Social Networks and eLearning: New Model for Learning at Workplace

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Abstract. *This paper presents a model of a technological infrastructure for integration of learning with business activities. This model deals with learning that is personalized, contextualized, adjusted to current business processes, and integrated within social relations of an organization. Hence, the model represents workers, their knowledge, competences and skills firstly. Secondly, business processes that are supported by a workflow management system are used to construct learning units. Finally, relations between workers are represented using a social network. The paper concludes with a presentation of the preliminary implantation and evaluation of the introduced model.*

Keywords. Social Network, Learning, Workflow Support System

1. Introduction

Ideally, IT tools should increase the efficiency of workers in business process execution. However, in order to achieve this aim workers have to learn how to use a particular tool in an optimal way. The conventional face-to-face training is becoming insufficient due to the increasing number of workers and rapid development of support tools. Therefore, it is our strong belief that a model of learning at workplace is needed.

In [5] authors discuss a similar approach to modeling of learning at workplace but without taking into account social relations between workers. In fact, modeling of social interactions within an organization is an important element of the model that is presented in this paper.

In this paper, we will use an experimental method of modeling of learning at the workspace, i.e. first a model will be created based on the previous research and the experiences in traditional face-to-face, as well as technology-enhanced training at the workplace. As a proof-of-concept the new model will be applied to training in the transportation industry branch. As a case-study an example of an international railway timetable coordination system, the workflow that it supports, the users of the system and the eLearning model for the particular system will be analyzed in this paper.

2. Learning at the Workplace: Model

Numerous research studies investigated learning behavior of workers (see e.g. [6, 7, 8, 9]). These studies identified the main learning resources in an organization as being documents and peers, as well as the main learning processes as being searching for documents, acquiring knowledge from documents, and interacting with peers.

It is our practical experience that these processes need to be extended to reflect the current working context of a worker, i.e. the current working task and the position of that task in a global business process. Thus, in order to reflect this working context we propose a new model for learning at the workplace dealing with the following topics:

- *Modeling of skills and competences of workers*

In order to provide a suitable model of the skills and competences of workers, the particular organization and working environment will be investigated and, as a consequence, the model will be proposed upon the results of the analysis.

- *Business processes*

Business processes that are supported by a workflow management system need to be analyzed and the significant steps of the particular business process need to be clarified, described and placed into the formal knowledge structure (i.e. learning units) accordingly.

- *Social Network Model*

Relations between workers need to be represented using a social network model. Actually, the efficiency in learning of new processes and tools inside an organization is usually bound to the internal communication and knowledge interchange between more and less experienced workers. Therefore, the creation of guidelines for modeling of the social network in the particular industrial settings to enhance both training and eLearning is important accordingly.

3. Case Study: International Railway Timetabling System

The research methodology relies on the case study of the particular industrial branch - railways. This "real life" example serves as a proof-of-concept of the proposed model.

The main goal of the case study is to assess the increase of learning efficiency within an organization when the proposed model is applied. The output of the case study will be a set of guidelines which (1) describe how to design learning models for integrated learning at workplace and (2) provide directions for further improvement of the model.

3.1 Modeling of skills and competences

In an organization the workers usually belong to one or more specific units, i.e. working groups within a particular organization. Mostly, working groups are structured regarding workers' skills and competences. In practice, the organizational structures are typically not managed cleanly resulting in working groups with mixture of competences and skills.

Nevertheless, the organizational unit model can serve as the first rough approximation of the general model structure for the worker skills. This model needs to be refined on-the-fly during the execution of the learning process to capture the competences and skills in an optimal way. For instance, a special structure of learning courses reflecting the organizational group structure might be prepared within a learning management system as a first approximation of worker skill and competences. In the next iteration steps this course structure might be altered to more closely reflect the "real-life" situation from an organization.

In our case study from the railways industry a railway business is typically functionally divided into:

- Organizations that take care of operating (running of trains)
- Organizations responsible for railway infrastructure (tracks).

The operating organizations are usually specialized in two categories: passenger travel and cargo / freight.

The organizations that are responsible for the railway infrastructure normally take care of track maintenance and distribution of track capacity.

The initial course structure reflecting skills and competences of workers can be divided into units corresponding to such an organizational division. This model structure serves only as a starting point, and can be seen as a container for further modeling of skills and competences. Thus, in our railways example knowledge skills and competences of workers can be divided into two main classes:

- Operational unit (in railway business such a unit would be foreseen for Railway Undertakings)
- Infrastructure unit (such a unit would correspond to Infrastructure Manager Organizations).

