Process Oriented Learning and Training
A Model-based Approach in Learn PAd

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Abstract: Process Oriented Training and Learning can be applied in two different approaches: (a) processes describing the methodology of training and learning as well as (b) processes describing the organizational context that need to be learned. This paper introduces the results of the EU project Learn PAd that developed prototypes of modelling tools enabling business processes for learning and training. Flexibility of business processes have been introduced with case management and knowledge artefacts had been integrated to provide a complete modelling environment. The created meta-model is introduced as well as the mechanisms and the algorithms implemented. The architecture of the modeling tool is also introduced.

1 INTRODUCTION

This paper revisits the contents of (Woitsch & Efendioglu, 2015). This paper elaborates the modelling language and mechanism & algorithms of the Learn PAd Modelling Method in detail. Moreover this paper discusses possible deployment scenarios about process oriented learning and technical deployment scenarios regarding to realized prototype.

In (Woitsch & Efendioglu, 2015) process oriented learning is introduced whereas (1) the business process defines the curriculum, (2) the knowledge product defines the required knowledge and (3) the knowledge sources identify the available knowledge. The end users are using the knowledge by learning, whereas the responsible decision makers and experts are managing the knowledge by appropriate learning goals and dashboards.

These use cases are realized in the EU project Learn PAd (Learn PAd EU Project, 2015) at two governmental use cases, first at a University and second in a municipality.

The technological infrastructure is introduced and some guidelines for the change towards process-oriented learning are highlighted.

This paper focus on process oriented learning and training, by discussing application scenarios, required modelling method, required tool support for collaborative learning, knowledge maturity score cards and possible case based deployment scenarios as well as technical deployment of realized prototype. Public results are introduced as form of proof of concept evaluation from the adoxx.org community (ADOxx.org, 2015).

In section 2 we present the identified scenarios that the Learn PAd Modelling Method have to support. In section 3 we introduce the Modelling Method with its core languages and the mechanisms (features) defined. In section 4 the deployed architecture is presented and the results are described in section 5.

2 APPLICATION SCENARIOS

In this section we shortly revisit the five application scenarios identified (Woitsch, Business Oriented White Paper in Learn PAd, 2015) and elaborated in (Woitsch & Efendioglu, 2015).

2.1 Individual Training

Individual training will support novices. The assessment of trainings enables much better insights into training demands.

The education of new employees is time consuming, as new employee typically lacks the organizational context. Hence, many questions or

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knowledge gaps are the result of fundamentally missing baseline knowledge of the organization.

Individual training is supported by the definition of different learning goals for different skill profiles, so that a learner can continuously improve their own skills through executing the business process.

Learn PAd merges the training and working environments, so that changes to business processes affect both the working environment for the daily tasks and the corresponding training environment.

2.2 Organizational Evolution

This process-oriented approach can also be applied to the development of the whole workforce within an organization.

In order to organizationally evolve the business process, learning goals need to define which part of the business process is to be changed, and – by involving skill profiles of team members – analyse how certain skill profiles are to be educated.

In addition to changes in the sequence of a particular process, knowledge of existing business processes can also change. Here the situation is different to individual training as users are very familiar with the process and usually claim that they know exactly what to do. The challenge is therefore to increase sensibility to minor, but important, changes.

2.3 Business Process Support and Reflection

The use of business processes and their explanatory documents as learning objects forces the public administration to critically reflect the current way of working and enables the detection of error prone parts.

Learning goals are defined in order to support the performance and reflect on the current business processes, which part needs to be improved.

An honest reflection on business process performance is usually very difficult as employees ideally need to critically reflect on their daily business within a so-called "failure-culture" in the organization – a culture that appreciates the identification of failures instead of pseudo-blaming some responsible actors.

Performance analysis needs a guiding structure. Business processes are an ideal candidate for such a structure as they enable a step-by-step analysis of daily operations that must result in an efficient sequence of activities that achieve organizational goals.

2.4 Process Optimization and Improvement

Process optimization and improvements are closely linked to performance support and reflection, which rely on the existing competencies of team members.

In order to support continuous improvement and optimization of a business process, learning goals can be used to identify the organizational learning objectives and identify the corresponding measures.

