

Teaching Business Process Change in the Context of the Digital Transformation: A Review on Requirements for a Simulation Game

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Abstract. This paper analyzes requirements for a simulation game to teach Business Process Change (BPC) in the context of the digital transformation. First, the necessity of a simulation game to teach BPC as part of the digital transformation of enterprises is presented. Afterwards, a literature review and focus group discussions are conducted to analyze the requirements for teaching BPC. Finally, the resulting requirements are presented within a framework that describes the learner specification, pedagogy, context, and mode of representation for a simulation game to teach BPC. The presented study contributes to theory by providing a starting point for further research regarding the teaching of BPC in the context of the digital transformation. It further contributes to practice as the provided requirements can be used as basis to implement a simulation game to teach BPC.

Keywords: Business Process Change, Digital Transformation, Teaching, IS Curriculum, Simulation Games.

1 Introduction

Digital technologies are becoming crucial to sustain the efficiency of a company's business processes. The impact that technologies have on the enterprises and economy is also defined as "digital transformation", which is "concerned with the changes digital technologies can bring about in a company's business model, which result in changed products or organizational structures or in the automation of processes" [1]. This often comprises decisions with regard to the implementation of digital technologies, and a core characteristic when digital technologies are implemented in an organization are business process changes [2, 3]. Therefore, business processes are one of the main drivers for the digital transformation of businesses, which makes it necessary to successfully manage this transformation for an organization to stay competitive [4, 5]. Hence, Business Change Management including Business Process Change (BPC) can be seen as a major competency when you want to manage the digital transformation of enterprises [6]. In general, BPC presents a management concept that involves any type of process change, either revolutionary or evolutionary [7]. Previous research on skills and

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competencies for the digital transformation already emphasized the relevance of Business Change Management and BPC for future employees [6, 8]. Therefore, it is an important topic, which should be addressed in Information Systems (IS) education.

However, in current IS education, an overall teaching concept for BPC in the digital transformation is still missing. Previous research on the general impact of BPC focuses on the success of BPC projects [9] or the complex relationships between their important constructs [10, 11], which is rather geared towards researchers and practitioners. When the topic is addressed in education, it is limited to a static view on business processes as an ordered set of activities, but without considering any business process changes [12]. Furthermore, there is only little research in general that shows the impacts of digital technologies on the business processes of an enterprise [13]. However, with regard to the digital transformation, especially a view on business process changes is important for students to understand the impact of digital technologies. A solution to this problem could be the use of business simulation games, as they are intended to improve the learning experience for students [14, 15]. Still, current simulation games focusing on business processes, such as the ERP Simulation Game called ERPsim [16], are also rather geared towards static business processes and are not intended for scenarios simulating business process changes. Hence, there is a need to analyze what is required to teach BPC in the context of the digital transformation of enterprises successfully.

In order to address these issues, this paper analyzes the requirements for a simulation game to teach BPC as part of the digital transformation of enterprises. Previous research on dynamic complexities of BPC projects already proposed to integrate the findings into a simulation game [17]. In general, such a game models a part of the reality and simulates dynamic situations based on the model [18]. In the context of BPC, a simulation game would provide the possibility to simulate the central business process changes and would allow to understand its effects. Moreover, it is an interactive method to convey knowledge about BPC. Therefore, this paper addresses the following research question: *What are the requirements for a simulation game to teach BPC in the context of the digital transformation of enterprises?*

By analyzing the requirements for such a simulation game, we lay the foundation for BPC education and the development of BPC simulation games in the context of the digital transformation. For this, the remainder of paper is structured as follows: first, the methodology to analyze requirements for a simulation game to teach BPC is described. Afterwards, general requirements for teaching BPC in the context of the digital transformation as analyzed in the literature and with focus group discussions are presented. Finally, specific requirements for a simulation game to teach BPC are proposed based on a framework for simulation games.

