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Educating Students in Business Process Management with Simulation Games

Vesna Bosilj Vuksic, Mirjana Pejic Bach, Tomislav Hernaus

***Abstract*—**The aim of this paper is to present a framework for empirical investigation of the effectiveness of simulation games for student learning of BPM concept. A future research methodology is explained and a normative model that extends the standard TAM model by introducing latent and mediating variables into the relationship between independent variables and dependent variable is developed. Future research propositions are defined in order to examine the benefits that can be achieved through the use of BPM simulation games in ERP courses.

***Keywords*—**Business process management, simulation games, education, technology acceptance model.

I. Introduction

THE concept of business process management (BPM) has become a widespread business practice in the last decade. It is an increasingly used approach for managing cross-functional and supply-chain activities. The adoption of process orientation through BPM seems to be relevant for gaining a better understanding of business; it improves collaboration among units and business partners, resulting in higher levels of organizational effectiveness [32]-[34]. However, in order to provide benefits, BPM requires that managers and employees take a holistic organizational perspective including not only technological, but also personal and cultural aspects of doing business [2], [4].

Although the history of BPM traces back to the 1990s, only recently it has been recognized that we need to move beyond technical (IT and engineering) aspects of process management. Building an infrastructure and organizational culture that supports process oriented methods, practices and procedures enables a continuous improvement of BPM. Scholars have, therefore, introduced the term BPM culture, which is defined as a culture that supports achieving BPM objectives [5]-[7].

The research conducted by Schmiedel and vom Brocke [3] empirically identifies four key cultural values supporting BPM: Customer orientation, excellence, responsibility, and teamwork. According to the findings, these cultural values create an environment receptive to BPM. Since a cultural group refers to a plurality of individuals, human resources must be considered a very important element of BPM. The capabilities, skills, knowledge and motivation of certain employees and groups to change business processes are related to the success of BPM projects [8], [9]. Therefore, BPM training and education can positively influence the organizational BPM readiness and BPM acceptance.

BPM education and training programs are mostly performed in-house. However, the growing interest of businesses in BPM has promoted the inclusion of process-centric issues in higher education courses. According to Sidrova and Isik [10], academic education on BPM has been provided within a broad range of academic disciplines, from organization theory and management science to computer science [31].

The cross-functional perspective and interdisciplinary nature of BPM make the teaching of BPM very complex and challenging. Since the majority of students have a limited understanding of business processes and no practical experience, most of the traditional teaching and learning methods are not efficient enough [16]. Academic BPM education requires new teaching approaches and methods if knowledge dissemination about process management among student population is to be improved. Simulation-based training in particular enables the development of management skills at a much faster pace than the usual teaching techniques [14].

Therefore, the purpose of this research is to develop a framework for empirical investigation of the effectiveness of simulation games as a new learning tool in the area of BPM education. We believe that business simulations facilitate the acquisition of a holistic BPM perspective and of basic knowledge about business processes. As a result, students will eventually become better organizational citizens.

II. Business Process Management: Learning and Training with Simulation Games

A. Simulation Games: A Missing Link in BPM Concept Education

Simulations are used to help predict potential impacts of changes to current operational processes and compare business scenarios prior to implementation. Besides, simulation provides a quantitative basis for decision making. In BPM learning, it is exceptionally important that students come to their own conclusions, and that they are able to independently solve certain problems. Empirical studies show that the implementation of interactive games or simulations of real situations can be very suitable for teaching BPM content

Vesna Bosilj Vuksic and Mirjana Pejic Bach are with the Faculty of Economics and Business, University of Zagreb, Trg J. F. Kennedya 6, 10000 Zagreb, Croatia, (phone: 00385-1-238-3333; fax: 00385-1-233-5633; e-mail: vesna.bosilj@efzg.hr, mirjana.pejic@efzg.hr).

Tomislav Hernaus is with the Faculty of Economics and Business, University of Zagreb, Trg J. F. Kennedya 6, 10000 Zagreb, Croatia (phone: 00385-1-238-3265; fax: 00385-1-233-5633; e-mail: thernaus@efzg.hr)

[11], [12]. A simulated environment conveys "business reality" more tellingly and eloquently than traditional teaching methods [13]. Simulation games are designed primarily to develop first-hand experience of players. Role-play simulation is a widely used type of simulation learning method in which players are required to solve business problems in fictional situations by taking the roles of specific employees in organizations [14]. Not only that simulation training programs achieve methodological learning, but they also support social, communicative and effective learning [21]. Moreover, when used in class, business simulation games stimulate students' interaction and teamwork [22].

