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Managing Process Dynamics in a Digital World: Integrating Business Process Management and Routine Dynamics in IS Curricula

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Abstract:

Information systems students need to be prepared to understand and manage unfolding dynamics in businesses operating in a digital world. We present a university course that systematically integrates knowledge from two streams of research that deal with dynamics: business process management and routine dynamics. Both streams of research study processes, dynamics, and change, but from different perspectives and with different methods and approaches. Our course synthesizes concepts, methods, and theories from routine dynamics with traditional business process management education, to provide students with competences to not only design business processes but also recognize, explain, and react to process dynamics. We present two variants of our course design, which we implemented and delivered at two European universities to students who had different levels of prior knowledge about business process management. We report on evaluations, provide recommendations for teaching and point to implications for research. All course materials are freely available at www.bpm-and-routines.com.

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1 Introduction

Business Process Management (BPM) is a core module in many information systems curricula (Topi et al., 2017). BPM is concerned with the development of methods, tools and frameworks to design, implement and manage business processes in organizations (Dumas, La Rosa, Mendling, & Reijers, 2018; vom Brocke & Rosemann, 2010). Traditionally, BPM has been embracing a prescriptive focus, providing process managers with recommendations and guidelines on how to design and manage work processes (Mendling, Berente, Seidel, & Grisold, 2021; Mendling, Pentland, & Recker, 2020). This focus is mirrored in BPM-related university courses that convey various skills and competences to support BPM initiatives in organizations (e.g. Bergener, vom Brocke, Hofmann, Stein, & vom Brocke, 2012; Recker & Rosemann, 2009; Saraswat, Anderson, & Chircu, 2014; vom Brocke et al., 2020; vom Brocke & Rosemann, 2015a; vom Brocke, Seidel, & Tumbas, 2015).

Without doubt, prescriptive knowledge in the form of tools, methods and frameworks is important for aspiring process analysts and managers (Müller, Schmiedel, Gorbacheva, & vom Brocke, 2016), as it directs their attention toward effective and efficient 'to be'-processes (e.g. vom Brocke, Mendling, & Rosemann, 2021). However, what receives comparably little attention in BPM education, is a *descriptive* focus on how business processes really unfold. A descriptive focus implies shifting attention to the 'as is'-processes as they *actually* run in an organization (Andrews, Suriadi, Wynn, ter Hofstede, & Rothwell, 2018; Davenport & Spanyi, 2019; König, Linhart, & Röglinger, 2019). While process mining applications have brought to light that business process performances often diverge from process models in considerable ways (Gunther, Rinderle-Ma, Reichert, Van Der Aalst, & Recker, 2008; Jans, Alles, & Vasarhelyi, 2014; van der Aalst et al., 2007), the widespread assumption in the field is still that actors will or at least should follow pre-designed process models (Baiyere, Salmela, & Tapanainen, 2020).

But through the ongoing increasing digitalization of everyday experiences, many process design and improvement initiatives enacted in practice on top of digital infrastructure (Bygstad & Øvrelid, 2020) or enabled by digital innovations (Baiyere et al., 2020) no longer follow the classical prescriptive top-down approach of BPM. Instead, they follow a blended logic that also integrates bottom-up dynamics (Badakhshan, Conboy, Grisold, & vom Brocke, 2019; Baiyere et al., 2020; Mendling et al., 2020). A shift towards 'as is'-processes implies that process managers and analysts become attentive and sensitive to the—sometimes subtle—dynamics that unfold in business processes as they are performed and enacted (Huising, 2019; Pentland, Vaast, & Ryan Wolf, 2021).

In this teaching report, we present a university course to equip information systems students with an interest in BPM with additional, complementary competencies to recognize and understand the dynamics emerging in business processes during performance. To this end, we draw on routine dynamics (RD) (Feldman & Pentland, 2003; Feldman, Pentland, D'Adderio, et al., 2021) and demonstrate how RD concepts can be integrated into a BPM curriculum. Like BPM, RD research also studies business processes (Mendling et al., 2021) but it takes a different focus. Located in the broader field of organization studies, it strives to understand why and how processes are enacted in particular ways (Feldman, Pentland, D'Adderio, & Lazaric, 2016), to identify and explain intended as well as unintended dynamics that emerge in organizational work (Feldman, 2016). From this perspective, insights from RD research can be used to equip BPM students with competencies for recognizing and handling emergent dynamics of business processes as they are performed. From a more abstract point of view, our report illustrates how we can integrate contributions from different disciplines to advance our understanding of processual dynamics (Pentland et al., 2021; vom Brocke, Van Der Aalst, et al., 2021).

In the following, we describe and explain the structure and content of a university-level course that systematically connects BPM and RD research. We implemented and taught this design in two courses at two European universities in 2020 and 2021. In one course, we drew on the BPM lifecycle (Dumas et al., 2018) to structure the course and then contrasted the BPM and RD research streams along the phases *process identification* and *process discovery*. In the other course, we foregrounded process theory, the ontological background of RD research (Langley & Tsoukas, 2017), as our course structure and mapped empirical findings from that stream to BPM concepts. We present the structure of both course designs, report on student evaluations we received on both, and develop recommendations for teaching. All lecture materials are freely available for teaching at www.bpm-and-routines.com.