2 Methodology

2.1 Literature Review

To analyze the requirements for a simulation game to teach BPC, we conducted a systematic literature review according to the guidelines of Webster and Watson [19] and vom Brocke et al. [20]. The main objective of the literature review was to identify and

categorize requirements for a simulation game to teach BPC in the context of the digital transformation. Therefore, we searched by using the following keywords: "Teaching" or "Education" or "Learning" or "Training" or "Course" or "Lecture" or "Skills" or "Competencies" or "Curriculum", in conjunction with "Business Process" or "Business Process Management" or "Business Process Change". Additionally, we included the keywords "Digital Transformation" or "Digitization" or "Industry 4.0" or "Industrie 4.0" or "Internet of Things" or "IoT" or "Cyber Physical Systems" or "CPS". With this amount of keywords, we aimed to conduct an exhaustive literature search.

For our search, we chose the databases ACM Digital Library, EBSCOHost, IEEE Xplore and Scopus, as they cover publications from IS, Economics, Computer Science, and Engineering. Furthermore, they contain many Education outlets and outlets focusing on Business Process Management (BPM), such as the BPM journal. Our search included all articles published until July 2017. All hits were initially screened based on title and abstract. Afterwards, the whole articles were investigated in detail. In addition, we conducted a Google Scholar search to discover relevant articles that were not included in the chosen databases. For this, we sorted the articles by relevance and screened the first 20 hits for each search string. Thereby, we found two additional articles. Moreover, following the guidelines of Webster and Watson [19], we conducted a backward and forward search on the articles. Thereby, we found two more papers.

Overall, we considered all articles as relevant that contained requirements for teaching in the area of business processes, BPC, or BPM, and that additionally mentioned the digital transformation, digitization, or a similar trend. In total, we had 269 hits in our database search, from which 18 were finally chosen for a detailed analysis. This small number shows that only little research exists so far for teaching BPC in the context of the digital transformation. Hence, the literature review only provides a first overview of the topic. From each document, we extracted requirements for a simulation game to teach BPC in the context of the digital transformation. Finally, we consolidated equivalent requirements mentioned in different articles and assigned them to eight subject areas overall.

2.2 Focus Groups

In order to evaluate and extend the results from the literature review, we additionally conducted focus group discussions according to Krueger and Casey [21]. We assembled three focus groups, with a number of around ten participants per group. The discussions lasted 50 minutes on average. The participants were lecturers with previous experience in university teaching and education in the areas of IT, IS, Economics, and Engineering. Some participants additionally had professional working experience. Overall, from 35 participants in the three focus groups, 13 were university professors, while the rest were university lecturers or school teachers. We addressed this target group due to their general understanding in teaching business processes from their previous teaching experience in this topic. All three focus groups consisted of lecturers from the EMEA region. The discussions were conducted at the Technical University of Munich as part of train-the-trainer workshops on business processes with SAP systems. Using this workshop setting was beneficial since the groups already got to know each

other during the workshop and therefore were prepared to discuss in an open way. They also had time to discuss topics related to business processes and teaching during the workshops in advance to the focus group discussion as teaching business processes was the main content of their workshops. Thereby, they already were in the right mindset to build up new ideas.

All focus groups were moderated by the same person, a co-author of the paper. We used semi-structured interview guidelines in each focus group to ensure that the findings are comparable. Furthermore, we applied the critical incident technique [22] to our interview guidelines in order to derive new requirements for teaching BPC in the context of the digital transformation. First, the participants were presented with simulation games as a modern teaching method for business processes. Then, we presented typical teaching scenarios for business processes in the context of the digital transformation, and asked how these are already considered in their curricula. Finally, we asked them about desirable content, technology, and didactical requirements for a simulation game to teach BPC in the context of the digital transformation.

In order to capture the focus group discussions, they were recorded and transcribed. The transcripts were coded using the software MAXQDA, and were analyzed based on the previously found requirements in the literature. If a new requirement was mentioned, it was added to the overall requirements catalog. The coding was conducted by two different researchers, and the found requirements were compared and discussed until a common decision on their relevance was reached. This resulted in a final requirements catalog for a simulation game to teach BPC in the context of the digital transformation.