According to the findings of research conducted by Roodt and Joubert [15], there are a number of simulation business games, which are currently being used by educational institutions to teach BPM content. One of them is IBM's INNOV8. Since process modeling is a complex organizational task that has to be performed in a cross-organizational environment, Brown et al. [23] propose a new collaborative process modeling approach. Based on a case study application, the results show that a 3D Business Process Modeling Notation (BPMN) modeling environment in Second Life (virtual world technology) increases user empowerment and contributes significantly to the collaboration and consensual development of process models. Additionally, using BPM simulation games in education can help students to accept information technology for BPM and to get technological know-how.

B. BPM Simulation Games in ERP Courses

The BPM concepts are mostly taught as a unified BPM 101 or a BPM-related title course at undergraduate or graduate level [31]. However, process management is sometimes studied as one of the topics in other courses [20], particularly within ERP courses. Such coexistence is reasonable as business processes should be regularly executed, designed, optimized, and controlled through both BPM and ERP systems. Since business schools increasingly integrated ERP systems in their curriculum during the last decade, a wider population of students is exposed to basic BPM issues as well.

Business processes and supportive ERP systems are complex and difficult to comprehend without practice and exercise. Thus, business students need to have the opportunity to practice using an ERP system while managing company-related business processes [17]. Business simulations in general and BPM simulations specifically, provide the necessary "playground".

Jaeger et al. [18] describe the success of such an innovative teaching method that enables students to understand business processes and transactions carried out in the business cycle. By running a BPM simulation, students can work through the business processes that take place in a real business environment. They are able to experience numerous business and process-related issues, and consider how to manage and optimize them. Results of a survey conducted at a major university in the United States over a three-year period (2008-2010) suggest that the ERP simulation game was instrumental in learning ERP concepts and business processes [19]. Jeyaray [12] described a simulated environment designed to enable students to understand business processes within an advanced undergraduate course on information systems (ERP) design and development. The simulated environment was found to be a very useful method for students to acquire and hone technical and soft skills related to ERP systems and business processes.

C. Limitations of the Usage of Simulation Games in Education

Despite the numerous advantages of the usage of simulation games in business schools, some limitations must be pointed out. Besides funding and technical issues, the major obstacles to using simulation games in class are the amount of preparation time and a lack of information [22]. In addition, a stronger collaboration between business practice and academic environment is needed in order to introduce simulation games in the academic environment. Unfortunately, most computer games still emphasize the commercial benefits instead of focusing on higher education, business school curriculums and teaching designs [28].

III. Investigating the Use of BPM Simulation Games for BPM Adoption

A. Problem Definition and Research Proposal

BPM implementation projects are costly and have a relatively low success rate. Since the nineties of the 20th century, BPM researchers have concentrated their efforts on identifying critical success factors (CFSs) that influenced BPM success [1]. Skrinjar and Trkman [27] identified five CFSs and their critical practices: (1) strategic alignment, (2) performance measurement, (3) organizational structure, (4) information systems and (5) employee empowerment and training. Some authors claim that communication, involvement of stakeholders and governance play a critical role in BPM success [25], [26]. According to Burlton [24], BPM introduction and governance programs work on capability and readiness concurrently. Since a capability without a readiness will not lead to BPM adoption, organizations must spend significant resources to provide their employees with the required BPM education and training. Prior research confirmed that applying BPM simulation games in education enables students (e.g. prospective business practitioners) to get an overview of BPM concept, but also to develop the communication and collaboration skills (e.g., confidence between co-workers; teamwork as a typical way of solving problems; performance recognition among co-workers) that contribute to the BPM success.

