Data Analysis of Workplace Learning with BOOST

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Abstract: Micro enterprises with less than 20 employees represent the majority of companies in developed economies. To achieve a positive attitude from both sides (i.e. company and employee) towards workplace learning in these settings, target competences of employees need to relate to business needs and learning should be done at the workplace. In this paper, we combine methodologies focusing on business critical needs that are linked seamlessly with learning resources by means of a simple, ready-to-use Web-based learning environment. As a result a cross-border and cross-cultural approach to increase participation of micro enterprises in the workplace learning was created. We collected data about 79 users from 56 micro enterprises in different countries with various settings. Our analysis investigates behavior of employees and managers in this workplace-learning environment, considering our original requirements.

Keywords: workplace learning, informal learning, personal learning environments, design

Introduction

Capable and professional employees are essential for the success of any enterprise. Therefore, employees have to be trained and engaged into the lifelong-learning process at the workplace. However, small and micro enterprises have a decreasing participation in vocational education and training. Thus, there is a real need to engage them in developing a positive attitude towards training (European Commission, 2012). In our studies we mainly focused on small enterprises (with less than 20 employees), as they represent a majority of companies in developed economies.

Here we present a ready-to-use Web-based learning environment, which considers business critical needs and provides tailored learning solutions for small companies. We assume that a positive attitude towards workplace learning requires to relate target competences of employees to the business critical needs and to integrate learning seamlessly into work processes. Our empirical evaluation studies include 79 users from 56 companies in five European countries. We track user interactions to better understand workplace learning and the roles of manager and employee in it.

The rest of the paper is organized as follows. First, we summarize a research done in this domain. Afterwards we describe our methodology and technical prototype. Then our analysis and its results are presented. Finally, we conclude the paper.

Related Work

Cross (Cross, 2007) claims that formal learning receives a lot of attention and funding. On the other side, informal learning remains often unrecognized even by the individuals that undertake it and is left to chance. He also argues that formal learning has almost no impact on job performance, while informal learning is the major source of knowledge transfer and innovation.

Skule (Skule, 2004) developed a framework for measuring, assessing and comparing learning environments in the workplace, as informal learning could not be measured by means of indicators traditionally used in the field of education and training. The framework consists of seven learning conditions, which have significant effects on informal learning at work: a high degree of exposure to changes, a high degree of exposure to demands, managerial responsibilities, extensive professional contacts, superior feedback, management support for learning, and rewarding of proficiency.

Berg & Chyung (Berg & Chyung, 2008) investigated factors influencing informal learning at the workplace, as learning and performance improvement practitioners gain new knowledge from informal learning activities more frequently than they do from formal training. The rank-order of factors affecting informal learning engagement can be utilized as a tool in prioritizing potential interventions to encourage informal learning: interest in current field, computer access, personality, professional capability, relationship with colleagues, job satisfaction, and job itself.

Eraut & Hirsh (Eraut & Hirsh, 2010) identified balancing 'top down' and 'bottom up' learning priorities as one of key challenges. They provide various recommendations, including the following ones: Set

aside some training resources to respond to individual as well as organizational needs; Try to involve the learners and their managers in the design as well as asking for their feedback afterwards; Train managers to act as coaches to employees; Encourage a work climate, in which sharing knowledge and helping others is seen as positive.

Based on these outcomes, we can conclude that it is highly important to address the issues of informal workplace learning. The demands both of companies and employees need to be considered. Managers are responsible for specification of the business critical needs and for identification of the competence gaps in their companies. They also have to assign learning goals and to monitor the learning progress of their employees, as well as to provide them with appropriate feedback. Here the employee's capability, personality, and satisfaction must be taken into account.

BOOST Approach

We aimed to address the above mentioned and additional demands in the BOOST project (Business perfOrmance imprOvement through individual employee Skills Training), where a sound methodology from the BeCome project[13] was integrated with widget-based technology from the ROLE project[14]. As a result, a ready-to-use Web-based learning environment to support and monitor learning process at the workplace has been created.

