Process-based Approach to E-learning
Educational Processes and Patterns

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Abstract: Most of the modern Learning Management Systems are focused on static content of the courses. This paper introduce process-based approach to course management inspired by *Business Process Management* (BPM) used in commercial sphere. Our approach leverages many ideas of BPM and apply them in the field of blended learning. The paper reflects current situation in e-learning, gives guidelines how to model educational processes and leverage small reusable units — learning patterns. It also discusses monitoring of such processes. Finally, the MEDUSY project as a framework for e-learning tool integration with help of educational process modeling is introduced.

Key words: blended learning, learning patterns, learning process management, learning process monitoring, MEDUSY project

1 Introduction

1.1 E-learning Dreams and Reality

We have seen a big hype around e-learning in recent years. Some people thought that with the help of e-learning technologies, we will be able to achieve distant learning. They believed that presence of the teacher on a lecture will not be needed anymore and students will use just e-learning tools presenting learning content to study. Obviously, such dreams did not come true. The hype is almost gone and many of those ideas did not succeeded. Although most of technologies for such approach were available (LMS, streaming audio and video and rich web applications), it turned out that distant learning is still much less effective way of learning than classic learning approach with the teacher and blackboard.

Today we know that e-learning technologies can be helpful as support for classic learning approach. When we create mix of classwork and e-learning we can achieve very good results. We know that e-learning systems are not going to teach for us, but they can help us significantly if we use them wisely, particularly in modes like *blended learning* which combines presence learning (lectures, exercises) with reasonable e-learning activities. E-learning can be very helpful in collaborative and person-centered learning [2]. It help to uncover common problems and help to share ideas across all actors of learning process. Collaboration should not be limited to students, but should involve all actors of learning process (lecturers, tutors...).

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2 Learning Process Management

Good blended learning often involve a lot of activities to be done on both educator's and student's side. Also many activities are performed by e-learning tools, some of them are automatized while some of them are not. With such number of activities and relations between them, the complexity of learning process organization is growing and *needs to be managed*.

According to BPM definition of a process, it is a sequence of steps that are preformed repeatedly and same can be applied to educational processes. The most obvious case from the university environment is a *course*. We usually give a particular course each term and usually the structure (process) does not change so often. More frequently, we change the learning content.

Modeling of courses with simple structure does not make much sense, but in blended courses with a lot of mixed e-learning classwork teamwork and other activities it is very useful. Actually when we try to make course really rich and interactive soon reach the moment when the organization is too complex and starts to take too much of our time. At this moment it is useful to start thinking about process solution, which can help us to automate certain tasks and at the same moment keep the organization complexity under control. Lets take a look at several example processes describing a course.

On the other hand modeling of each process from scratch is time consuming as well. If we take look at couple of our blended learning courses we see that there are quite some sequences of activities (such as teamwork, assignment evaluation etc.) common for many courses. As process approach give emphasis on re-usability with help of global subprocesses, we would like to identify certain subprocesses in our learning process that we can reuse later [6]. And that is why we need educational patterns.

3 Learning Patterns

We define educational pattern as a small reusable sequence of steps making one blended learning activity. Patterns should be used as building blocks for more complex blended courses [1]. A pattern should define general structure of the activity and should be customizable to suit our needs. Our aim is to build community based repository of such patterns. Patterns should be build on best practices in blended courses and each patterns should define "standard" structure of activity that can be extended according to our specific needs [5]. In context of e-learning activities it should serve as a guideline, how to use certain e-learning tool.

4 Modeling — Advantages and Pitfalls

There is one very strong argument against course process modeling — when the gain of modeling does not compensate the effort spent. To model course processes from scratch demands a lot of resources. We have to carefully consider the appropriate level of *granularity* and build *reusable* patterns. With growing complexity of a pattern, we decrease its flexibility. So, the usage of such patterns can actually limit us during building the *whole* course process. On the other hand, too fine-grained patterns increase the effort

required to model the course. Therefore, a rational decision on the pattern granularity is crucial. To identify good sized pattern we have to consider several aspects:

1. Is our activity we want to model as pattern independent enough from other activities in a course?
2. Is the whole activity often repeated in other courses similar way?
3. Can we identify the parameters that can be changed to reuse this pattern somewhere else?
4. Is our pattern independent from course content?

In case we are able to find positive answers for those question we can probably start with pattern definition. We have to carefully consider roles in our pattern and we have to make sure they can be mapped to roles in other learning process where we want to reuse our pattern.