Let us focus for a moment on the Infrastructure unit. Here we classify the workers as workers:

- Maintaining the tracks (track construction)
- Maintaining the capacity of tracks (track usage).

3.2. Modeling of business processes

Maintaining of the capacity of the tracks consists of timetabling and customer services (usually, the sales and customer care department at the railway infrastructure company).

The most complex part of timetabling and customer services is actually the international path requesting process. This process is agreed on international level between railway undertakings and infrastructure manager organizations. The process consists of strictly defined steps that have to be executed by the participating organizations in a given timeline. This process is supported by a workflow management system.

The result of international path requesting process is an international timetable schedule defining the when a train enters and leaves a particular track (path). In turn, a path is split into parts or so-called path sections. The starting and ending points of path sections can belong to different countries and can be maintained by different infrastructure manager organizations. This particular issue makes the path coordination extremely difficult and time consuming, especially if the communication between the participating organizations is not made electronically (i.e. without tool support). For this purpose, on the European level, a web application called Pathfinder has been developed. The application corresponds to the workflow model given by the defined international timetabling process.

Therefore, in order to efficiently participate in the process the usage of the workflow support tool Pathfinder has to be learned by the workers of Particular organizations.

Before the analysis of the particular learning model is made, it is necessary to give a short outline of the tool.

The system Pathfinder is suited for international path request and timetable coordination management. As such, the system is used by more than 600 users and 100 railway undertakings and railway infrastructure organizations in more than 20 European countries. Pathfinder is a web application used as communication platform for the optimization of the international train path coordination which can be accessed via the internet by a web browser.

The main features of Pathfinder are:

- Coordination of international paths for any timetable period: annual timetable, late path requests, ad-hoc path requests (short term path requests) as well as path feasibility studies
- Displaying of so-called "catalogue paths" – the paths that are already prepared and offered for participation in international path by Infrastructure Managers (IMs).
- Workflow solution for international timetable coordination process:
    - The coordination process between Railway Undertakings (RUs)
    - The coordination process between Railway Undertakings and Infrastructure Managers
    - The coordination process between Infrastructure Managers
- Path feasibility study
- Train composition data for passenger and freight trains
- Message system for the on-line users
- Data export in PDF, XML, MS Excel
- Usage of international location database which is provided by UIC (International Union of Railways) for the time being

The coordination of international path requests and path offers is done between railway undertakings (in future text referred RUs) and infrastructure managers (in further text referred as IMs).

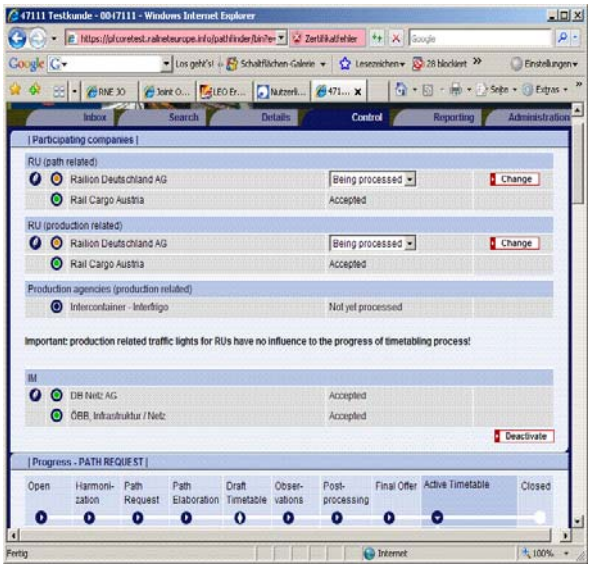

Figure 1. Pathfinder process control page

The tool Pathfinder supports the workflows which are specific for each of these two organizations in a separate process layer. Therefore, the users of the tool are divided to the groups of so called "RU-users" and IM-users".