3 Requirements for Teaching Business Process Change in the Context of the Digital Transformation

3.1 Requirements Identified in the Literature

The goal of the literature review was to identify requirements for a simulation game to teach BPC in the context of the digital transformation. Based on the literature, various requirements could be found. We grouped them by eight different subject areas, which were initially analyzed according to the number of papers per subject area mentioning requirements. While the main focus in the literature is on topics required for teaching BPC in the digital transformation, also didactic aspects such as learning goals, teaching scenarios and teaching methods contain important requirements. Software and tools rather play a subordinate role in the literature, as well as methods and principles. Fig. 1 gives an overview of the most mentioned requirements grouped by their appearance per subject area. This is followed by a more detailed description of the requirements in the mentioned as part of the different subject areas.

Overall, the authors mention various **topics** that are important when teaching BPC in the context of the digital transformation. First, with regard to digitization, the Internet of Things (IoT), Cyber-Physical Systems (CPS), Product Service Systems (PSS), and digital technologies such as sensors are central topics that should be considered [2, 13,

23–26]. These trends can also be summarized under the term Industry 4.0 and play an important role in the education of the future workforce in general [6]. Therefore, it is no surprise that several authors mention them as important topics when teaching BPC. Second, the authors consider various topics from the BPM area. This comprises general business process terminology, business process reengineering, the optimization of business processes and also their transformation [2–4, 12–14, 24, 27–30]. Third, digital business models are emphasized as important topic when teaching BPC [23, 24, 30, 31]. This is most likely due to the strong connection between the establishment of new business models and the resulting changes of the underlying business processes [24]. In addition to the various topics, the authors further mention some **methods** and **principles** that should be taught as part of BPC in the context of the digital transformation. This comprises business process modelling [3, 12, 28], standardization [13], and multidisciplinary [4].

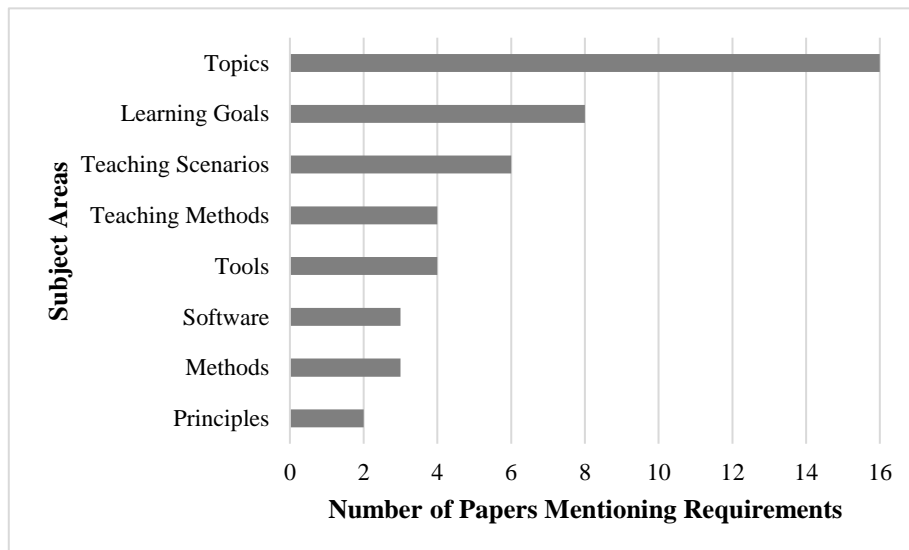


Figure 1. Requirements per Subject Area for Teaching BPC in the Digital Transformation (Source: Own Illustration)

Regarding **software** for teaching BPC in the context of the digital transformation, the usage of an Enterprise Resource Planning (ERP) system is a central requirement [3, 14, 23]. As a company’s business processes are usually implemented in an ERP system, these systems are often used in higher education as a means to teach business processes [14]. Thereby, they are also suitable tools for teaching changes in business processes, e.g. as a result of the digital transformation of an enterprise. Furthermore, the usage of process modelling tools and the Business Process Model and Notation (BPMN) are mentioned as important **tools** when teaching BPC in the context of the digital transformation [3, 12, 28]. This is probably due to the fact that process modelling is a popular method in the IS education to visualize business processes. Therefore, it often serves as a first step when you want to retrace changing business processes [32].