Our aim was to support these phases of workplace learning: planning, tutoring, learning, and reflection. *Planning* includes identification of critical business goals in the company (together with related competences and learning resources) and selection of suitable employees to address them. In *Tutoring* phase relevant learning resources are assigned to target competences. In *Learning* phase access to relevant learning resources is provided, together with searching facilities, in order to look for additional ones. *Reflection* means monitoring of the learning progress of the company, as well as of individual employees.

The basic data model is simple and includes key *Business Goals* (like project administration or Web development) at the top level. Each of them can refer to relevant *Learning Indicators* (competences, like reporting or HTML5). For these suitable *Learning Resources* (materials, tools, and peers) can be recommended.

In BOOST, we distinguish two user roles: Manager and Employee. *Manager* can specify business goals with learning indicators (e.g. relevant competences), and assign them to employees. This role can also monitor and assess the learning progress of employees. *Employee* gets an overview of the assigned business goals, learning indicators, and recommended learning resources. Then they can learn by accessing the learning resources as well as search for new ones and assign them to learning indicators. Employee can also reflect on his or her own learning progress.

BOOST Platform

The BOOST technical prototype has been already described in (Kravcik et al, 2014a; Kravcik et al, 2014b). BOOST learning platform follows a widget-based web application development approach [8] and it was developed using ROLE Software Development Kit[15] (SDK). A widget is a relatively simple software component created for a particular task. By combining widgets we create specific predefined learning areas (Start, Management, and Learning) that support different phases in workplace learning. Users can easily adjust the design of individual areas to their needs by selecting the relevant widgets and arranging them appropriately. The BOOST platform enables inter-widget communication and supports real-time chats too. The BOOST software is open source and fully available for further development and extensions. It can be hosted by vocational education and training (VET) providers as demonstrated in the project. Its translations into five European languages are currently available.

In *Start* area one can choose the preferred language, read a brief introduction about the platform, and Manager can also assign roles (Manager or Employee) to users. Here also the license agreement has to be confirmed at the very beginning.

Management area (Figure 1) includes three components: *Goals* widget to specify relevant business goals and assign then learning indicators (competences), *Personnel* widget to assign learning goals (learning indicators with target proficiency levels and deadlines) to individual employees, and *Progress* widget to monitor learning progress and recognize competence gaps. Due to privacy issues, Manager and Employee have different access rights here. Manager can see all Employees and can edit specification of business goals and learning indicators, as well as their assignment to employees. Moreover, Manager can also assess proficiency levels of

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[13] http://become.dedi.velay.greta.fr
[14] http://www.role-project.eu
[15] https://github.com/rwth-acis/ROLE-SDK

employees. On the other side, Employee can see only his or her own data, which was one of the key requirements from our project partners.
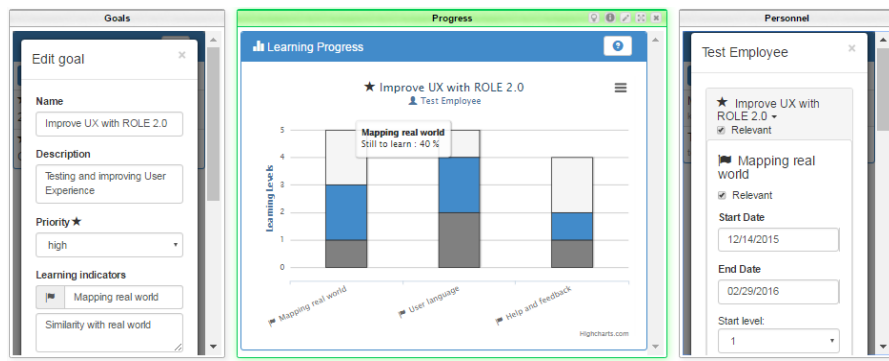