2 Business Process Management and Routine Dynamics

BPM provides recommendations for managers and organizations to design and manage efficient and effective business processes. Research has developed frameworks that shed light on different aspects of BPM. The BPM lifecycle describes in an idealized way how processes can be managed (Dumas et al., 2018), including, for instance, the design and implementation of business processes. Also, it has been suggested that organizational capabilities for successful BPM form around six pillars, including strategic alignment, governance, methods, information technology, people and culture (Rosemann & vom Brocke, 2015; Schmiedel, Recker, & vom Brocke, 2020). University courses typically build onto these frameworks, and either progress along the entire lifecycle (Dumas et al., 2018) or zoom into specific aspects of BPM, such as process modeling (Recker & Rosemann, 2009).

At least since the advent of process mining technology (Van Der Aalst, 2016; Van der Aalst, Weijters, & Maruster, 2004), BPM scholarship has become more interested in the dynamics of business processes (vom Brocke, Van Der Aalst, et al., 2021), that is, the recognition of how and why processes unfold as they are enacted. The main interest of BPM is to balance its focus on 'to be'-processes with an equal attention to 'as is'-processes (Davenport & Spanyi, 2019). To this end, insights obtained through process mining, for example, reveal that business processes often exhibit a large number of variants (e.g. Andrews et al., 2018; Van Der Aalst, 2011). Also, proponents of social BPM (Suša Vugec, Tomičić-Pupek, & Vukšić, 2018) argue that BPM research should direct more attention to the social dynamics of organizational work in order to better understand collaboration and coordination issues that are often ignored in process designs. Furthermore, studies on context-aware BPM (Bose & Van der Aalst, 2009; Rosemann, Recker, & Flender, 2008; Weber, Grisold, vom Brocke, & Kamm, 2021) have long questioned the applicability of a 'one size fits all'-approach in process design; they advocate for obtaining an in-depth analysis of contextual requirements reflected in process designs. Furthermore, it has been argued that the dynamics emerging from digital innovation and transformation defy the established logics of BPM (e.g. that all relevant behaviors should be modelled and actors will follow these models, see Baiyere et al., 2020) because much of what will happen in the future cannot be anticipated in the present (Mendling et al., 2020).

One of the moves to expand the assumptions of BPM (Baiyere et al., 2020; Mendling et al., 2020; Recker, 2014) has been to connect BPM research with research on routine dynamics (RD). At the core of RD research (e.g. Feldman & Pentland, 2003; Feldman, Pentland, D'Adderio, et al., 2021; Feldman et al., 2016) is the insight that business processes and other organizational routines are not as stable as assumed. While, from a distance, routines often appear to be inert, a closer look reveals their endogenous dynamics which, over time, will also change their structure. Through an in-depth exploration of these endogenous dynamics, this research community has developed concepts and methods to unravel and explain the continuous change of routines. One central idea is that a routine has an ostensive aspect (how the routine is understood) and a performative aspect (how the routine is being enacted at a specific point in time), and that a routine changes over time because these two aspects recursively interplay. RD researchers study different phenomena involved in organizational work, for example, how actors learn (Dittrich, Guérard, & Seidl, 2016), coordinate (Dionysiou & Tsoukas, 2013), find workarounds (Pentland et al., 2021) or prioritize tasks (Kremser & Blagoev, 2021). From a methodological point of view, routine dynamics is strongly driven by observational field research, primarily drawing on qualitative methods, such as interviews and ethnographies (e.g. Dittrich et al., 2016; Kremser & Blagoev, 2021).

Concepts and methods from RD can be useful to foreground and explain aspects of business processes that have received little attention in established BPM research (Beverungen, 2014). For example, it has been argued that the implementation of process mining can trigger unexpected dynamics in organizations, which can be explained through insights from RD (Grisold, Mendling, Otto, & vom Brocke, 2020, see e.g. Berente et al. 2016). Relatedly, Mendling et al. (2020) argue that RD also provides a useful perspective to shed light on the dynamics surrounding digital innovation which can often not be fully anticipated.

Table 1 contrasts the two fields of BPM and RD. It shows that both fields study the same phenomenon – that is, work processes in organization– but they do so with different objectives and interests. The exemplary research questions and studies underline that BPM and RD provide complementary perspectives on similar research themes.

Table 1. Contrasting Business Process Management and Routine Dynamics Research (see Mendling et al., 2021; Mendling et al., 2020; Wurm et al., 2021)

	Business Process Management	Routine Dynamics
Core phenomenon	Business process as “collection of activities that takes one or more kinds of input that is of value to the customer” (Hammer & Champy, 1993, p. 35)	Organizational routine “as repetitive, recognizable patterns of interdependent organizational actions carried out by multiple actors” (Feldman & Pentland, 2003, p. 95)
Research objective	Largely prescriptive; designing organizational work with respect to certain key performance indicators (Dumas et al., 2018)	Largely descriptive and explanatory; studying how routines form, change and dissolve in intended as well as unintended ways (Feldman et al., 2016)
Knowledge contribution	Frameworks, tools and (computational) methods to support the design and management of business processes (e.g. Dumas et al., 2018; Rosemann & vom Brocke, 2015)	Theories to explain the dynamics of organizational routines through inductive research designs, drawing on interviews and/or ethnography (e.g. Dittrich, 2021; Feldman et al., 2016)
Exemplary research questions	How to (re-)design a business process in optimal ways? (e.g. Reijers & Mansar, 2005) How to support business processes through digital technologies? (e.g. Mendling et al., 2018) How to predict and proactively manage business process performance? (e.g. Breuker, Matzner, Delfmann, & Becker, 2016)	Why and how do routines diverge from intended designs? (Pentland & Feldman, 2008) Why and how do digital technologies change routines in (un-)anticipated ways? (Berente, Lyytinen, Yoo, & King, 2016) Why and how do organizational actors adjust routines in light of anticipated future events? (Dittrich & Seidl, 2018)