In this scenario, the team members use the learning platform as a communication and collaboration portal. The intention is to use business process based collaborative learning not only for the initial identification of improvements, but also to use those improved processes when performing the aforementioned organizational learning scenario.

2.5 Citizens Transparency

This use case is not a traditional training scenario but is an add-on use case with the aim of addressing the citizen that interacts with the Public Administration.

Learning goals are defined in order to increase transparency for citizens, addressing the misunderstandings reduction, incorrect submitted documents or increase appreciation.

Under such special conditions, the collaborative process-oriented training platform can be provided to citizens who interact with the administration.

Of course, the process will not be represented in detail, but on a higher abstraction to only point out the relevant decisions for the citizens, as well as only including high-level information.

3 THE LEARN PAd MODELLING METHOD

The Generic Modelling Method Specification Framework (GMMSF) introduced by Karagiannis

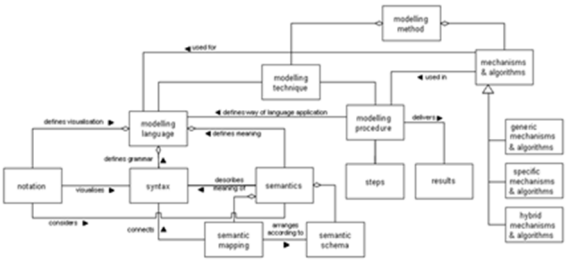

Figure 1: Generic Modelling Method Specification Framework.

and Kühn in (Karagiannis & Kühn, Metamodelling Platforms, 2002), (Kühn, 2004) has been used to develop the Learn PAd meta-modelling method.

As depicted in Figure 1 the building blocks of a modelling method include: (1) the modelling language introducing modelling concepts pre-defined according their semantic, their syntax and their graphical notation, (2) the modelling procedure which defines the stepwise usage of the modelling language and may not be always available and (3) generic and domain specific mechanisms and algorithms enabling the computer-based processing of models.

3.1 Modelling Language

The modelling language has been developed following the meta model based approach and is described in detail in D3.2 (Learn PAd D3.2, 2015).

The core domain is the business process model (using BPMN (OMG, OMG BPMN, 2015)) and the flexible case management (using CMMN (OMG, OMG CMMN, 2015)), which is linked to the business processes. Both are performed by workers, who are described in the organizational (structure) model. In order to perform skill-management, there is also a competence models, which details the traditional work place description of the organizational model.

Document and knowledge models provide the organizational knowledge in order to perform and execute the business processes and the cases.

In order to enable continues improvement, the business motivation model describes goals, intensions and rules, whereas the KPI (Key Performance Indicator) model, collects and aggregates measures and construct measurable indicators to assess the evolution of the learning organization.

Some other model types like the process map or the knowledge system model are introduced. Those model types do not carry own domain information but mainly act as a navigation support to navigate between the different aforementioned models.

BPMN 2.0 has been realized in Learn PAd focusing on those aspects which are relevant for human – learning – interaction, and leave out – technical – aspects, which are not relevant.

Although all concepts are specified in the BPMN 2.0 standard, its realization including abstract classes as well as references to other model types (– so called model type weaving.

More information on the BPMN realization is provide on the Learn PAd development space at ADOxx.org (ADOxx.org DS, 2015), as well as in D3.2 (Learn PAd D3.2, 2015).

The use of flexible case management, hence the description and collection of different cases introduces not only a flexibility into the business processes but also enables collaboration in form of discussions, recommendations and lessons learned in exceptional cases.

Due to the absence of appropriate standards that describe the organizational structure, Learn PAd used the meta model from the first and most successful community business process management tool ADONIS® Community Edition.

Organizational units describe the different departments, sections or the enterprises, hence define organizational boundaries. The roles describe the ideal representation of competences, whereas the performer describes the current workplace holder and hence describes the actual competences.

The Document and Knowledge Model type specification, that is interesting for learning and / or knowledge management models, traditionally, is a document pool, that lists all documents that are needed – either as input, as a resulting output, as a guidance or as a support document – when executing a business process. This traditional view is highly important in quality management scenarios or in keeping the business process documentation clear and simple.