Despite the perceived usefulness of BPM simulation games, it is necessary to investigate students' readiness to accept simulation-based training in higher education. Although Generation Y and Generation Z students grew up with technology and prefer to use technology in their learning, it is important to understand the preferences of these cohorts of

students regarding the usage of BPM games and learning about BPM. The factors that enhance the perceived effectiveness and usefulness of BPM must be examined. Thus we suggest that a BPM simulation game be used for research purposes, with the simulation functioning as the platform which enables the students in an ERP course to experience BPM. The objective of the current research is to determine the factors that stimulate students to continue learning about BPM after its initial adoption. We applied the Technology Acceptance Model (TAM) to examine ways of investigating the outcomes of student learning and BPM acceptance prior to and after their participation in the BPM simulation game.

B. Technology Acceptance Model as a Research Instrument

TAM is very often used as a theoretical framework in IS research for studying IS acceptance and for predicting system use. It was proposed by Davis in his doctoral thesis and, since then, it has been tested and extended by many researchers [28]. The main constructs of TAM are perceived usefulness (PU) and perceived ease of use (PEOU). They are originally used to explain IT usage behavior. These two constructs were taken from the psychological and IS theory to demonstrate that PEOU would have a positive association with PU. According to Davis [30, pp.320], PEOU is defined as "the degree to which a person believes that using the system will be free of effort" while PU is defined as "the degree to which a person believes that use of the system will enhance his or her performance".

For more than two decades TAM has been applied for different types of external variables to predict behavioral intentions that led to user behavior of using various technological features. It has been examined in different environments and with different subjects. TAM has also been revised in numerous studies to fit a specific context of technology being investigated. The primary objective of this study is to test and augment the original TAM with the external variables identified as relevant for the acceptance of BPM simulation games.

IV. Research Framework

A. Research Methodology

The sample for the future study should include senior undergraduate students at the university level. Participants should be enrolled in Enterprise Information Systems (EIS) course in which SAP or similar software packages are used as the software tool with which to learn ERP. Generally, acquainting students with the notion of EIS, as well as its roles, functions, and applications should be the main objective of the chosen course. Specifically, the course should enable students to gain knowledge and skills needed to actively participate in the development and usage of EIS and all its key functions and business processes. The course should be delivered through traditional classroom lectures and lab assignments. Students should be obligated to prepare a written essay or computer presentation of a specific case study. Since the emphasis of ERP is on business processes giving the horizontal perspective of organizations, students should familiarize themselves with basic BPM terms, methods and information technologies. Thus, BPM should be one of a dozen key topics that are taught within the course. For the purpose of research, students should be asked to play a BPM simulation game (INNOV8) and to complete an on-line survey after participating in the game.

INNOV8 is a BPM simulation game developed by IBM as a pseudonym for a video game designed to enhance learning and aimed at college level students and young professionals who need to develop a combination of business and information technology skills. The game has already been incorporated into syllabi of more than 100 colleges and universities [15], [29] and the INNOV8 2.0 Full Academic Edition game is available for educational purposes at the IBM website. Besides the game, additional material should be 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 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.

The students should be divided into teams of three (simulating participants of a BPM project). Each team is allowed to conduct three runs of simulation with a different participant (team member) in each run. Success in the simulation is measured by company performance. Students should already be familiar with the majority of performance measures (e.g., profit, ROI, ROE) that appear in the game. At the end of each run, the students need to make a short team report about the achieved results. After the game is finished, each team member is supposed to complete a questionnaire. Finally, each team submits the written report to the teacher.

B. Conceptual Framework

We have developed a normative model (Fig. 1) that extends the well-accepted TAM model by introducing latent and mediating variables into the relationship between independent variables (i.e. social norms, perceived understanding of BPM importance and graphic quality of BPM simulation games) and dependent variable (i.e. the intention to use BPM simulation games). A latent variable PU (i.e. perceived usefulness of BPM simulation games) and mediating variable PEOU (i.e. perceived ease of use of BPM simulation games) are proposed. Besides, two more variables that could potentially influence the students' attitude towards the use of BPM simulation games are added to the original TAM – learning efficiency of BPM simulation games and barriers to

the use of BPM simulation games.