3.2.1 Business Process and Learning Units

The Pathfinder system supports the specific international timetabling process [1]. The main

issue of timetabling process is request handling. The requests for using of railway tracks (capacity of the infrastructure) are issued by RUs that harmonize with their international partners on the operational level. IMs are responsible for handling the requests and offering of the free capacity regarding to the request. The requests can be handled differently depending on the time period of the year when they are issued. The timetabling agreement between RUs and IMs differs between the regular requests that are issued early enough by RUs to be processed by IMs and late / ad-hoc requests that are made just before the start of the timetable period or during the timetable year, just a few days before the train has to run. Therefore, the four process types are supported in Pathfinder:

- *New path request* (the process type for requests issued more than eight months before the train run)
- *Late path request* (the process type for requests issued less than eight months but more than two months before the train run)
- *Ad-hoc path request* (the process type for the requests made shortly before the train run, during the particular timetable period)
- *Path study* (the process type for the requests for path feasibility study by IMs, often used for long term planning)

Consequently, the eLearning material is organized in the similar way as the above given process categorization. It is quite natural to organize learning units corresponding to the process types.

Additionally, the introduction learning unit for the basic explanations of the business process and the learning unit containing the overview of the utility functions (so called "general functions") of the system surely needs to be considered. Hence, we have the following learning units:

- Process description
- General features of the application
- Path study (path feasibility study)
- New path request
- Ad-hoc path request
- Late path request

Each learning unit is divided into lessons corresponding to the topics. Process description and the explanation of the general features are built in a rather straight-forward matter.

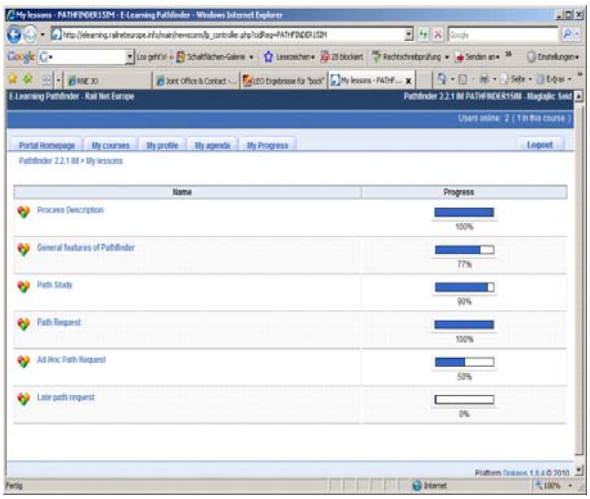

Figure 2. eLearning system: the learning units

The learning units concerning the business process types are carefully structured. The structure was built upon the experience from the live training sessions and support activities. Thus, each process step (actually, the subsequent workflow step) is represented by the lesson which contains the explanations:

- How to achieve the particular process step
- How to work in the process phase
- How to proceed to the next process step, i.e. how to finish the current workflow phase.

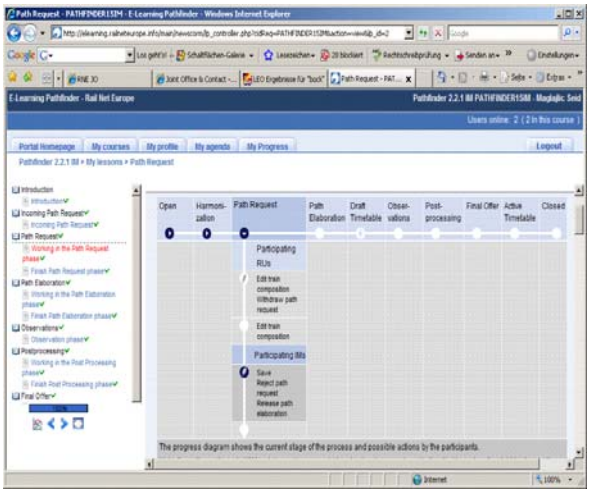

Figure 3. eLearning system: the lesson structure

3.2.2 eLearing System: Selection Criteria

The criteria for selection of a suitable eLearning system were:

- Possibility to organize the learning content in lessons, learning units and courses
- Possibility to categorize the users due to the organizational affiliation, geographical location (country) and knowledge level
- Possibility to organize virtual classrooms for the particular courses due to the user grouping
- Possibility of assigning a tutor for the user group
- Possibility to track the knowledge acquiring progress of the user (both for users and tutors)
- Possibility of question/test modeling and evaluation
- Context-sensitive search of the content, documents and user lists

Due to the criteria given above, after an evaluation process, we have chosen the platform Dokeos [2] which fulfils the requirements. The screenshots given above are made of the eLearning production system of Pathfinder [3].