The authors further mention various requirements regarding **learning goals** when teaching BPC in the context of the digital transformation. On the one side, this comprises the understanding of business concepts [14] and the function of BPM in an organization [2–4, 33]. On the other side, applying soft skills such as team communication, problem solving, critical thinking, and decision making is also considered as important [3, 26, 29, 33, 34]. In addition, several **teaching methods** are mentioned as requirements for reaching the learning goals. The methods range from individual teaching methods such as self-learning or homework [2, 3, 12] over group teaching methods such as group work or discussions [12, 33] to newer approaches such as experimental learning or course development by students [12, 14]. According to the mentioned authors, choosing the right teaching method highly depends on the **teaching scenario** a teacher is using. For this, also specific examples are mentioned in the literature. The authors emphasize traditional approaches such as practical exercises or case studies [3, 12, 26, 34] as well as more sophisticated mixed scenarios such as starting with theoretical lectures, going over to hands-on experience with practical exercises and ending with own decision making for the students, e.g. through game-based learning [2, 14]. Altogether, the mentioned teaching scenarios are rather unspecific and always depend on the previously defined learning goals and methods. Hence, an overall teaching concept is necessary to teach BPC in the context of the digital transformation successfully.

3.2 Requirements Identified in Focus Groups

In general, the focus group discussions confirmed the requirements for teaching BPC found in the literature. However, some of the aspects mentioned in the literature were described in more detail by the participants, and were further combined with new aspects.

The participants agreed that digital technologies are an important topic that should be considered as requirement for teaching BPC in the context of the digital transformation. However, they also mentioned that it is important not to focus on any specific digital technology, as this would limit the long-term usage of such teaching materials, e.g.: *“If I was to teach digitization, I would not link it to any specific topic such as IoT, but rather mention examples from digitization and allow the students to come up with their own investigation and opinions about these topics”*. Concerning process management topics, the most important content according to the participants is to teach the end-to-end process that creates value in an organization. This should contain the communication with suppliers and customers, the in-house supply chain management, and also focus on the primary and support activities in an organization, as proposed by Porter [35]. Furthermore, the participants mentioned that the implementation of business processes in ERP systems should be part of teaching BPC: *“for me, the students have to understand three levels in the system, which is the organizational structure, the master data, and transactional data”*. Thereby, they also understand the advantages of an ERP system. In addition to these topics, the participants also confirmed the importance of including process modeling as method for teaching BPC, whilst also mentioning Event-

Driven Process Chains (EPC) and BPMN as concrete modelling languages. In this context, process models can provide a benefit as they help comparing processes before and after the change.

Regarding the required software, the participants went more into detail with concrete examples of software that should be used to teach BPC in the context of the digital transformation. Most of the participants emphasized the need of a cloud-like solution that can be accessed via web browser. Some directly mentioned SAP S/4HANA as the next generation ERP system, which was designed to fit the needs of the digital transformation and which can be accessed through the new browser-based interface SAP Fiori. Another participant stated his desire to use modern devices and interfaces: *“I want to use smartphones, tablets and mobile browsers. They are easy-to-use and the focus should be on the processes and not on the technology”*. The participants further mentioned some details of how this could be implemented within a simulation game. The main user interface should contain a process map, and several apps to manage the different sub-processes of an enterprise. Additionally, there should be an input help, glossary, and links to further information on the processes and on how to use the interface. Altogether, it should be possible to execute and monitor all tasks in the game through this single interface.

Regarding the required learning goals, both soft skills and the knowledge of business concepts were mentioned, equivalent to the findings from the literature. Concerning the teaching methods, the participants emphasized the importance of group teaching compared with individual teaching methods: *“my experience is that teamwork and competition really motivate the students when using a simulation game”*. Additionally, the participants mentioned the positive effect of competition in a simulation game as a way to motivate the students.