3 A Higher Education Course Integrating BPM and RD

This section presents the design of a university-level course that we called “BPM and Organizational Practice”. It sets out to teach aspiring process analysts and managers to become more attentive to ‘as is’-processes as they unfold in organizations. In analogy to Schoen (1983), our course aims to educate ‘reflective process practitioners’: process managers and analysts who are able to recognize, understand and deal with process dynamics, and adjust their management practices, if needed. We taught this course at two European universities (WU Vienna and University of Liechtenstein) to two student audiences with different backgrounds (Bachelor and Master students) in 2020 and 2021. Accordingly, we developed two versions of this course.

Course design 1 was taught at the Vienna University of Economics and Business (WU Vienna), Austria, and targeted Bachelor students enrolled in the study programs “business administration”, “business law”, or “information systems” with the specialization “Process and Knowledge Management”. Students in this specialization have little to no prior knowledge about BPM. Course design 1 first introduces core concepts of BPM before gradually presenting insights from routine dynamics.

Course design 2 was taught at the University of Liechtenstein as an elective course to students enrolled in the Master program “Information Systems”. Prior to taking the course, the students completed BPM courses that provided them with received advanced knowledge, including key frameworks, such as the BPM lifecycle (Dumas et al., 2018) and the BPM capability framework (vom Brocke & Rosemann, 2015b). Furthermore, the students previously attended courses on information systems design, implementation and management. Course design 2 starts by drawing on the implications of strong process theory (Tsoukas & Chia, 2002) as the ontological background of routine dynamics research before it maps them against concepts in BPM. We describe both courses in the following.

3.1 Course Design 1

Course design 1 was developed as an elective course for students in the bachelor specialization “Process and Knowledge Management” at WU Vienna. The course is awarded with 3 ECTS¹ points. Depending on

¹ ECTS stands for “European Credit Transfer and Accumulation System”; 1 ECTS point corresponds to 25 working hours on the side of students (including taught units and private study time)

their study program (“business administration”, “information systems”, or “business law”), students may or may not have had previous touch points with business processes and the management of information systems. Students in the study programs information systems and business administration typically have some knowledge on (process) modelling. Students enrolled in business law typically do not have prior relevant knowledge.

Against this background, course design 1 provides an introduction to the management of organizational processes while it does not assume any prior knowledge. As such, the course combines the most fundamental aspects and techniques from BPM with theoretical insights from routines dynamics research. The overarching goal of the course is to educate aspiring process analysts who can design, analyze, and manage organizational processes, but also understand their endogenous dynamics.

To do so, course design 1 draws on the BPM lifecycle (Dumas et al., 2018) and compares BPM and RD along two phases: process identification and process discovery. It reflects on key research themes in BPM, teaching students how to create process models (Mendling, Reijers, & van der Aalst, 2010) and discover processes from digital trace data through process mining (Van Der Aalst, 2016). Furthermore, it discusses principles of ethnographic fieldwork (Dittrich, 2021) and puts an explicit focus on how information technology influences and is influenced by the endogenous dynamics of organizational processes (e.g. Berente et al., 2016).

Table 2 summarizes course design 1. Overall, the course consists out of 8 lectures. The course starts with a general introduction to organizational processes, contrasting BPM and organizational routines (Mendling et al., 2021; Wurm et al., 2021). It then continues with the lifecycle phases of process identification and process discovery. Afterwards, the last lectures focus on organizational routines and the role of information technology in their dynamics. Each lecture comprises explanations of theoretical aspects, concepts, and techniques combined with exercises and questions for reflection. In addition to the work in class, students carry out a small individual project where they collect ethnographic data on a process of their choice and analyze their data using a process mining software. Each lecture starts with a recap of the previous one. The syllabus of course design 1 and details of each lecture are provided in Appendix 1.

Table 2. Summary of Course Design 1

Audience	Bachelor students
Required knowledge	None
Intended learning outcomes	Competences to identify, model, and analyze business processes Awareness about dynamics that emerge in business processes
(Suggested) number of lectures	8 (3 hours each with lectures being held weekly or bi-weekly)
Key contents	Process discovery Process modeling using BPMN Ethnography Process mining Dynamics of organizational processes
Exercises	Process modeling Hands-on-exercise on ethnography Computational process analysis (process mining)
Workload	75 hours (3 ECTS)

3.2 Course Design 2

Course design 2 was designed for students enrolled in the Master program “Information Systems” at the University of Liechtenstein. Students who take this course are in their second semester. In the first semester, these students attended a 6 ECTS course on BPM that provided them with a comprehensive introduction to key frameworks (Dumas et al., 2018; vom Brocke & Rosemann, 2015b) and basic concepts, such as business process design. They also learned about the role of information systems, such as process mining and ERP systems, in business processes.

