing some changes to learning situations. Consequently, it cannot be conclusively stated that the learning environment was the sole cause of differences in the learning outcomes. Demonstrating it would require further validation.

Another limitation is with the first cognitive learning test consisted of open-end questions that were graded manually. There is potential bias in the grading process. However, the

grading was based on a priori set of ideal responses and graded by the same people in both years, reducing the potential for differences in grading standards.

CONTRIBUTIONS AND FURTHER RESEARCH

The state and the development needs of business education are constantly debated. Experiential learning environments are seen as means to bring the practical element to business learning. In this paper, we participate in that development by offering the following contributions:

- A concrete, validated implementation of a BSL that combines an ERP-simulation to the practice enterprise model. The ERP-simulation gives the momentum, the sense of reality and the business tools lacking in the practice enterprise model [28], [27], [31].
- Evidence that the ERP-simulation enhances the practice enterprise model and improves poor and average student's lower-level cognitive learning, which is the very domain that needs improvement in the practice enterprise model [36].
- Indications on the affective domain areas where the students seem to benefit most from the ERP system: perceived practical hands-on skills and improving the learning motivation.
- Support for the earlier research [35], [15], [49] that the low-performing students benefit from the experiential business learning environments.

Combining the practice enterprise model with an ERP-simulation to a BSL holds great potential to evolve into a comprehensive environment for active and collaborative learning. Implementing an integrated curriculum through such a pervasive learning environment is no minor task. It requires a new kind of administrative orientation, resourcing and staffing. That area holds great research potential.

The environment does neither learn nor teach. The most important elements still are the learners who need to take responsibility for their learning, and the teachers who facilitate, coach, and create the learning situations. Teachers need to step outside their area of solitary disciplinary expertise, increase teamwork with other teachers and become the students' partners in learning. Also, the students need to take an active role in their learning. The changing roles of teachers and students would also provide for interesting topics for further research.

Changing the mindset from a teacher-centric approach to a collaborative learning in dynamic situations requires a formidable effort from both the learners and the teachers. Yet the effort will pay off in motivating learning experiences – as we have shown with poor and averagely performing students – the ones with the greatest challenges in our present educational environment.

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