However, most of the contributions in the focus group discussions referred to different teaching scenarios that can be taken as recommendation for teaching BPC in the context of the digital transformation. In general, the participants discussed both the advantages and disadvantages of teaching in block courses compared with weekly courses, agreeing on the fact that this mainly depends on the goal of the course or is restricted by guidelines from the participants' schools or universities, which serves as basis for designing a teaching scenario. They also mentioned combinations of both: *“I would start with a simulation game as teaser and afterwards explain what happened in theory”*. In this way, it would be possible to present theoretical methods and content and further experience reasons and scenarios for business process changes in enterprises based on practical exercises, case studies, or teaching cases. Overall, the participants emphasized their desire for a curriculum that can be used in class without extensive adaptations, but which is still customizable to the lecturers' needs: *“it should have a stable basis, but still with open interfaces”*. When discussing this on the concrete example of a simulation game, they mentioned that there should be different variants for a simulation game to teach BPC, which can be adapted based on the scope of the course. Such a game should comprise both strategical and operational tasks, e.g. by providing different roles and tasks to the players. Furthermore, there should be ways for the students to monitor the effects of their decisions, and provide the possibility for the lecturer to evaluate and compare the students' performance. Finally, all participants of the focus

groups agreed that a great teaching scenario would be to start with the process as is, allow the students to make decisions that change the process, and evaluate the process before and after the change. This should be accompanied by theoretical foundations of process modeling, the presentation of a proper teaching case, and the illustration of the processes before and after the change.

4 Applying a Framework for Simulation Games to Structure Requirements for Teaching Business Process Change

In our research, we elaborated several general requirements for teaching BPC in the context of the digital transformation from the literature. Additionally, in three focus group discussions, we evaluated and extended these requirements based on the opinions of lecturers who teach business processes. In order to structure the requirements, we arranged them according to the four-dimensional framework for simulation games by de Freitas and Oliver [36]. This framework serves as basis for developing and evaluating simulation games and consists of the following four parts: learner specification, pedagogy, context, and representation [37]. The learner specification considers the attributes of the particular learner, such as age, level, or their learning background. The pedagogy focuses on the process of learning, which includes teaching methods, materials, and supporting technologies for teaching. The context considers time and location where the learning takes place, and the mode of representation includes the level of fidelity, interactivity, and immersion used in the game [36]. Fig. 2 shows how the requirements analyzed in the previous step were structured according to these four dimensions.

Regarding the **learner specification**, we first decided to focus on IS education, as the focus group discussions emphasized the importance of BPC as part of IS curricula. Furthermore, group-based learning and individual homework will be combined, as both ways were described as very important for teaching BPC in the literature [2, 3, 12, 14, 33] as well as in the focus group discussions. Additionally, especially the focus groups showed that competitions in class increase the learning effects for the students, therefore student presence should be part of the learner specifications. Finally, the literature [12, 33] as well as the focus groups mentioned the importance of group work. Hence, group work and inner-group collaboration will also be included as necessary components of the simulation game.

Regarding the **pedagogic considerations**, understanding BPC as it is induced by the digital transformation is defined as a central learning outcome of the simulation game. This includes topics about the digital transformation [2, 13, 23–26] as well as topics about the whole BPM area [2–4, 12–14, 24, 27–30], as they were described as requirements in the literature. The central learning activities for the students, which were mainly derived from the focus group discussions, will be decision making with respect to the design, execution and redesign of business processes. This includes role-based tasks for the individual students, but each decision will influence the success of the whole team. For instance, if there is a manager role and the role of a clerical assistant, management decisions will influence the tasks the clerical assistant has to do. Finally,

there is a briefing and debriefing included in the pedagogical considerations, which means that there will be a theoretical introduction to the game and its content, and several post-activity reflections during the game. This is important to help the students understand the effects of their decisions and therefore increase their learning success.