Course design 2 is offered as an elective course for students who wish to deepen their knowledge about BPM. The course emphasizes that the management of business processes does not necessarily follow linear models and frameworks as they were acquainted with in the first semester. The course shows that business processes, and the implementation and use of information systems in business processes, can trigger unexpected dynamics that process managers need to respond to. Therefore, the expected benefit for students is that they develop an awareness for such dynamics as well as competences to deal with

them. Epistemologically speaking, the aim of this course is to complement students' theoretical knowledge about BPM with knowledge on how they can apply it in practice (Eraut, 1985).

To this end, course design 2 foregrounds strong process theory as an ontological background of routine dynamics (Goh & Pentland, 2019; Tsoukas & Chia, 2002). At its core, strong process theory suggests that the world is in "volatile flux" (Rescher, 2000, p. 5) and a constant state of becoming. Accordingly, we *perceive* a world that is relatively stable but in fact, it is dynamically changing and evolving (Chia, 1999). Hence, studying (organizational) phenomena from the perspective of strong process theory foregrounds processual dynamics at different scales and examines how these phenomena are constantly 'in the making' (Langley & Tsoukas, 2017). Thinking in terms of strong process theory provides students with an increasing awareness that dynamics in business process performance occur on an everyday basis, but can be very subtle.

Table 3 summarizes course design 2. It comprises 8 lectures. Besides strong process theory (Rescher, 2000), the course touches upon topics related to BPM, especially focusing on its key assumptions (Baiyere et al., 2020). Furthermore, it contrasts BPM with RD along specific themes. In particular, it highlights the role of learning and coordination (e.g. Dionysiou & Tsoukas, 2013), and IT implementation (e.g. Berente et al., 2016). Each lecture has a practical part where students perform hands-on exercises to reflect on theoretical content. We provide mandatory as well as suggested readings for each lecture. The syllabus and a detailed description of each lecture is presented in Appendix 2.

Table 3: Summary of Course Design 2

Audience	Master students
Required knowledge	Advanced; knowledge about key models, frameworks and basic concepts of BPM Basic knowledge about information systems use, design, implementation and management
Intended learning outcomes	Awareness about dynamics that emerge in business processes Competences to recognize and manage such dynamics
(Suggested) number of lectures	- 8 (3.5 hours each with lectures being held weekly or bi-weekly)
Key contents	Process ontology Underlying assumptions of BPM Contrasting BPM and RD along specific themes (e.g. learning and coordination)
Exercises	Reading exercises Computational process analysis (process mining) Hands-on-exercise on ethnography
Workload	100 hours (4 ECTS)

4 Feedback and Evaluations

We delivered two iterations of each course design at two European universities. We evaluated all courses with regards to course structure, contents, and opportunities for improvement. Table 4 provides an overview the evaluations. Overall, the evaluations indicated that students were very satisfied with both course designs. For course design 1, students mainly highlighted didactical elements. They reported that the various examples from practice and the project work helped them to better understand the contents discussed in class. With respect to course design 2, students emphasized that the course helped them to understand how and why organizational processes change and how this complements traditional BPM. We present detailed evaluations and student feedback for each course design next.

Table 4: Summary of Course Feedback and Evaluations

	Course design 1	Course design 2
Overall impression	Overall very positive, especially due to relevance for practice (e.g. use of digital tools)	Overall very positive, especially due to relevance for practice (e.g. hands-on exercises and examples)
Perceived benefits	Competences to identify, model, and analyze business processes Awareness about dynamics that emerge in business processes	Awareness around emerging dynamics in business processes and business environments in more general terms Competences to recognize and manage these dynamics
Positive comments	Course environment and discussions Examples from practice Use of digital tools for process modeling	Understand how and why organizational processes change Process model/reality-divide

	and process mining Project work to apply course contents to a real-life process	More realistic understanding of (organizational) change
Suggestions for improvements	Assignment on process modeling instead of reflection exercise (suggestion implemented)	More real-world examples

4.1 Course design 1

Course design 1 was taught thrice at the Vienna University of Economics and Business in winter semester 2020/2021, summer semester 2021, and winter semester 2021/2022 respectively. Overall, 38 students attended the course. Due to the Covid-pandemic, all courses were taught virtually. While teaching the course, we made slight adaptations to account for student feedback, but we generally closely followed the syllabus (see Appendix 1). We tried to make lectures as interactive as possible and provide ample room for discussions.

We conducted two evaluations of course design 1. The first evaluation followed the standard template for evaluations at WU Vienna that is amendable only to a limited extend. We conducted an additional customized evaluation that addressed more specific aspects of course design 1. Both course evaluations covered didactical aspects as well as feedback on the course contents. We received 25 responses for the first and 12 responses for the second evaluation, respectively.

In the evaluation, students highlighted the interactive environment that helped them to reflect on the course content of the course.

The practice examples in class. The environment [...] enables a work-environment where students want to participate, because you get value out of it. (Student, winter semester 2020/2021)

Especially good were the discussions, which help to understand the content. (Student, winter semester 2020/2021)

Students emphasized that the examples used in class helped to better understand the covered theoretical concepts.

