Simulation Games in Business Process Management Education

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Abstract—Business process management (BPM) has become widely accepted within business community as a means for improving business performance. However, it is of the highest importance to incorporate BPM as part of the curriculum at the university level education in order to achieve the appropriate acceptance of the method. Goal of the paper is to determine the current state of education in business process management (BPM) at the Croatian universities and abroad. It investigates the applied forms of instruction and teaching methods and gives several proposals for BPM courses improvement. Since majority of undergraduate and postgraduate students have limited understanding of business processes and lack of any practical experience, there is a need for introducing new teaching approaches. Therefore, we offer some suggestions for further improvement, among which the introduction of simulation games environment in BPM education is strongly recommended.

Keywords—business process management, simulation games, education

I. INTRODUCTION

THE growing interest of business practice for BPM has promoted the development and implementation of BPM courses in higher education. Nowadays, BPM is a mature concept which is accepted in business practice and which is supported by extensive literature worthy of being taught. Still, BPM concept offers a number of teaching challenges. Based on the cross-functional nature of BPM, academy education on BPM has been conducted within a broad range of academic disciplines from organization theory and management science to computer science [1]. This dispersion of BPM courses across different disciplines and departments reflects the interdisciplinary nature of the field which focuses both on management approaches to business processes and the technologies to support these processes [2].

According to Seethamraju [3] the perspectives of business processes have evolved from scientific management, operations research, information systems and process reengineering towards service process management, process intelligence, process agility, business activity monitoring and service oriented computing. Some surveys show that BPM in general is a very important topic in teaching and research for many universities worldwide.

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However, there is still a relatively small number of universities in Croatia that offer specialized education in BPM. Various BPM courses, books and literature from different vendors exists, which show different aspects of Business Process Management field of knowledge, but there is no coherent course for the students in Croatia. This paper provides an overview of Croatian BPM education programs survey and the findings of the similar surveys conducted worldwide. The results of Croatian survey are analyzed and summarized in a form of several proposals for BPM courses improvement. The proposal is to create a mix of classwork and pc-lab exercises by combining presence learning (lectures, exercises) with simulation modeling activities.

II. BPM EDUCATION IN HIGHER EDUCATIONAL INSTITUTIONS

According to Jain et al. [4] BPM courses should aim at both providing student learning and at the same time prepare the students for a career in the corporate world. The authors conducted a research in order to collect information from the employers on how relevant are the topics on BPM that are covered in the course at Stevens Institute in 2006 for an entry-level position. The results of the survey showed that the two highest rated areas were ability to research and collect process related data and ability to use graphical methods to map business processes. Besides, research findings indicate a strong support for more case studies, use of BPM tool, and real-life projects [5].

Similarly, Ravesteyn and Versendaal [6] describe a joint effort by two educational and scientific institutes in Dutch higher education, in designing a BPM course that not only transfers theoretical knowledge but gives students also experience of real life BPMSs and implementation issues. The proposal is to provide BPM courses for two different types of students: more business oriented versus more technology oriented because this will make the practical track of the course less complicated. Another change the authors are considering is the amount of the involvement of business. They suggest the companies to submit small research projects that the students do as part of the course.

Tuckova and Tucek [7] present BPM tool used in the education and stress the fact that this software is used by Czech students to model and analyze processes from working practice in manufacturing production and non-manufacturing enterprises. On the other hand, the implementation of sophisticated BPM software tools (such as TIBCO, IBM WebSphere Modeler, ARIS) into teaching becomes challenging.

World Academy of Science, Engineering and Technology
International Journal of Industrial and Systems Engineering
Vol:6, No:9, 2012

Even though these tools does not require any in-depth technical skills to use them, the general apathy of business students in taking these courses may make it difficult to gain the learning outcomes [3].

III. BPM Courses In Croatian Academy

A. Methodology

The empirical study conducted by Bosilj Vuksic et al [8] in June 2011 aimed at establishing the current state of education in the area of BPM at universities in the Republic of Croatia. The interview was structured so as to obtain information about lecturers, structure of the courses, number of students, required literature, course concept, evaluation, professional training of students and the opinion of those surveyed about the labour forces needs in the target area. The results show that BPM courses are developed at the undergraduate, graduate and postgraduate levels and are delivered by different departments (Organization and Management, Information Systems, Informatics) within faculties of Economics and Business, Organization and Informatics, Mechanical Engineering and Naval Architecture, Tourism and Hospitality Management.