3.2.3 Learning Material

Pathfinder implements separate process layers for RUs and IMs due to the fact that RUs and IMs have different responsibilities in the timetabling process (RUs issuing the request, IMs handling the request/offering capacity) and, consequently, participate in separated project steps in many cases. For this purpose, the learning units are grouped to the separate courses for RUs and for IMs. The learning units are structured in the same way for both courses, however, the content is "tailored" for the corresponding user group, e.g. there is detailed explanation for RU-users how to issue a request, and the same lesson for IMs is significantly shorter. On the other hand, the process step of drafting of a path offer is in-depth explained for the IM-users.

Surely, not only the company type (RU or IM) that the user is working for, but also the organizational unit and the corresponding knowledge background of the user as a worker have to be considered when setting up the eLearning environment. Moreover, the acquired knowledge and knowledge test results that are recorded in the eLearning system can be used for grouping the users by the knowledge level.

This is handled by the social network model of the Pathfinder users.

3.3 Modeling Social Network

We will use the social network definition and notation given in [4]. Therefore, the social network model for the users of the Pathfinder eLearning system is given in the following way:

- *Actors* are registered users.
- Relational *tie* – the linkage between actors due to organizational / geographical affiliation or by knowledge transfer between each other.
- *Group* – a finite set of actors on which network measurements can be made.
- *Relation* – a collection of ties of a specific kind among members of a group.
- *Social network* – the final set of actors and relation(s) defined on them .

Consequently, we can see the organizational affiliations of the *actors* (i.e. of Pathfinder eLearning users) as the *relational ties* in the focused *social network*: member of the timetable department or member of the customer care department, just to mention a few.

Finally, the knowledge transfer from a tutor to the members of his/her virtual classroom as well as the knowledge transfer between the members might be also modeled as a relational tie. Hence, we can group our social network actors due to the relations mentioned above. Due to the definition of social network given in [4] the social network that we have here is said to be "multi-modal" since several *relations* can be applied on the same set of *actors*.

Modeling a social network in the eLearning system enables the more powerful information and knowledge transfer between the users (actors) based on their knowledge level and organizational affiliation.

Let us consider the following example: a timetabling department worker knows the timetabling process very well, whereas the sales person does not have the complete knowledge about the timetabling process for the proper usage of the tool. Now, the social network might provide valuable information about a timetabling department worker belonging to the same company or country, or the contact data of the user from the same *group* who is already "certified" for the product due to the eLearning test results. Hence, the knowledge transfer from person to person after the evaluation of the context-sensitive search results can significantly help the particular worker to acquire the

knowledge about the topics of the learning unit. We call this phenomenon *context-sensitive knowledge transfer* and treat it as a *relation* in the social network of eLearning users.

4. Achievements

The eLearning platform for Pathfinder has been developed and configured initially in fall 2008. Learning material was edited and structured as described in the chapter 3.2.3. The intention to enhance the Pathfinder training facilities and provide more intuitive help material than the "normal" application reference manual is successfully achieved. However, the new approach with *social network model* consisted of the Pathfinder eLearning users as *actors* and context-sensitive knowledge transfer as *relation.* The model has been applied in practice and proved as one of the crucial mechanisms for increasing the efficiency in international railway timetable coordination and cooperation via Pathfinder. RailNetEurope, the owner of the system Pathfinder and supporter of this research has succeeded in certification of 20 "trainers" (the experienced users of Pathfinder who passed the appropriate examination to be able to transfer their knowledge to their colleagues, partners and customers). Consequently, the number of calls to RailNetEurope user support for Pathfinder (functional support for "distance help" for the users of the system) was reduced by 15%, due to the easier knowledge transfer from the "certified", more experienced colleagues to their organizational affiliates and customers as well. Thus, the productivity in the international timetable coordination increased automatically. The positive difference in the productivity was noticed by measuring through monitoring of the business process (workflow) execution in the Pathfinder on the system level.

5. Conclusion

Since the eLearning system tracks the learning progress of each user one of possible topics of the further research would be structuring of the social network regarding learning progress. In this way one could form a relation for knowledge transfer from a lesson tutor (or certified user) to other virtual classroom attendants. It would be also possible to evaluate the learning path of the users belonging to the same virtual classroom and propose the "closest" colleague for knowledge transfer.

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