Every pattern description should consist of:

- Pattern *purpose* and goal we want to achieve
- *Roles* involved in pattern
- List of *activities* performed within the pattern
- Data *objects* use in a pattern
- *Inputs* and *outputs*
- *Communication* with parent process
- *Process model* of the pattern (preferably BPMN)

4.1 Pattern Examples

Lets take a look on some examples of learning patterns. Patterns are modeled in BPMN 2.0 notation and they were modeled as a part of thesis from Jiří Novák, one of our students and members of the MEDUSY project that implements the concepts described. The first and a very common pattern we are going to examine is *Mid-term test* (see 1), being something very common in many courses.

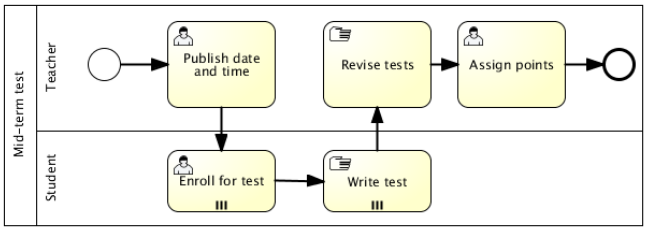

Fig. 1. Mid-term test pattern

Teacher publish the date of the test, each of the students enroll for that test and write it. Later test is revised and teacher assign point for each student. This is basic pattern,

which we want to parametrize for our needs. In this case parameters given to the pattern is just publishing date of the test. As we see we can easily model such pattern once and use it several our course processes.

Another bit more complex example can be teamwork project. Also very common in blended courses where we want students to elaborate a teamwork project. There are currently two running courses where the modeling has been done — *Business Process Management* and *Communication and Soft-skills*, see 2.

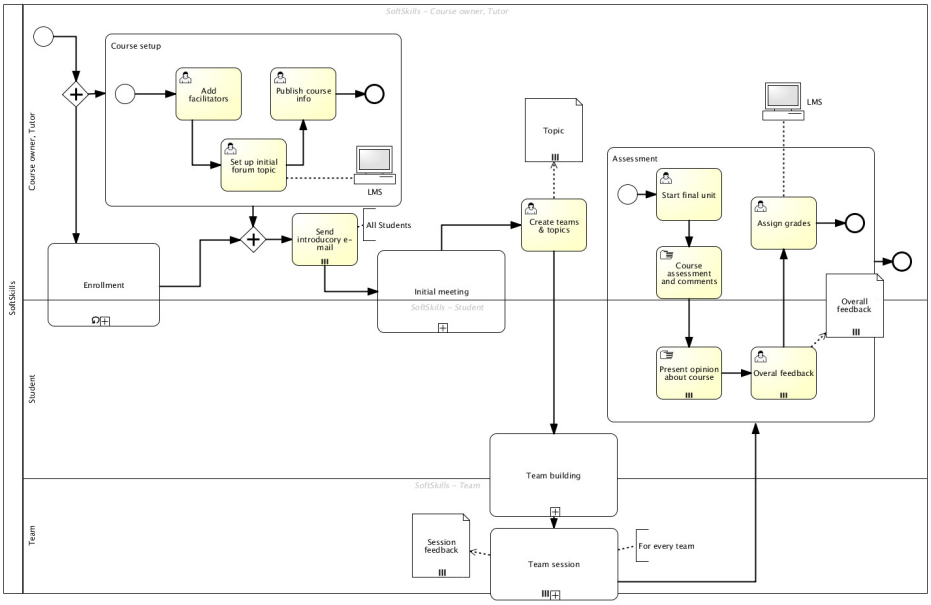

Fig. 2. Complete model for the "Soft-skills" course

5 Monitoring and Improvement

One of the main advantages of process approach is possibility of continuous *improvement* of our processes. In every iteration we model the process structure and set *indicators* that we want to watch during process execution, we record monitoring data and we use them for later evaluation of process efficiency and use them for improvement of process in next iteration [4]. In our common case where process represent a course, one iteration is usually equal to term when course is given, from beginning till the end. It is recommended to revise monitoring data each time the course is completed and analyze them for further process improvement. Monitoring is always important but it particularly makes sense in case when more participants are involved. A course with up

to ten participants is less attractive in this respect. On the other hand, in courses with 50+ participants, monitoring can already give us data that otherwise could not be obtained.