In the context of learning, we enriched this model type with elements from the PROMOTE® modelling language (Robert, Process-Oriented Knowledge Management: A Service-Based Approach, 2004). A language that was first implemented in 2000 in a research project (Rainer, Dimitris, & RobertWoitsch, 2001) and now founds its way into teaching and industrial projects.

Knowledge resources are described in three forms: (a) the document as an atomic knowledge carrier with a unique identifier, (b) the knowledge source that is – often a very large – container of documents, which collects, manages and encapsulates the big amount of documents like databases, document management systems or file directories, as well as (c) the knowledge resource, which represents not only complicated but also complex knowledge carries such as humans, or communities.

The difference between knowledge source and knowledge resource is that a knowledge source provided predictable results, hence a formal correct query into a database or file repository, will result in

a predicable list of documents. Knowledge resource in contract, represent the complex knowledge resources and hence do not provide predictable results. The assessment of the opinion of an "expert community", the forming of a "committee" or the "impressions of an exhibition" may be valuable knowledge resources but in contract to a document by far not predictable. Hence those artefacts can be described in the knowledge resource.

When realizing a knowledge management or learning environment, the pure knowledge carrier like documents, sources or resources are often not relevant, but the so-called knowledge products. The knowledge product is a successful artefact that enables the consumption of knowledge in the similar way, like the consumption of any other non-physical good (Klaus & Robert, 2005), (Woitsch & Hrgovcic, Knowledge Product Modelling for Industry: The PROMOTE Approach, 2012).

It is based on implicit and explicit knowledge, hence can be distinguished in (a) information products that realize the internalization, (b) the service, that realizes the socialization and finally (c) the application that realizes the combination of external knowledge. For completeness reasons it is stated that (d) the externalization is not considered as it is a knowledge production and not a knowledge consumption.

Hence, typically a business process consumes knowledge products that are prepared for the use. Information products are mainly provided as documents, services as "responsible" colleagues and applications as "IT-resources" to be used.

As we consider the knowledge product as the essential carrier of knowledge and hence the essential artefact for learning, which is important to be observed, supported and measured, the consortium decided to include the knowledge product into the document and knowledge model type although this seems not obvious from a business process management point of view.

In that form, knowledge products can be integrated into the business processes and into cases, their responsibilities can be defined in the organizational structure and their quality and evolution can be measured with key performance indicators.

The full specification of the modelling can be downloaded in form of D3.2 form the Learn PAd webpage. Additional material and specification on aforementioned modelling language implementation can be downloaded from the Learn PAd development space of the ADOxx.org community.

3.2 Mechanisms and Algorithms

Mechanisms and algorithms implement the model value by processing the models and by introducing features for modelling. Here, some relevant features are introduced.

3.2.1 People Oriented View

Business process models belong to the family of concept models, hence they consist of a graphical representation of concepts, which are often unintuitive to agents from public administration or to citizens. In order to ease the interpretation of business processes, so-called people oriented view has been introduced that enables the switch form a business process in the traditional graphical notation to a new graphical notation, where icons graphically describe the nature of the activity. Hence, instead of "blue boxes", an iconic representation of the action is provided, as shown in Figure 2.

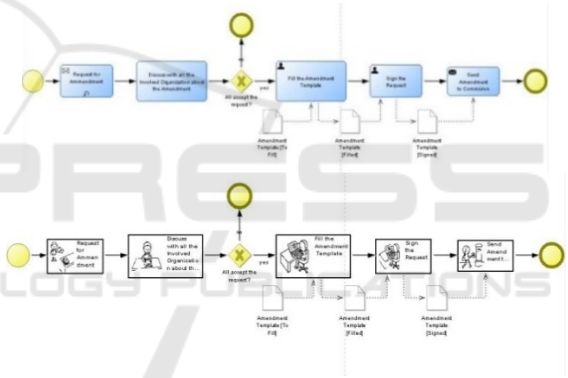

Figure 2: Standard and People-like View of a business process.

This is achieved, by a so-called semantic lifting of each concept, hence the relation of a model object with an ontological description. A list of explanatory graphical icons is also annotated to the same ontological description. Hence, when switching into the people-like view, the images that are annotated with the model object are included in the new graphical description.

Current set of graphical description is based on the artefact types in the BPMN 2.0 specification. As the approach is open, other graphics can be included.