<p>Learner Specification</p> <ul style="list-style-type: none"> • Information Systems education • Mixture between group-based learning and individual homework • Competing groups of students • Inner-group collaboration required to successfully manage the game 	<p>Pedagogic Considerations</p> <ul style="list-style-type: none"> • Learning Outcome: Understanding BPC induced by the digital transformation • Learning Activities: Decision making regarding design, execution, and redesign of business processes • Role-based tasks for individual students • Decisions of individuals influence the whole team success • Briefing/debriefing: Theoretical introduction and post-activity reflection
<p>Context</p> <ul style="list-style-type: none"> • University education • Classroom-based courses, incl. homework • Interaction with information systems • Embedding of theoretical and practical content in an overall curriculum 	<p>Mode of Representation</p> <ul style="list-style-type: none"> • Work with a modern ERP system • Work with modern devices and user interfaces • High-level of interaction

Figure 2. Applied Framework for a Simulation Game to Teach Business Process Change (Source: Own Illustration based on de Freitas and Oliver [36])

Regarding the **context** of the game, we mainly extracted the findings from the focus group discussions. This leads to university education as target group of the game, since the focus groups showed that BPC induced by the digital transformation is an important topic in this context. Furthermore, we defined classroom-based courses as context, as the previously described learner specifications and pedagogic considerations imply that attendance is necessary for collaboration and communication between the students. Finally, the interaction with information systems is seen as very important by the participants of the focus group discussions, as well as the embedding of the theoretical and practical game content in an overall curriculum. This will provide the possibility to use and adapt the game according to the lecturers' needs, which is an essential requirement according to the focus groups.

Regarding the **mode of representation**, also the focus group discussions provided specific requirements. The participants emphasized the importance of work with a modern ERP system, and also with modern devices and user interfaces such as smartphones

or tablets. Additionally, there should be a high-level of interaction with these systems, since business processes are a topic which has to be taught in a practical way according to the focus group discussions. Therefore, combining the theoretical content with practical exercises in a system is a central requirement for a simulation game to teach BPC.

5 Discussion and Conclusion

This paper analyzes requirements for a simulation game to teach BPC in the context of the digital transformation. With a structured literature review and focus group discussions, we first extracted and evaluated general requirements for teaching BPC. Afterwards, these requirements were structured according to the four-dimensional framework for simulation games by de Freitas and Oliver [36]. Thereby, important aspects for teaching BPC were analyzed and presented. The main findings are based on the fact that teaching BPC in the context of the digital transformation requires a different approach to cover all parts of this novel topic. Central requirements according to our analysis are the work with a modern ERP system and own decision making with regard to BPC. Hence, traditional teaching methods are not sufficient for education in this topic. Therefore, we propose a simulation game as method for teaching BPC induced by the digital transformation. This game should focus on soft skills, such as group work, decision making and collaboration, as well as on business process knowledge, which comprises BPM, BPC, and the implementation of processes in information systems. Overall, the main focus of teaching should be on the effect of digital technologies on the business processes of an enterprise. As the literature review and focus group discussions showed, there are several ways how this can be taught. Therefore, the framework analyzed these requirements in a general way and serves as basis for future research.

However, especially the focus group discussions showed that there are highly different opinions how BPC should be taught as part of the university education. While some lecturers desire to integrate the newest technologies, devices, and a high level of interaction into their lectures, there are also some who still prefer traditional teaching methods such as frontal teaching. When designing a simulation game to teach BPC in the context of the digital transformation, it is important to consider these different teaching methods and make the simulation game adaptive to the different needs of the lecturers by providing standardized and still customizable teaching scenarios.

Overall, the analyzed framework can be considered for future research regarding the teaching of BPC in the context of the digital transformation, e.g. by extending the framework with more detailed requirements or by developing detailed teaching scenarios for BPC. Furthermore, it can be taken as basis for the design and development of a simulation game to teach BPC in the context of the digital transformation. However, for this, the technical requirements have to be defined prior to the implementation. So far, the requirements are limited to the analysis in the literature and the focus group discussions with lecturers, which mainly address aspects apart from the technical implementation. In a next step, a simulation game to teach BPC in the context of the digital transformation can be implemented based on the requirements as analyzed within this paper.

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