Lots of examples, which were very good to understand the topics. Very interactive. (Student, summer semester 2021)

Especially the examples from practice (NASA, train maintenance) were very interesting, which make understanding the theoretical part much easier. Additionally, I believe that through the practical orientation, the content will remain longer and more sustainably in the heads of students. (Student, winter semester 2020/2021)

Even more practical examples would be nice. (Student, winter semester 2020/2021)

Students found the use of the different tools (Signavio and Celonis) in class not only instructive, but also fun:

It was really fun and instructive. I was never working with such tools before. The instructor really taught me to work with analytical tools. (Student, summer semester 2021)

Give process mining a try, it might change your way of thinking or improve your daily life. (Student, winter semester 2020/2021)

It was actually fun, I honestly didn't expect that. I felt like a detective during the process, would love to work as a process analyst. (Student, winter semester 2021/2022)

The student projects were found to be an important component of the course as they help students to apply the course content to real-life processes. Student stated:

The project work was very important to learn how to apply the theory. (Student, summer semester 2021)

Brilliant. Link between project work and lecture was very strong and with that you learn the most. (Student, winter semester 2021/2022)

It should be noted that even during lock-down, students did not have major problems collecting data for their projects. Multiple students stated that the findings gained through their project work were insightful. One student who investigated the coffee making process in his shared flat commented:

The results will be discussed with my flatmates and maybe one or the other will change their behavior at the coffee machine. (Student, winter semester 2020/2021)

After the first iteration of the course during the winter semester 2020/2021, one student suggested to replace the initial reflection exercise on the overall course with an assignment on process modelling:

Not necessary is in my opinion the reflection paper. Instead of it, one could create smaller exercises that should be completed before the exam in order to practice the modelling of processes. This would prepare the students additionally for the exam and would thus be more advantageous than the reflection exercise. (Student, winter semester 2020/2021)

The suggestion by the student was used to adjust the curriculum. Now, the assignment on process modeling helps to capture students' knowledge and check whether clarifications are required.

In summary, the course was successful in introducing students to BPM and RD. The evaluation indicates that students especially profited from the use of tools in class and the application of the course contents throughout their project work to a real-life process of their choice.

4.2 Course design 2:

We taught course design 2 at the University of Liechtenstein in summer terms 2020 and 2021. In total, 32 Master students participated and 28 took part in the evaluation. Due to Corona, we could not entirely follow the syllabus as outlined in Appendix 2. This was due to the shift to virtual teaching and the fact that we could not conduct all group works as they were designed. Despite the shift to virtual teaching, we held highly interactive lectures and extensive discussion rounds. We also invited guest lecturers (e.g. from Celonis, a world-leading process mining provider) who provided additional insights on business process dynamics.

The evaluation was customized to ask targeted questions about (1) the extent to which the connection between BPM and RD was comprehensible, (2) the means by which the course materials were presented, and (3) the implications that students see for practice. In the following, we provide statements from the evaluations.

The evaluations indicate that the course was successful in conveying the connection between BPM and RD. One student indicated that one of the key insights s/he obtained was about

The different drivers of change and the aspects of it. Because it helps to further understand WHY things are happening and WHY people are behaving in a certain way. (Student, Summer term 2020)

Another student indicated that he/she gained

An understanding that simply modelling everything "to the ground" and trying to micromanage it might not be the best way to handle process management in every scenario. [...]. Especially in scenarios with highly dynamic organizations applying routine dynamics practices is a more than valid alternative. (Student, Summer term 2021)

Students reported that they see much practical value in this course. Many of them were or are working companies and they found utility in being able to shift their attention to subtle dynamics in organizational work. One student reported on the following key take-away:

A different, probably more realistic understanding of (organizational) change and that those little actions taken by each and everyone on any given day can and do make a huge difference when looking at the organizational context. Additionally, more awareness for routines in general - how they are created, changed and what happens when a new person joins a group of people that has a routine established already. In contrast to many hard skills taught an university, this knowledge can be applied each and every day - thereby helping a lot! (Student, Summer term 2021)

One student also reported that the implications of strong process theory have implications for his/her work beyond business process management. He/she notes that

I will take with me the strong process theory that everything is constantly becoming but we normally tend to think of something as stable. This is something I take with me as it helped me in my personal life as well - Another part is the way that we learn with social interaction and decrease uncertainty. [...] (Student, Summer term 2021)

In terms of improvement, students indicated that in addition to the empirical insights provided by studies on RD, they would appreciate more connections to real-world examples and actual business cases. One student noted that

I think at Uni we covered most of the aspects and in depth topics but it would more interactive if there will more real time examples and cases. (Student, Summer term 2020)

In a similar vein, one student reported that

I believe that this course helped to further enhance my understanding of these dynamics, but I would have liked to see more practical cases during the class on ways to really implement this thinking / dynamics into a business. (Student, Summer term 2021)

Taken together, the course fulfilled the goal to connect BPM and RD and provide students with an awareness towards dynamics that emerge in business processes. More in-depth examples can be provided.

5 Discussion

5.1 Recommendations for teaching

We recommend considering the following points when teaching one of the two course designs.