A detailed instruction of this feature is described in the Learn PAd development space in ADOxx.org.

3.2.2 Semantic Lifting of Business Processes

Semantic lifting is a form of a loose coupled model weaving, where concepts of a business process – e.g.

tasks – are semantically lifted. This semantic lift is implemented by annotating the BPMN objects with an ontological concept (Hrgovcic, Karagiannis, & Woitsch, 2013).

There are different forms of semantic lifting, hence three cases that explain the different nature of semantic lifting are explained.

First, the direct lifting within the model is a simple copy / paste of the ontology URI into a generic or specially adapted attribute of the business process object. In this form, no changes in the modelling languages are necessary, but the usability is low and error prone is high.

The import ontological concept into the modelling tool and the selection of the semantic concepts within one modelling tool – e.g. via the former introduced pointer concept the so-called INTERREF – has the benefit that all concepts are safely managed in one repository and in one tool. As concept modelling and semantic have differences in the tool handling, it is likely that the ontology is maintained in the separate tool, which raises redundancies, requires replications and raises challenges in maintaining objects in the concept model repository. Therefore, this approach is not applicable if the ontology changes, but is required to stay stable.

The third approach is the invocation of an ontology management system out of the modelling environment. Hence, each model object of a business process, can access an interface of an ontology management system and can select one of the concepts, which are then stored in form of the URI in a special annotation attribute.

Finally, it has to be mentioned that there are many combinations of the introduced approaches, where the second and third approaches are combined to realize also complex scenarios and use the second approach as a pre-selection of stable part and the third approach for the identification of the concrete concept.

A discussion on the different implementations in more detail as well as the necessary development tools can be downloaded from the Learn PAd development space form ADOxx.org.

3.2.3 Business Processes in Collaboration Portals

The graphical representations of business processes is used to simplify the introduction of the business process tasks and link the corresponding description and attached document to the graphical representation. Although this form of process documentation is widely known and applied, the use within collaboration portals raises new challenges.

The simple export of graphical representations and model information is typically performed via Web-enabled APIs. In the ADOxx case in form of Web-Services that deliver the (a) table of content, (b) model image, (c) model information and (d) model image map to enable click-able interaction in the Browser.

While user interface technology improves – e.g. Ext JS – the interaction possibilities improve. Former file based interaction, or static Web-API approaches are now exchanged by the attempt to continuously interact with a WIKI portal or realize Widgets that run within different Web-user interfaces.

Traditional Web-Service interaction and creation of WIKI pages can be downloaded from the Learn Pad development space from the ADOxx.org community. The mentioned Widget interaction is currently under development.

3.2.4 Business Process Verification

Business process design is an error prone process. The domain expert acting as modeler of the BP can easily introduce logical errors especially on complex and high collaborative business processes, which can results in failures at the execution time.

Verifying some quality properties over a Business Process in a formal and rigorous way is the safer way to avoid such kind of situations (Falcioni, Polini, Polzonetti, & Re, 2012) (Corradini, Polini, Polzonetti, & Re, 2010).

The Learn PAd platform integrate a Formal Verification component in order to provide such kind of functionality. This component interact with the Learn PAd Modeling environment prototype through the Learn PAd platform in order to verify some properties like soundness or critical path existence, and visualize the results on the model.

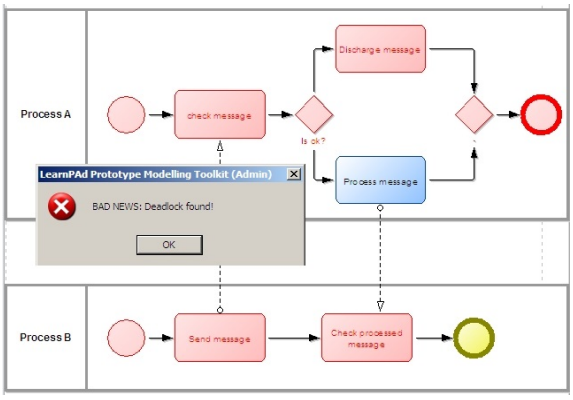

Figure 3: Deadlock Trace Highlight on Business Process.