B. Research Results

Ultimately, the study gave answers to the questions about the range of courses on business process management at Croatian universities and the forms of course work and teaching methods used in education in the field of BPM at Croatian universities. The range of courses offered in the field of BPM at the faculties is diverse. BPM programmes are offered at various levels of study (professional, undergraduate, graduate and postgraduate study), and the courses are either compulsory or elective. The basic difference in the course content is between the organizational and information science approach to BPM.

A project task (team or individual) is part of the course requirements in almost all courses, and is considered by lecturers as an exceptionally useful learning tool. Other interactive forms of learning are also used: oral presentations, discussions on case studies, resolving assignments in the course. Knowledge is tested in writing, and less frequently in combination with oral examinations. The majority of courses include practical computer work (exercises). Courses in postgraduate study are an exception (due to the smaller number of hours) and courses that focus on the organizational aspects of BPM. Various software packages are used for computer exercises: Aris, Promodel, Arena, Extend, Visio, MS Dynamics Navision, Business Modeler, and Cool Biz.

The number of students attending each course varies, depending on the popularity of the faculty and the type of study. However, on average, there are large numbers of students in the professional, undergraduate and graduate studies, while smaller groups attend postgraduate courses. For example, at the Faculty of Economics of the University of Zagreb, about 100 students enroll in these courses. The problem can only be resolved by limiting the enrolment of students in the course so as to ensure greater teaching efficacy.

C. Suggestions for Improvements

According to Seethamraju [3], difficulty of teaching concepts of business processes using traditional teaching and learning methods is well recognized in the literature. Most of the students lack the knowledge about the business practice. A consequence can be that the materials are too abstract and not realistic enough for students. In order to help students understand the wider business process context, there is a need for introducing new innovative teaching and learning activities.

In BPM courses, it is exceptionally important that students come to their own conclusions, and that they are able to independently solve certain problems. Besides, individual work is exceptionally useful, as each student works on his/her own to resolve a given task. Under ideal conditions, this implies small groups of students, and direct lecturing should be avoided and used only as the introductory and concluding parts of the class.

Group work is also an efficient teaching method. This is particularly useful as it simulates real situations in the business world. Students are divided into smaller groups and work together to resolve the same task, with some assistance from the professor. Group work on BPM topics assists students in recognizing their own contribution to the work of the group, in which students complement one another, and are taught to think at a target level, while also learning about important concepts such as leadership and team management.

It is possible to also employ interactive games or simulations of real situations, which can be very suitable for BPM content [9], [10]. There are a number of simulation business games currently being used by educational institutions in this regard, one of these being IBM's INNOV8 [11]. The Academic Edition of INNOV8 2.0, the IBM Business Process Management (BPM) simulation game, gives both IT and business players an excellent introduction to BPM, from learning the anatomy of a model, to how one might optimize the model and make a company more profitable [12] .

Additional improvements to BPM classes are also possible through the introduction of an e-learning system. This approach helps to uncover common problems and to share ideas across all actors of learning process. Collaboration should not be limited to students, but should involve all participants of BPM learning process.

IV. Simulation Games usage in Business Education

A. About Simulation Games

Simulation games are used effectively as a useful tool for facilitating the knowledge-constructing classroom ([13]. Business students use simulation games to practice how to make decision in the real world, and also experience the results of their decisions in safe environment. Usage of simulation games in business education has been advocated as an effective tool for bridging the gap between learning concepts presented at ex-cathedra lessons and using the specific tools and knowledge to solve real problems outside of the classroom [14].

World Academy of Science, Engineering and Technology
International Journal of Industrial and Systems Engineering
Vol:6, No:9, 2012

Business process management courses are taught with the goal of enhancing the students' understanding of the importance of effective management of business processes and the importance of usage of IT tools that support BPM. However, it is hard for students to fully comprehend the benefits of the BPM for the success of the companies, since they have no experience with the real world business problems. Simulation games are proposed as an effective tool that could help students to gain real-like experience of using business process management in virtual environment. The case study of using INNOV8 is presented in order to illustrate usage of simulation games in business process management course.

B. Case Study: INNOV8 – BPM Simulator

INNOV8 is a computer simulation game developed by IBM as a pseudonym for a video game designed to enhance learning of students at the college level and young professionals with the goal of developing a combination of business and information technology skills. The game has been incorporated into syllabus of more than 100 colleges and universities [15] and the INNOV8 2.0 Full Academic Edition game is available for educational purpose at the IBM website. Besides the game following additional material are available: Pre and post usage surveys (online), BlueWorks Communities (online), and Instruction manual.