Figure 1. Management area – Manager view

Learning area (Figure 2) consists of the following modules: *Resources* widget shows learning resources assigned to learning indicators (and business goals), *Viewer* widget displays the selected learning resource for learning, and *Search* widget allows searching for additional learning materials in several repositories: YouTube[16], Scribd[17], Wikipedia[18], and SlideShare[19]. Newly found documents can be displayed in Viewer and added easily to Resources. Both Manager and Employee can add new learning resources, either as public or private ones.
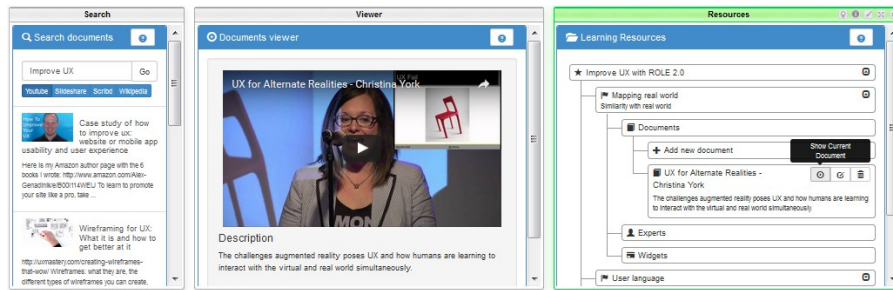

Figure 2. Learning area – Employee view

Data Analysis

BOOST partners have conducted evaluation studies during period of three months (13th May - 19th August, 2015) with 79 users from 56 different companies in five countries: Great Britain, Germany, France, Czech Republic, and Greece. Typically, each company has used its own installation of the BOOST platform, in order to respect the privacy issues. BOOST partners helped the companies by introducing them to the platform, assisting them in specification of their own data, and running their pilots.

Compared to community supported dashboards [9, 10], we focused primarily on individual users. Our aim was to trace user actions and then to visualize it for each individual from various perspectives, in order to understand his or her behavior. We wanted to know when the user was active, what kind of activities they performed, and in which order. To collect user specific interactions a JavaScript based tracking system was implemented. We recorded each traceable action (click) of the user, together with all relevant data related to it. The stored data included the following information on each (traceable) user action: user identifier, installation URL, widget, user role, element (button) name, user action, and time. Due to privacy issues, we did not store user identities, just random user identifiers for further analysis.

To visualize the collected data sets, we have created a Web-based dashboard. Each user interaction is assigned a specific color based on the corresponding widget and the interactions are visualized chronologically over various time scales. We expect that in this way we can interpret the user behavior and compare it with the

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[16] https://www.youtube.com
[17] https://www.scribd.com
[18] https://en.wikipedia.org
[19] http://www.slideshare.net

workflow we intended to support originally, considering the predefined phases of workplace learning. Not all users have used the platform intensively over a longer time. Therefore, for further analysis we have mainly focused on the most active users, including both managers and employees.

Two types of visualization can be considered. Long-term views illustrate user activities over several days, weeks, or months, providing various perspectives on them – a chronological view, an assignment of activities to different areas or phases, as well as an assignment of activities to individual widgets. Short-term views show daily activities assigned to concrete widgets, usually from one session. It is worth mentioning that some widgets are more interaction demanding than the others. For instance, interactions in Viewer are not traceable at all, as the viewed learning material is selected in Resources or Search widget, and the embedded player works independently of our platform.

Manager role

To analyze the collected data, we aimed to identify and visualize the following phases in Manager's actions:

1. *Start*: in Start area
    a. Welcome actions in *Welcome* widget
    b. Role setting actions in *Role* widget (Access)
2. *Planning & Reflection*: in *Management* area
    a. Goal setting in *Goals* widget (BCN)
    b. Checking progress in *Progress* widget (Graph)
    c. Assigning goals & checking personnel in *Personnel* widget (Employee)
3. *Tutoring*: in *Learning* area
    a. Checking and setting learning resources in *Resources* widget
    b. Viewing learning resources in *Viewer* widget
    c. Searching learning resources in *Search* widget