The Figure 3 is an example of the resulting of such interaction. In this case, deadlock presence is checked on a Business Process model and the found trace that lead to deadlock is shown on the model. Deadlock verification is only one of the supported properties that can be verified. For a complete list, please refer to the Deliverable 4.1 of the Learn PAd project.

The full support of this interaction scenario is under development. More details are available on the Learn Pad development space from the ADOxx.org community.

4 PROCESS ORIENTED LEARNING DEPLOYMENT

Process oriented Training and Learning has in principle two main categories with different technical realization:

Process Oriented Training and Learning, where the process describes the training and learning method.

Process Oriented Training and Learning, where the process describes the organizational content.

The technical realization in the first case can be realized by a process oriented training and learning methodology like ECAAD, (Evidence Evidence Centred Design Methodology) (Consortium, 2015), (Misley, Steinberg, & Almond, 2015) whereas the training and learning environment are Learn Management Systems like Moodle or Blackboard (Blackboard, 2015).

The technical realization of the second case can be realized by using business process modelling method like the extended BPMN 2.0 as developed in Learn PAd but then faces the challenge to be integrated into an existing legacy application.

Learn PAd dealt with the latter case and hence had to challenge the installation of this organizational learning-add on into existing legacy infrastructure.

4.1 High Level Reference Architecture

Learn PAd indicated functional capabilities for process oriented training and learning in organization, based on the knowledge management high level reference architecture.

Figure 4 indicates the major building blocks from the reference architecture: 1) Knowledge, Learning and Business Process Context that considers the complex and heterogeneous operative legacy systems of the end users organization, (2) Collaborative Business Process and Knowledge Based Learning that enables a process-oriented learning from knowledge workers, (3) Business Process and Knowledge Based Learning Modelling enables the definition of learning processes that are then realized in the aforementioned execution environment, and finally (4) Business Process Learning and Knowledge Assessment introduces monitoring and dashboard functionality to identify improvements opportunities.

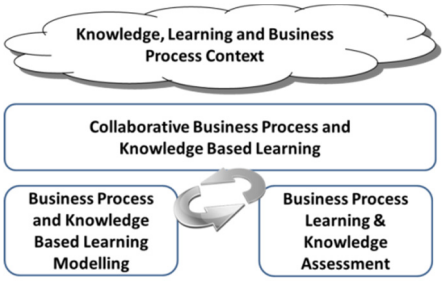

Figure 4: Tools and Applications for Process-Oriented Learning.

In the following the four building blocks are described:

Knowledge, Learning and Business Process Context: is a collection of relevant legacy applications that are necessary to execute the business process. In order to enable the seamless implementation of process oriented learning within an organization, the available IT infrastructure has to be considered as it is, and the process oriented learning framework has three choices to interact with the existing applications.

First integration is a loose link from the learning system to the legacy applications. This is most likely the first choice, ideally if the legacy application is a Web-application. Hence, this will be a Hyperlink to the Web-interface of the legacy application

Second integration is via an implemented API. This will be used if valuable learning or feedback information is required from the concrete legacy application. In the case where a social enterprise tool, enterprise wikis or similar are already in place, it may be worth implementing an interface. (e.g KPI container)

Third integration are learning system components that are added to the IT infrastructure, hence the integration is given by the use of the learning system.

Pragmatically, a Wiki environment that describes how to access the legacy systems and

providing the necessary links is the most appropriate way to start with a process oriented learning system.

Collaborative Business Process and Knowledge based Learning: is a collaborative platform that is specially configured to support business processes. Traditional business process descriptions that are exported in collaborative Web-platforms are enriched with learning functionalities, such as stepping through a process, starting simulations, commenting on documents and knowledge as well as assessing learning progress.

Business processes can be trained by the user either in a manual or automatic way. The manual way is performed by stepping through a business process, reading the documents and discussing with colleagues whether the decision that would have been taken is the correct one. Automatic training of a business process is understood as simulation, whereby the process is triggered and the trainees have to commit their decisions into the system.

Collaborative Business Process and Knowledge Based Learning workspace provides all functional capabilities for a user-friendly entry point into the process documentation, the manual stepper and the automatic simulation. Business processes are presented graphically, the corresponding documents, the required skill level and the capability to provide feedback and comments in form of an intuitive Wiki are provided in the form of a collaborative environment.