For efficient monitoring of the process we have to consider monitoring already in phase of process modeling. Process have to be designed to handle non standard behavior and document such situations. For example we want to monitor failure of participants performing certain tasks and efficiency of corrective actions. Thus we have to record such situations and be able to see the results. A real world example — we let the students to work out certain homework assignment related to previous sessions. We can monitor how many students failed to accomplish the assignment and how they dealt with corrective actions that have to be taken when assignment is not accomplished.

From those data we can identify the problems of previous sessions and find out why participants failed to accomplish the assignment and also see if our sequence of corrective actions work well or not. This can help us to improve sessions related to the assignment and also rework the system of corrective actions to improve knowledge gain.

6 Implementation: MEDUSY Project

As we can see there are already quite some tools for e-learning, but they lack something that would integrate them together and provide versatile mechanism for plugging various complementary actions necessary for earning desired knowledge. Our desire is to develop light-weighted versatile platform that would allow to leverage existing e-learning tools and provide infrastructure for design and execution of learning process.

MEDUSY is purely open source project, focused on development of rich e-learning environment which enable wide integration of various e-learning tools. Project try to leverage some of the e-learning best practices used in modern community-based and commercial LMS systems and introduce Process-centric approach to learning management. MEDUSY aims to be modular and allow to plug in traditional content based LMS systems as well as other widely web-services used in e-learning context [3] (see the system architecture in 3). It should also allow management of systems and installed applications used for hands on trainings in technical courses. Last but not least MEDUSY should also provide infrastructure for governance and monitoring of learning processes. At the moment project is in earlier phases of development such as analysis and design. We have done one functional prototype and now we are in next iteration where we try to integrate more widely used services into project. Project is developed within industry partnership between Red Hat and Masaryk University (LaSArIS lab).

7 Conclusions

Our Business Process Management course and MEDUSY project provide rich "playground" that help us to validate some of the process-centric ideas in practice. According to results gethered during the project we believe that with such a platform, we will be able to fully leverage the advantages of processes in e-learning. Another important success factor are standardized interfaces for e-learning tools, such as Web-services [4]. Nevertheless there is still a long way to go and many concepts have to be verified in practice.

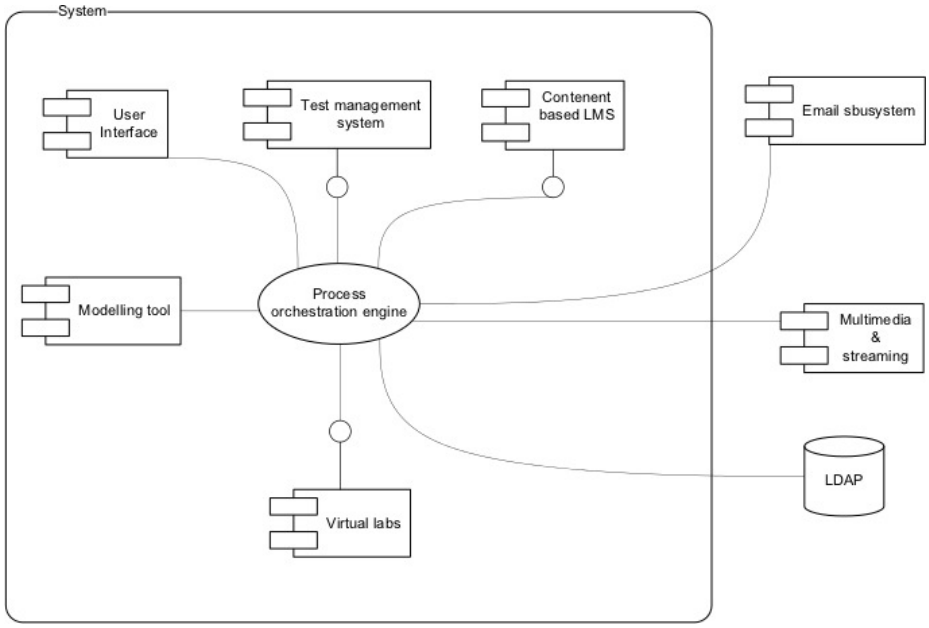

Fig. 3. Architecture of MEDUSY

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Annotation:

Příspěvek ukazuje roli vzorů učení (learning patterns) v kontextu procesního řízení výuky. Přístup je ilustrován na komunitním, open-source projektu MEDUSY vyvíjeném na pracovišti autorů. V článku je diskutována důležitost jak počítačového modelování, tak sledování výukových procesů.