We have counted 3957 interactions of managers (Figure 3). Just few of them (290) came from the *Start* area, representing language changes in *Welcome* widget (17) and right changes in *Role* widget (273). About one third of manager interactions (1293) happened in the *Management* area performing planning and reflection, namely specification of goals and learning indicators in *Goals* widget (477), showing learning progress in *Progress* widget (251), as well as assigning goals with priorities to employees and checking their progress in *Personnel* widget (565). Nevertheless, managers mostly interacted (2374) in the *Learning* area doing tutoring, especially assigning learning resources in *Resources* widget (1525) and searching for new learning resources in *Search* widget (849).
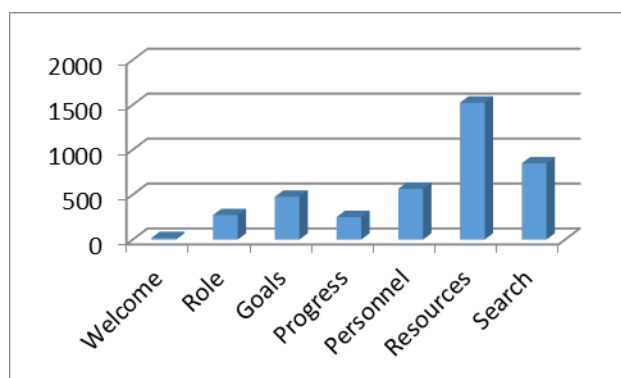

Figure 3. Manager interactions with widgets

There are several alternatives of a long-term view. Figure 4 shows the distribution of Manager's activities over several months and times of the day. We can see that most of the work has been done in June and afterwards the user came back just sporadically, at the end just checking the progress of employees and reflecting (Graph).
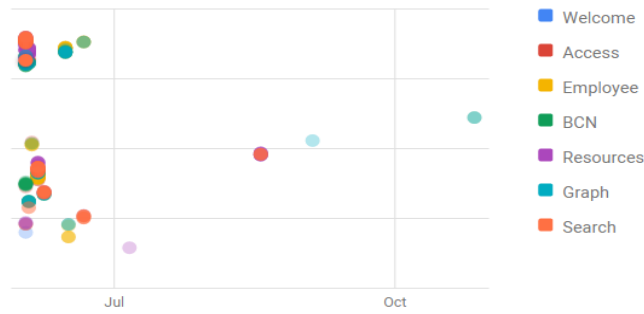
Figure 4. Manager's long-term view – user activities

Figure 5 shows more precisely the distribution of activities (clicks) per day, indicating that actually in the first half of June the user was most active, busy both with Planning (*Management* area) and Tutoring (*Learning* area).
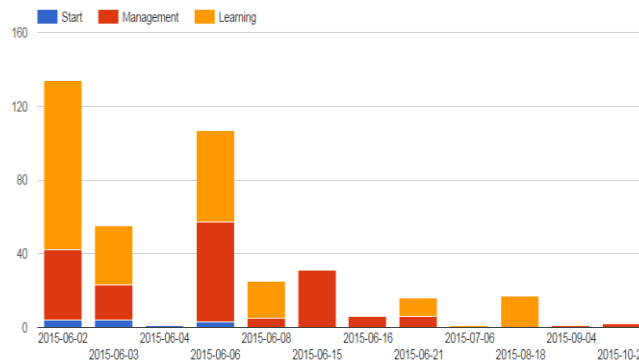

Figure 5. Manager's long-term view – usage of areas

A more detailed overview of the interaction with individual widgets provides Figure 6. We see that Manager started with searching for learning resources (Search) and assigning them to individual learning indicators (Resources). Moreover, the user also specified the goals (BCN) and later on assigned them to employees (Employee).
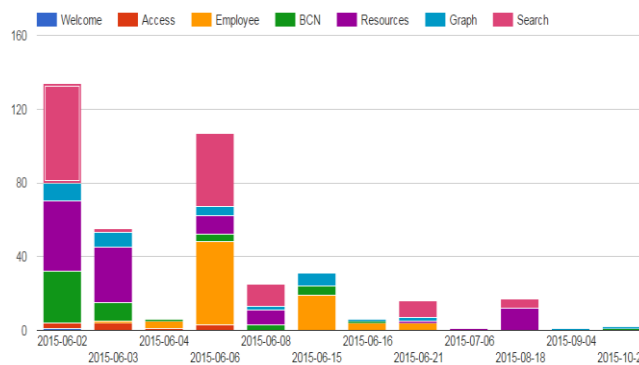