The game consists of three different modules: (1) Smarter Customer Service – designed for testing Smart SOA (Service-Oriented Architecture) solutions for improving customer relations, reduce wasteful inefficiencies and increase company profits, (2) Smarter Supply Chain – designed for using BPM (Business Process Management) and new technologies, such as RFID, to change the way supply chains are managed, and (3) Smarter Traffic – designed for implementing BPM skills to real world traffic situations to improve the way traffic events are handled and thus reducing traffic congestion and greenhouse gas emissions in a crowded city. Smarter Traffic module of the game will be presented in the greater details.

C. Description of the Smarter Traffic Module of the INNOV8 game

Smarter Traffic module has been designed with the goal to give the participants the opportunity to make real-life decisions in a fictional agency, After Inc. that has the job of improving efficiency of the traffic in one crowded city by reducing crowd within rush hours. Objective of the playing the game is to improve sub-optimal processes within the following phases: (1) discover the current model, (2) detecting under-performing processes, and (3) optimizing the processes in order to meet the goals of the city. Smarter Traffic module of the INNOV8 game is operating in three steps: (1) Improving the rerouting traffic around accident scenes, (2) Set rerouting Business Rules around accident scenes, and (3) Selecting tolling system type.

D. Operation of the Smarter Traffic Module of the INNOV8 Game

1. Step: Improving the Rerouting Traffic Around Accident Scenes

In the first step the student is welcomed to the After Global Collaboration meeting. The situation with the traffic in the city is presented by the member of the team and it refers to serious challenges like heavy gridlock. Due to high commuting from suburbs into downtown peak hour crowds are increasing. Vehicle accidents worsen congestion and decrease the speed of movement. Even worse, the critical personnel, like First Responders cannot approach the place of the accidents. Traffic Prediction tool has been used for forecasting congestion due to the traffic crowds taking into account also vehicle accidents. The student has to decide on one of the three options regarding the reaction to the vehicle accidents. Three possible simulation runs are available to the student before deploying the final solution to the system. Traffic Prediction Tool has been suggested as the most optimum solution that can be used for setting rerouting business rules.

2. Step: Set Rerouting Business Rules Around Accident Scenes

The student is warned by the member of the virtual team that the Traffic Prediction Tool cannot be used as a stand-alone solution and it needs the support of other functions. Decision on using such support has to be made by the student within the Nerve Center dashboard. Three possible tools are proposed for usage in order to support Traffic Prediction Tool: reprogramming of traffic signs, reprogramming of traffic lights, and manual facilitation (Figure 1).

The dashboard for making decisions is opened by clicking on the button Simulate (Figure 2), that displays explanation of the tools for setting rerouting business rules if question sign is clicked. Traffic police (manual facilitation) has following features: Cost Per Officer ($150), Sick Day (2-4% extra), Efficiency (Low), Environmental Impact (Medium) and Customer Satisfaction Impact (Medium). Smart Roadside Signs has following features: Cost Per Sign ($2000), Efficiency (Medium), Environmental Impact (High), and Customer Satisfaction Impact (High). Smart Stoplights has following features: Cost Per Light ($3500), Efficiency (High), Environmental Impact (Low), and Customer Satisfaction Impact (Low). Restricted budget is available for implementation, like in the real life.

After three simulations, the student is encouraged to deploy the chosen solution that consists on the usage of tools available for setting rerouting business rules. Quality of the decision is measured by using two key performance indicators: satisfaction and environmental impact. The screen appears with the message from the member of the virtual team, key performance indicators, and the virtual display of the traffic in the city (Fig. 3).
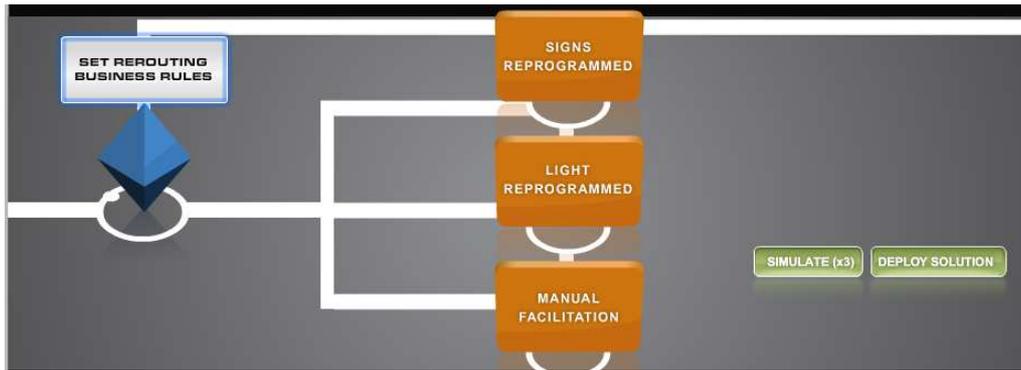
World Academy of Science, Engineering and Technology
International Journal of Industrial and Systems Engineering
Vol:6, No:9, 2012