First, start simple. Both course design 1 and 2 blend two entirely different streams of literature and ideas, and it is important that students gradually learn each area's key concepts first before relating them to one another. Based on our experience, it is advisable to start lectures with brief 're-cap sessions' to state the 3-5 key take-aways of the previous lecture. This proved useful for students as they could repeat what has been discussed before, but also for lecturers because they could assess whether all concepts have been understood correctly. The basic tenets of strong process theory in course design 2, for example, initially appeared counter-intuitive to most students as they tend to implicitly assume a substantialist view on the world when they think about change (Chia, 1999). Repeating the idea of strong process theory helped them to understand its implications. We also observed that explanations and exercises should be based on examples and processes that are familiar to students (Recker & Rosemann, 2009), such that none or very little domain knowledge is needed and students can fully focus on the concepts and theories being introduced. It is also useful to reflect on all concepts with regards to their practical implications. Guiding questions can be: How does a given concept allow us to see aspects of organizational work which remained unknown before? How does a given concept inform management activities?

Furthermore, we recommend to continuously complement abstract knowledge (e.g. concepts, assumptions) with hands-on exercises. An important factor for the positive evaluations of our course designs was that students could continuously reflect on how the theoretical content adds actual value to business process management in organizations. Besides manual exercises on business process modeling, design and ethnography, we also included exercises that involve new digital tools and methods, such as process mining or process modeling in a virtual environment. We did so for two reasons. On the one hand, these tools create additional awareness around dynamics in business processes. On the other hand, students will presumably deal with them in their future careers as these digital tools become more and more prevalent in business processes (for the case of process mining, see e.g. Gartner, 2019). We chose tools that are free for students, widely used in practice, and easy to learn (more details can be found in the Appendix).

Finally, we recommend to design the final exam such that it reflects whether students can translate the contents of the course into practical implications. The course contents provide ample opportunities for doing so. We provided them with tasks, for example, where they were asked to explain the relevance of a given concept for planning and decision-making, argue for its strengths and weaknesses, and provide own examples when explaining the concept. In course design 2, we included a case study where students should develop a BPM approach that is based on insights from RD. The exams are not freely available on the website but the corresponding author of this paper is happy to share them upon request.

5.2 Implications for Research

We also see a number of implications for information systems research, and the management field in broader terms.

First, our work follows a recent interest to revisit the assumptions and logics of BPM in the digital age (Baiyere et al., 2020; Kerpedzhiev, König, Röglinger, & Rosemann, 2020; Mendling et al., 2020). Core to this emerging body of knowledge is the observation that digital innovation is driven by rapid dynamics, unforeseen changes and unprecedented novelty (Benbya, Nan, Tanriverdi, & Yoo, 2020; Mousavi Baygi, Introna, & Hultin, 2021), which challenges the assumption that optimal business processes can be designed in the present and will be strictly followed in the future (Baiyere et al., 2020). We add to these works and further specify that three aspects of business process management should receive particular attention: business process design, implementation and management. Our course design sheds light on how aspiring managers can pay attention to these aspects. Future research can further study how BPM can account for dynamic working environments by focusing on these three aspects.

Second, we advance the connection between BPM and RD. Both research communities study business processes from different angles (Mendling et al., 2021), and several recent claims call for a cross-fertilization among BPM and RD researchers (e.g. Mendling et al., 2020; Pentland et al., 2021). While the majority of the existing works discuss how BPM can contribute to routine dynamics, primarily on the grounds of computational tools (e.g. Grisold, Wurm, Mendling, & vom Brocke, 2020; Mendling et al., 2020; Pentland, 2017; Pentland et al., 2021), we look at this the other way around. As we integrate descriptive and explanatory insights from RD research, we show that this stream of research can contribute to the management of business processes in different ways. To this end, we identify key themes that are useful for BPM, including the lexicon of routine dynamics (e.g. ostensive and performative aspects of routinized work), empirical observations about process dynamics (e.g. unintended consequences of information technology on business process performance) as well as methodological approaches (e.g. ethnography). From a more abstract point of view, our course echoes recent calls to integrate assumptions, methods and theories from fields that pursue different yet complimentary views on processes (vom Brocke, Van Der Aalst, et al., 2021). Future research can further study how our findings enable process managers in actual work environments to recognize and manage dynamics in business processes.

Third, our work aligns with a broader interest in the management field on how organizations and managers can deal with the dynamics of today's business environments (e.g. Chia, 1999; Peschl, 2019; vom Brocke, Van Der Aalst, et al., 2021). To embrace a future that is characterized by "more uncertainty, more unpredictability, and more unknowns" (Rinne, 2021), a growing number of works set out to translate implications of a strong process view into managerial recommendations (Hertz, Garcia, & Schlüter, 2020; Peschl, 2019; Rinne, 2021). We add to this emerging interest and propose methods and tools that managers can use to integrate "fluxiness" (Rinne, 2021) into planning and decision-making. In particular, we suggest how managers can develop awareness for work dynamics and draw on ethnography and process mining to recognize and analyze these dynamics. Future research can examine how and to what extent the approaches we have developed here are applicable to other management domains, such as marketing or strategy.

6 Conclusion

In this teaching report, we have mapped out an innovative course design that integrates business process management and routine dynamics research. The key idea is to teach students how they can account for, recognize, and manage the dynamics of contemporary organizational work. All teaching materials are available for free on www.bpm-and-routines.com.

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Appendix 1

Detailed structure and Content of Course Design 1

The syllabus of course design 1 is shown in Table 3. Each lecture comprises explanations of theoretical aspects, concepts, and techniques combined with exercises and reflection questions. In addition to the work in class, students perform a small individual project where they collect ethnographic data on a process of their choice and analyze their data using a process mining software². Each lecture starts with a recap of the previous one.