Process Simulation for Learning is used by the knowledge worker in order to learn how the process has to be executed. Depending on different skill levels the process is simulated in a form that the knowledge worker performs each step with the correlated content. Hence the process is not executed directly but simulated with the aim to derive findings from recorded clicks and links. Focus is the end users interaction with the platform and with the process so that the user learns to perform the process in practice.

Business Process and Knowledge based Learning Modelling: is used by trainers to design business process models for public administration. Typical conceptual and semantic modelling will be applied to define relevant conceptual artefacts that are processed for management and improvement.

Modelling covers typical capabilities like (1) graphical visualization of models, (2) query and analysis features of models, (3) simulations of graphs as well as (4) transformation into different input and output formats. Depending on the platform and usage scenario the aforementioned generic modelling feature are differently grouped or detailed.

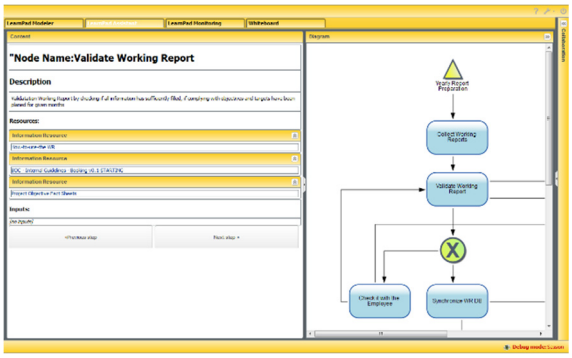

Figure 5: Learn PAd Prototype: Modelling Tool.

Collaboration and Feedback transforms the previously made "Wiki-like" collaboration functionality into the modelling tool. Hence track changes, ratings or comments may be considered in this group.

Business Process Learning & Knowledge Assessment: is used by experts and trainers to analyses the use of the business processes and assess which part of the process is well supported and trained and which needs adjustments. A dashboard displays key performance indicators that enable the assessment of the maturity, skills and training levels of the process and its end users. It is seen as a cockpit for the trainer that represents KPIs for learning and knowledge maturity in a Scorecard like presentation.

The aforementioned grouping of high-level functional building blocks describes the major components, which can be added into an existing working infrastructure and the organization's site.

4.2 Modelling Tool Deployment

This section introduces the business process and knowledge based learning modelling tool, which can be downloaded in form of the first prototypes at the development space of ADOxx.org, or can be tested in the online version at advisor.boc-group.eu.

There are two prototypes: (a) the standalone rich client installation, which can be downloaded from the development space at ADOxx.org, as well as (b) the Web-based training and learning modeler on advisor provide modelling features, shown in Figure 5.

The deployment of the full fletched rich client is in form of a local installation of the prototype. Export can be performed using the transformation features in order to generate special formats for learning simulation engines or collaborative portals.

A server side installation may be required, in case the collaboration portal interacts with the modelling tool not via file exchange using the transformation features, but via the Web API. For such more complicated scenarios, additional effort is required to evolve the current prototype to an operational execution environment.

The deployment of the Web-based training and learning prototype in Learn PAd is a hosted deployment in form of a Web-application to flexibly instantiate modelling tools for different organizations. Cloud technology is available, in case such a service should be offered as SaaS.

In general, both modelling tools provide the basic concept modelling features, which can be extended on both prototypes.

Modelling features are distinguished in: (a) model repository and access management, (b) Visualization, model management and graphical design, (c) Query, analysis and semantic inference of models as well as (d) Transformation from the model repository in requested output formats for documentation, execution or interchange.

Beside those generic functional capabilities, the feature details described in section 3 are implemented in the standalone modelling prototype.

5 CONCLUSIONS

Process Oriented Training and Learning supports two approaches, one where process models are used to describe the teaching and one, where process model are used to describe the organizational context and content.

In Learn PAd the latter approach is applied for civil servants in five application scenarios: (a) individual training, (b) organizational evolution, (c) support and reflection, (d) process optimization and improvements as well as (e) citizens transparency.

The Modelling Method with its core languages has been introduced and some special features has been proposed, like the people oriented view, the semantic lifting and the business process verification. In the end the deployed architecture has been presented focusing on the high level architecture.

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