Figure 6. Manager's long-term view – usage of widgets

Short-term views display in a chronological order what happened in one session. Interesting are especially the longer sessions, which illustrate how the two main phases of Planning and Reflection on one side, and Tutoring on the other, complemented each other. Figure 7 (visualizing 87 interaction activities) shows that Manager started with checking learning resources, searching for new ones, and assigning them to the existing learning indicators (Tutoring in rows 1-2). Then the business goals were checked and newly created, as well as assigned to employees, monitoring their progress occasionally (Planning & Reflection rows 3-5) and checking the assigned learning resources (Tutoring in row 1).
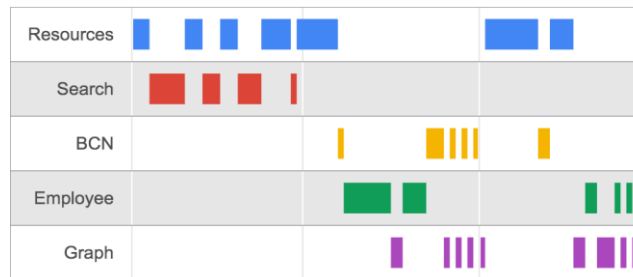
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Figure 7. Manager's short-term view

Our analysis of 8 most active Managers shows that they spent 86% of their interactions in Tutoring phase and they mostly used Resources widget. This means that they put a lot of effort to preparation of suitable learning resources for Employees. In addition, 11% of Managers' interactions belonged to Planning & Reflection phase, where they mainly specified business goals and assigned them to Employees, which apparently consumed much less effort than searching and assignment of learning resources. It is not surprising, as to each business goals, several learning indicators are assigned and to each learning indicator several learning resources belong. Finally, 3% of their interactions happened in Preparation phase.

Employee role

From another perspective, we intended to identify and visualize activities performed by Employee in these phases of a cycle:
1. *Start*: in Start area
    a. Welcome actions in Welcome widget
    b. Role actions in Role widget (Access)
2. *Learning*: in Learning area
    a. Accessing learning resources in Resources widget
    b. Viewing learning resources in Viewer widget
    c. Searching learning resources in Search widget
3. *Reflection*: in Management area
    a. Checking goals in Goals widget (BCN)
    b. Checking progress in Progress widget (Graph)
    c. Checking personnel in Personnel widget (Employee)

Surprisingly, there were only 1118 employee interactions (Figure 8), which is much fewer than the manager ones. Less than a quarter of them (235) happened in the *Start* area, mainly changing the language in *Welcome* widget (230), while in *Role* widget employees could only show help (5). As expected, employees were most active in the *Learning* area (461), using learning resources (149) and intensively searching for additional ones (312). Reflection phase in the *Management* area was also properly used (422). In *Goals* widget employees could check their own assigned goals and deadlines (89). Then they could compare it with their learning progress in *Goals* widget (160), which can be initiated also from *Personnel* widget (173).
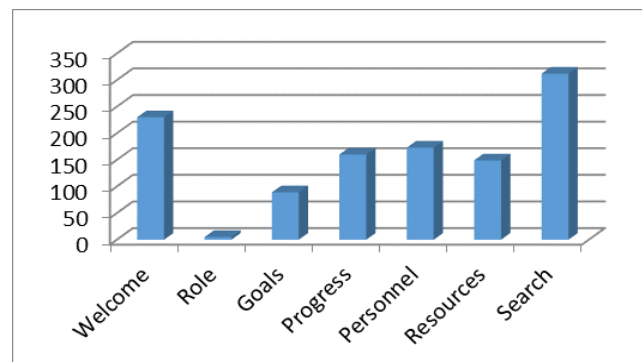