Lecture 1 provides a general introduction into the course. It includes organizational matters, and an instruction round where students share their personal experiences with organizational processes. Furthermore, the fields of BPM and RD are outlined along with their differences and commonalities. Definitions of business processes and organizational routines are compared and discussed.

Lecture 2 presents process identification and process discovery as two phases of the BPM lifecycle (Dumas et al., 2018). Important concepts and techniques include the process landscape model, the process portfolio as well as different approaches to process discovery (for example, interview-based and automatic process discovery). The lecture is accompanied by illustrative examples of local companies, for example 'Wiener Linien' (the public transport provider of the city of Vienna). Several hands-on exercises are included for students to apply the presented techniques. For example, students create a process model portfolio of a fictitious university and identify potential interviewees for process discovery.

Lecture 3 introduces the students to process modeling with BPMN. From a conceptual point of view, the primary language elements, its syntax and modelling conventions (Mendling et al., 2010) are explained based on exemplary processes (Dumas et al., 2018). The lecture also gives an introduction to the Signavio process modeling suite, the most widely used software for collaborative process design. The lecture contains verbal descriptions of exemplary processes and students are asked to translate them into a process model using Signavio using AND, XOR, and OR gateways.

Lecture 4 focuses on advanced BPMN. After repeating core aspects of basic BPMN, it continues with more complex modelling elements, including additional event types, process decomposition and reuse, exception handling, and parallelization (Dumas et al. 2018). Again, the lecture comprises several process modeling exercises. The assignment on process modeling after this lecture serves to test the students' process modeling knowledge and assess whether there are any ambiguities that should still be discussed.

Lecture 5 combines principles of ethnographic fieldwork (e.g. Dittrich, 2021) with an introduction to process mining (Van Der Aalst, 2016). First, it discusses the role of ethnography in organizations and illustrates this with research from Mark de Rond about the Cambridge University Boat Club (Cambridge University, 2009). Second, it gives a hands-on demonstration of process mining drawing on the 'pizzeria'-use case of the process mining vendor Celonis³. Last, the lecture discusses how ethnographic observations and digital trace data can be analyzed with process mining software.

Lecture 6 recaps and expands on the dynamics of organizational processes as introduced in lecture 1. Furthermore, this lecture sheds light on the relationship between information technology and organizational routines. To illustrate these dynamics, it presents Berente et al.'s (2016) study on NASA's implementation of an integrated financial management system. By following the vignettes presented in the paper, students and the instructor together analyze how organizational routines and information technology co-adapt to overcome misalignments of information systems implementations (Berente et al., 2016). The lecture is accompanied by a reflection exercise for students to think about how process change occurred in processes that they are familiar with.

Lecture 7 extends the discussion on the interrelationship between organizational routines and IT with a focus on physically-straining work. This lecture is case-based and asks the students to transfer what they have learned so far and apply their knowledge to an unpublished case of one of the authors. What makes the discussed case interesting is that information technology is not used in a traditional office environment, but in the maintenance plants of one of Europe's largest railway provider. After the general description of the case, students are provided with interview excerpts that describe the usage of tablet computers in different maintenance routines. After discussions in small groups, findings are shared across

² In this course, we used the software *Celonis* (www.celonis.com) which offers free licenses for students.

³ We used the pizzeria use case provided by Celonis.

groups and the course instructor summarizes the conversation. The lecture closes with a synthesis of the material and the discussion of open questions. The course highlights that (1) there are different approaches to collect and present knowledge about organizational processes, (2) processes might deviate from their intended design, and (3) there are different digital tools for process modeling and process mining.

Finally, lecture 8 concludes the course with the exam comprising theoretical questions on BPM and RD as well as exercises on the techniques presented in class.

Table 3. Syllabus of Course Design 1

Lecture No.	Lecture content	Exercise	Reading
1	Organization Introduction to course Get to know each other Introduction to organizational processes	Reflection on a process based on students' experience	Suggested: Dumas et al. (2018), Chapter 1 Wurm et al. (2021)
2	Process identification Process discovery	Creation of a process portfolio for a fictitious university; identification of interviewees for process discovery	Suggested: Dumas et al. (2018), Chapters 2 and 5
3	Basic BPMN	Process modeling exercises: Modeling of AND, XOR, and OR gateways	Suggested: Dumas et al. (2018), Chapter 3
4	Advanced BPMN	Modeling exercises: Modeling of rework, multi-instance activities, and event-based gateways	Suggested: Dumas et al. (2018), Chapter 4
5	Introduction to ethnography Process mining	Hands-on process mining walk-through using the Celonis pizzeria case	Suggested: Dumas et al. (2018), Chapters 5 and 11
6	Introduction to routine dynamics Information systems and organizational processes	Reflection on process deviation and process change based on students' experience: How do (did) familiar processes change?	Suggested: Miller et al. (2012) Wurm et al. (2021) Berente et al. (2016)
7	Interplay of physical work and information technology in organizational processes Synthesis Discussion	Analysis of interview statements from one of the authors' research project	

Appendix 2

Detailed Structure and Content of Course Design 2

Lecture 1 introduces students to the general idea of the course. It points to recent studies that highlight the dynamic nature of business processes and underlines the relevance for process analysts and managers to become more attentive to dynamics of business processes. In the exercise part, students gather in groups of 2-3 and model a business process which at least one of the group is familiar with (e.g. from his/her workplace). Students can use any modelling language they know. The resulting process model is expected to have 40-50 elements (activities and events).