We offer four research propositions (RPs). Perceived usefulness of computer usage (PU) is a standard construct of the Technology Acceptance Model [e.g., 35]. However, when analyzing the usage of BPM simulation games, the latent variable of PU can be further decomposed and measured through three dimensions: graphic quality of BPM simulation games, perceived understanding of BPM importance, and social norms among game players. BPM simulation-based training will be perceived as useful if the simulation game is of a high graphic quality and thereby more attractive to players. It can also add value by offering students a better understanding of both BPM concepts and BPM practice. The impact of social norms, however, should not be underestimated if we are to determine the usefulness of BPM simulation games. Groupthink in particular is a powerful behavioral phenomenon that can strongly shape a student's understanding of BPM simulation games.

RP1: Social norms, graphic quality of BPM simulation games and perceived understanding of BPM importance impact perceived usefulness of BPM simulation games.

The perceived usefulness of BPM simulation games certainly improves the intention to use such a learning method. Students like to learn with a purpose and tend to optimize their learning time. Thus, if simulation games offer a quicker and more efficient way to acquire the necessary knowledge, they will certainly strive towards their higher usage. However, even if numerous business simulations are very useful they are not widely used. It is extremely important for a simulation game to have a user-friendly interface. Such an interface can increase the likelihood of future usage of BPM simulation games. In addition, a simulation game should be clear and understandable, easy to learn, and controllable. Such features of BPM simulation games can significantly increase the intention to use them.

RP 2: Ease of use of BPM simulation games has a mediating effect on the relationship between perceived usefulness of BPM simulation games and the intention to use BPM simulation games.

Beyond PU, some other variables also have an impact on the intention to use BPM simulation games. We believe that learning efficiency could also have a positive impact on the usage of BPM simulation games if they are able to facilitate the learning process and increase its efficiency. Students feel more attracted to new e-learning methods in general. Especially to simulation games that succeed to attract their attention and provide better understanding of the issue under study. However, opposite effects are expected regarding the barriers to the use of BPM simulation games. Both high requirements on PC's performances and high internet connection can diminish the interest for a particular simulation game.

RP 3: Learning efficiency of BPM simulation games has a positive impact on the intention to use BPM simulation games.

RP 4: Barriers to the use of BPM simulation games have a negative impact on the intention to use BPM simulation games.

V. Conclusion

Business simulation games provide students with opportunities to develop skills and knowledge in a controlled environment without risk of harm and with relatively low costs. Experimentation, knowledge discovery, "hands-on" and "role-play" experience, teamwork and collaboration are very important aspects of BPM simulation games because those can help students to develop business and managerial skills. This paper presents a future research framework for analyzing students' acceptance of BPM by introducing simulation games in ERP courses. This research should address the manner of applying BPM simulation games, the problems that may be encountered and the benefits that can be achieved if simulation games are used in ERP courses.

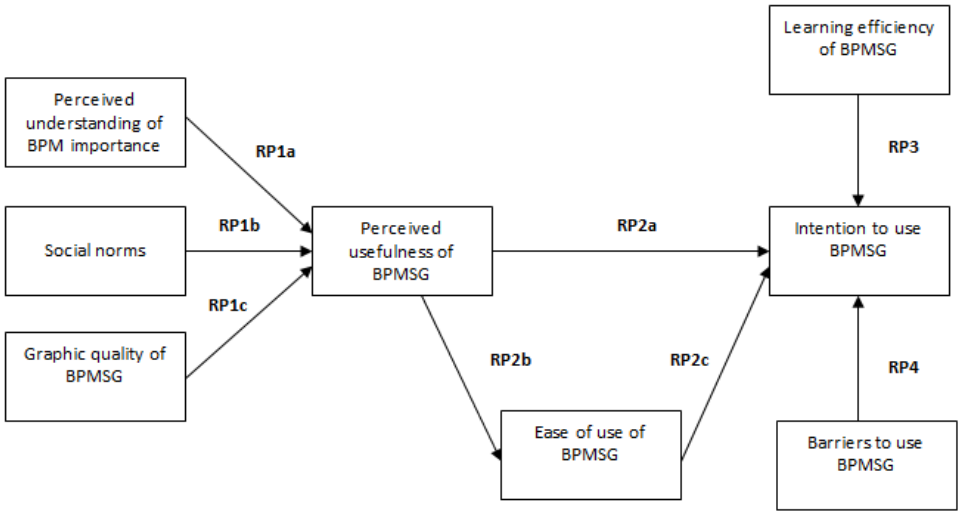

Fig. 1 Conceptual framework

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