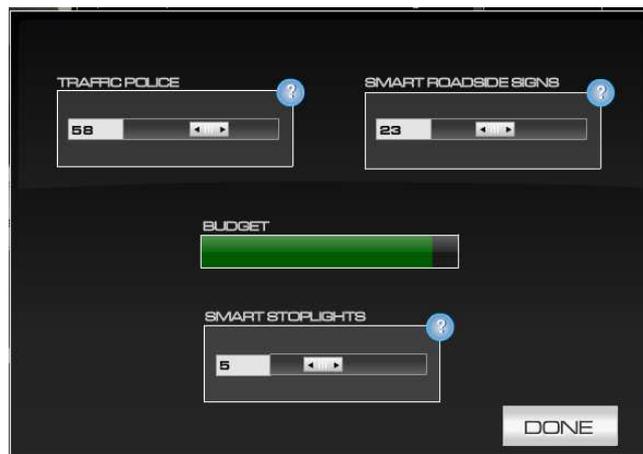Fig. 1 Tools for seting rerouting business rules

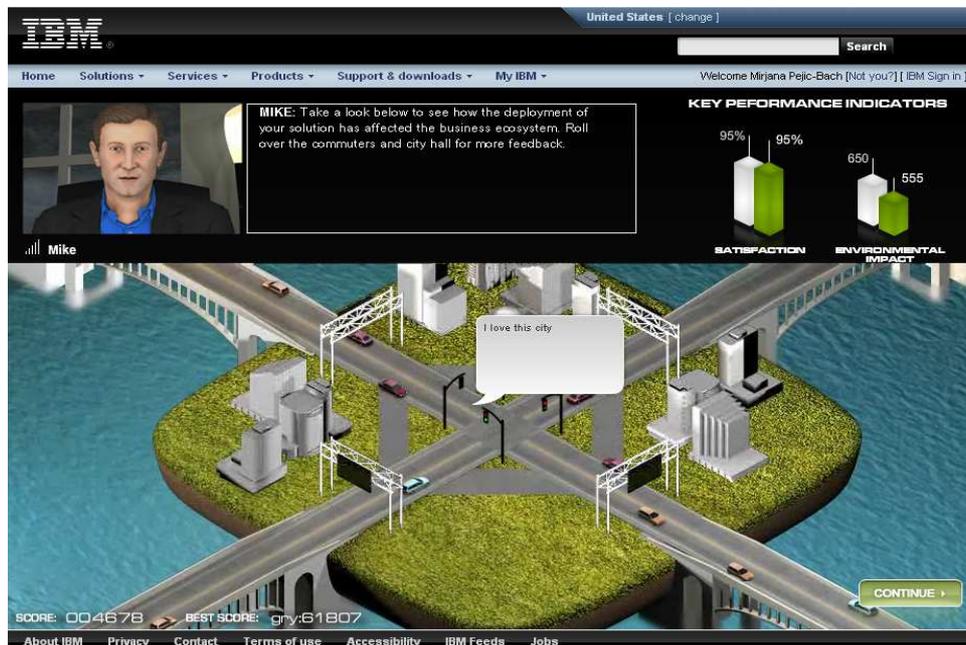Fig. 2 The dashboard for making decisions on using tools for setting rerouting business rules

Fig. 3 Final results of the decisions made on using tools for setting rerouting business rules

3. Step: Selecting tolling system type

The student is asked by the member of the virtual team to select the ideal time to implement a Smart Tolling system, and adjust the bus and toll fares.