Figure 8. Employee interactions with widgets

Figure 9 illustrates activities of one employee over two weeks. The first week was quite intensive (except of the weekend in the middle), especially on two days. The second week was rather relaxed.
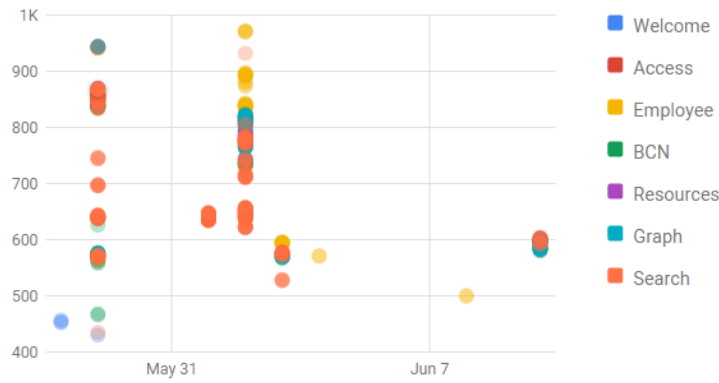
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Figure 9. Employee's long-term view – user activities

Figure 10 shows that the employee spent most of the time in Learning phase (*Learning* area), but devoted enough time also to Reflection (*Management* area).
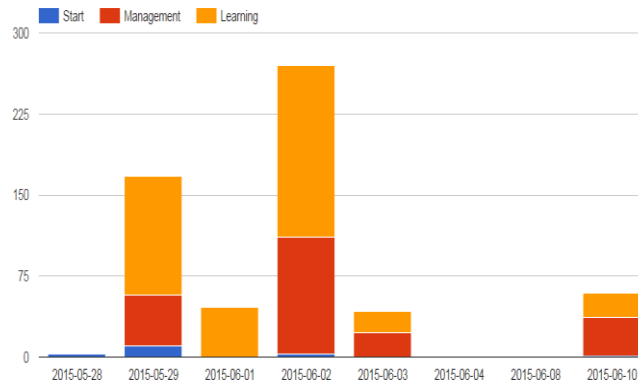

Figure 10. Employee's long-term view – usage of areas

In Figure 11 (showing 252 interaction activities) we see how one session of an employee looked like. The first row belongs to Start phase, while the next two ones represent Learning phase and the last three rows show Reflection phase. The user starts with an introduction (Access – Start in row 1) and then (Learning in rows 2-3) checks available learning materials (Resources) as well as looks for new ones (Search). This is gradually complemented (Reflection in rows 4-6) by checking the current progress (Employee, Graph) and the assigned goals (BCN).

Figure 11. Employee's short-term view

We have found out that 3 most active Employees did 51% of their interactions in Learning phase, 45% in Reflection phase, and 4% in Start phase. The most used widgets were Search, Employees and Resources. It is

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not surprising to see that this role put most effort into learning activities (considering also the invisible interaction in Viewer), but the fact that neither reflection was neglected, is quite positive.

Conclusion

In this paper, we have presented a ready-to-use Web-based learning environment, which is based on an innovative methodology for workplace learning. In order to investigate it in small companies, we have evaluated platform with more than 50 enterprises in five European countries. It is necessary to take into account that these companies usually cannot afford long-term planning and training, as they are typically busy with operative tasks. Therefore, it is pretty challenging to get them engaged in evaluation, which requires certain time investment from their side.

The involved companies belonged to various domains, not only technical ones, and in some cases encountered usability issues. Nevertheless, the evaluation outcomes suggest that the BOOST approach can be a viable one and has a potential for a further improvement, especially in the user interface area. Our data analysis shows that it was often not easy for the companies and their employees to find enough time for a comprehensive evaluation. Nevertheless, some of them worked in certain periods intensively and followed the envisioned workflow, dividing their activities among planning, tutoring, learning, and reflection accordingly.

An important finding for us was that openness and sharing, quite typical in the academic environment, are not so common in the corporate settings. Therefore, means for different levels of privacy and data security have to be provided, to allow for various levels of integration. Configuration options should enable organizations to tailor the infrastructure to their specific requirements. The BOOST approach is not necessarily restricted on small companies, but can be useful also for larger ones.

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