Lecture 2 presents the basic principles behind strong process theory. Strong process theory embraces the idea that the world is in a constant state of flux (Tsoukas & Chia, 2002), and the lecture emphasizes that organizational reality—including business process management—is constantly changing and becoming (Langley & Tsoukas, 2017). In the practical part, students use the process model they designed in the first lecture to discuss where, when and why dynamics (can) occur. Students are encouraged to think of all kinds of dynamics (subtle versus major; expected versus unexpected; likely versus unlikely).

Lecture 3 sheds light on the core assumptions of BPM, stressing that it is traditionally based on a prescriptive focus that assumes a considerable degree of stability in organizational work. It introduces the basic concepts of RD research and contrasts its underlying assumptions with those of BPM (Beverungen et al., 2020; Mendling et al., 2021). The process model is once again used to reflect on assumptions that underlie BPM. Guiding questions are; What does BPM assume about a process? What does it assume about those who are involved in the process? What does it assume about the environment in which an organization operates?

Lecture 4 presents the first theme from routine dynamics research. It sheds light on the role of learning and coordination in business processes (Dionysiou & Tsoukas, 2013; Dittrich et al., 2016). It stresses that business process performance involves human sense-making, learning and different types of memory which are gradually built up as actors work together (Miller et al., 2012). The exercise part familiarizes students with basic principles of ethnography. Students are encouraged to choose a process (e.g. from their workplace, such as a daily stand-up meeting) and conduct an ethnographic observation until the next lecture.

Lecture 5 focuses on IT implementation and intentional process change (Pentland & Feldman, 2008). Drawing on findings from routine dynamics research, the lecture conveys that new IT systems (e.g. ERP systems) can affect business process performance in many unintended ways (Berente et al., 2016; Volkoff, Strong, & Elmes, 2007). In the exercise part, students report on their ethnographies and reflect on how they can use their experiences in work settings.

Lecture 6 focuses on process dynamics. It draws on recent studies (Goh & Pentland, 2019; Pentland, Liu, Kremser, & Haerem, 2020) that measure and explain such dynamics in terms of changes in process complexity. Lecture 6 introduces a case study where students are encouraged to translate insights gained from routine dynamics research into managerial actions and strategies.

Lecture 7 synthesizes all lectures and concludes that the connection between BPM and RD is useful in three respects. With respect to (1) business process design, a RD perspective underlines that there is need to integrate feedback and adjust designs after they have been implemented (Mendling et al., 2020); (2) business process implementation, a RD perspective stresses that new process designs and, in particular, new IT can lead to unintended side-effects that managers need to respond to (Berente et al., 2016); (3) process management, a RD perspective enables managers to better understand why and how dynamics occur, which in turn, can enable effective decision-making (Dittrich et al., 2016). In the exercise part, students continue working on the case studies, and compare and discuss their strategies at the end of class.

Table 4. Syllabus of Course Design 2

Lecture No.	Lecture content	Exercise	Reading
1	Organization Introduction to course Motivation for this course	Process modelling: Modelling of familiar process in group 2-3	Mandatory: Mendling et al. (2020) Suggested: Huisling (2019)

2	Strong process theory	Process modelling (continued): Discussing sources of expected/unexpected dynamics in modelled process	Mandatory: Van de Ven & Poole (2005) Suggested: Tsoukas & Chia (2002) Langley & Tsoukas (2017)
3	Core assumptions in BPM Routine dynamics: basic concepts BPM versus routine dynamics	Process modelling (continued): Discussing assumptions about work and people that underlie the process model	Mandatory: Mendling et al. (2021) Suggested: Baiyere et al. (2020) Recker (2014)
4	Theme 1: Learning and Coordination	Ethnography: Introduction to ethnography; selection of phenomenon to be observed	Mandatory: Feldman & Pentland (2003) Suggested: Dittrich et al. 2016 Dionysiou & Tsoukas 2013
5	Theme 2: IT implementation and intentional process change	Ethnography (continued): Comparing results and reflecting on experience	Mandatory: Berente et al. (2016) Suggested: Volkoff et al. (2007) Pentland & Feldman (2007) Grisold et al. (2020)
6	Theme 3: Process dynamics	Case Study: Developing management implications through routine dynamics	Mandatory: Goh & Pentland (2019) Suggested: Pentland et al. (2022) vom Brocke et al. (2021) Grisold et al. (2021)
7	Synthesis: Implications from RD for BPM Discussion	Case Study (continued): Developing management implications through routine dynamics.	Mandatory: Kremser & Xiao (2021) Suggested: Grisold et al. (2020) Pentland et al. (2021)
8	EXAM		

About the Authors

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In his research, **Waldemar Kremser** is combining a routine dynamics perspective on organizations with insights from complexity theory and other fields like design and strategy. He is most interested in open strategy processes, self-managing forms of organizing, self-reinforcing dynamics and radical innovations. In exploring these phenomena empirically, he combines ethnographic research with the analysis of various forms of digital trace data. Waldemar has published his work in international top journals, including *Administrative Science Quarterly*, *MIS Quarterly*, *Organization Science*, and *Organization Theory*.

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