The goal is to find the best solution with paying attention to the key performance indicators. The student has three chances to simulate possible decisions before deploying the solution.

World Academy of Science, Engineering and Technology
International Journal of Industrial and Systems Engineering
Vol:6, No:9, 2012

Smart Tolling system has three options regarding tolling type: (1) AM Tolling Only (6AM-9AM), (2) AM&PM Tolling Only (6AM-9AM; 4pM-6PM), and All Peak Hours Tolling (6AM-6PM). The student has to choose one of the options and then set toll fares and prices of the bus tickets. The game is set so that the people in the city will be generally satisfied with the first and second option, but the second option will be better for the environment. However, toll fares should not be too high because people will be dissatisfied. Third option is the least popular, and could be successful only if toll and bus fares are low enough. If this is not the case, people will find the way to reroute the traffic around the toll lines, and this will increase green house gasses and traffic congestion.

Again, after three simulations, the student is has to deploy the chosen solution, and the quality of the decision is measured by using three key performance indicators: satisfaction, environmental impact and traffic congestion. As in the previous three steps of the game, the screen appears with the message from the member of the virtual team, key performance indicators, and the virtual display of the traffic in the city.

D. Implementation of the Smarter Traffic Module of the INNOV8 Game in the Curriculum of the Business Process Management Course

Students enrolled to the Business Process Management courses would benefit from using INNOV8 simulation game. However, implementation of the game into the curriculum of the course at the tertiary level of education should be carefully conducted. Otherwise, the problem of adapting complex games to the classroom context would create possible obstacle in achieving the optimal results in learning and teaching success [16]. Therefore, systematic framework to incorporating simulation game in the curriculum of the BPM course should be followed [17] with the goal of evaluating the advantages and disadvantages of using the game. Authors propose the following contents of the framework: context, learner specification issues, pedagogic considerations and mode of representation.

By following the framework proposed by de Freitas and Oliver [17], INNOV8 has been evaluated for using in BPM education at the tertiary level (Table I).

TABLE I

USING THE FRAMEWORK TO EVALUATE INNOV8 *adapted according to de Freitas and Oliver* [17]

Context	Learner specification	Pedagogic consideration	Mode of representation
School-based learning in BPM studies	Students enrolled at the BPM course	Learners learn from experience through simulation experiments deployed in the virtual environment	INNOV8 uses 2D characters (members of virtual team), dashboards for making decisions, and simulation of the city after deployment of final solution.
Classroom-based	The game could be used by other age groups and in informal settings	Learning outcomes: Understanding of the importance of BPM and usage of IT for improving BPM	
Interactions with the software	The game could be used by the single learner	Learning activities: Students learns trough activities based upon deciding on possible business processes. Briefing/debriefing: pre-class preparation and post reflection is necessary.	Level of interactivity is medium, since the "conversation" between the student and the 2D characters are defined in advance

V. CONCLUSION

The research on BPM education at higher educational institutions has revealed that teaching in emerging disciplines such as BPM in higher educational institutions is very challenging. The design and reengineering of business processes requires students to gain a variety of practical, technical and soft skills that can be reached through student-centered teaching approaches which are significantly different from the traditional, direct lecturing forms.

Therefore we suggest the development of new educational activity that is professionally oriented with both practical hands-on experience as well as theoretical instruction and requires students to more actively participate in the learning experience.

It is proposed to introduce business gaming in BPM education because it gives them an excellent understanding of business processes modeling, re-design, management, real-time monitoring and control.

"Learning from mistakes", experimentation, knowledge discovery and deep learning are very important aspects of simulation gaming because those can help students to develop business and managerial skills. In order to present usage of simulation games in teaching BPM, simulation game INNOV8 has been presented.

Features of the game has been discussed, and the process of one hypothetical game playing has been described in order to demonstrate the possible benefits of using simulation games in BPM education.

Finally, systematic framework to incorporating simulation game Innov8 in the curriculum of the BPM course has been developed.

Limitations of the survey stem from the fact that it has been conducted only in universities in Croatia. In order to further assess the usage of simulation games in BPM courses, survey on the international level should be conducted. In addition,

World Academy of Science, Engineering and Technology
International Journal of Industrial and Systems Engineering
Vol:6, No:9, 2012

experiments with the students before and after playing the game with the goal of assessing increase in knowledge of BPM should be conducted, possibly in longitudinal study in order to comprehend long-lasting effects of active learning in the form of simulation game.

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