

Knowledge Communities II: Online Education

Sifa-Portfolio – a Continuing Education Concept for Specialists on Industrial Safety Combining Formal and Informal Learning

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Structured Abstract

Purpose–Specialists on industrial safety (Sifas) are appointed by companies due to German occupational safety act (ASiG) as safety advisors, to analyse the work environments and the work procedures. Their principal task is to inspect workplaces for adherence to regulations on health, safety and environment, and design actions to prevent from disease or injury of workers and environmental damages. Due to variety of settings in which work safety specialists are involved, they are obliged to continuous further education and permanent adoption to changing circumstances of occupational context. To do so, Sifa's need access to tools which provide the following three key features:

- possibility to share knowledge with experienced specialists on industrial safety (Sifa-Community),
- ability to promptly recognize critical topics in the field of their activities (Trend- Monitoring),
- opportunity to create track of records of further education on current topics, including the validation and certification of work-related informal learning (Sifa-Portfolio).

Sifa-Portfolio and Trend-Monitoring are based on Sifa-Community, an exchange platform (www.sifa-community.de) with currently 5.000 members established in the context of a longitudinal study on Sifas. This paper will focus on the concept of Sifa-Portfolio that was developed as a prototype of further education application based on the concept of EPortfolios. It allows Sifa's to share their knowledge, recognize critical topics and create track of records of their informal further education to showcase their competencies and eventually receive certification.

Design/methodology/approach–In the paper authors present the approach of Sifa- Portfolio - an application for further education, based on Sifa long-term study (Sifa- Langzeitstudie), data mining (text mining), and user centred design. It starts with the description of results of an online study and specific requirements that have

to be considered when designing applications for specialists on industrial safety. It then presents the trend monitor based on Sifa-Community posts, which provides up to date information about most important topics that are being discussed within the community. It finally introduces Sifa-Portfolio, a high fidelity prototype of an expansion module for Sifa-Community.

Originality/value—Until now, there are no dedicated solutions for further education of professional group of Sifas, which comply to the specific requirements of this group and which enable to react promptly to changing demands of the safety issues in dynamicly growing companies.

Practical implications—The presented approach delivers a concept of a software-module that could be implemented into Sifa-Community Forum. Due to evaluation with users, we could identify requirements and specifications of Sifa-Portfolio. Furthermore this concept can be transferred to variety of professional-groups, which are working in dynamic professions to support their work-related informal further education.

Keywords—e-portfolio, specialists on industrial safety, further education, validation of informal learning

Paper type—Academic Research Paper

1 Introduction

The digital age is marked by an entropic growth of data and information, which entails a continuous change and increasing complexity of the world of work by itself. This change in the world of work, confronts specialists for industrial safety (Sifas) with new challenges. There are types of training required that enable the experts for industrial safety on the one hand to adapt in a flexible way to the constantly changing demands of the workplace, and on the other hand promote knowledge exchange amongst them. To tackle these problems, the concept of a Sifa-Portfolio presented in this paper, proposes a work-integrated training concept for Sifas, which addresses the following three objectives.

First, the prototype should provide Sifas an opportunity to gain an overview of the current issues and problems that are discussed within the Sifa community. This creation of „awareness“ about changes in the regulations on safety at work should help to choose appropriate measures of continuous education and training. Secondly, the prototype aims to help the professionals to create a training portfolio that can be shared with other specialists for occupational safety, to exchange views on relevant

topics and to facilitate collaborative skills development . Third, the continuing education program is designed to help in future to certify or recognize the activities and learning outcomes that have been documented within the portfolio. The prototype was developed and evaluated with the help of user-centered methods (Knight et al. 2014). The concept offers the possibility of documenting training as a specialist for occupational safety digitally and to link their own Sifa-Portfolio with other experts within the Sifa-Community to exchange knowledge in a targeted way. A special account within the concept will be given to informal learning processes. Thanks to the evaluation of the prototype information on use practices, usability and expandability of the training concept were compiled.

These findings serve as implications for the next stages of development: the graphic design and programming.

2 Problem Outline

Specialists for occupational safety have a special position in the company (Köhler et al. 2015). Regardless of whether they are trained internally, or if they are appointed externally, they are always responsible for security across the entire organization. The level of safety in the workplace decides in the strict sense on productivity and status of employee's illness. In a broader sense , occupational safety affects the competitiveness of the company. For these reasons, the specialists for industrial safety are required by law to continually educate themselves.

Sifas in Germany can be appointed in different ways within companies. They can be employed as intercompany full-time professional, as intercompany part-time professional with or without management function, as external freelance specialist and as an external expert in inter-company services (Trimpop et al. 2013). Regardless of the type of appointment, Sifas must have a constantly updated knowledge from the varied field of industrial safety and the adjacent domains (Kahnwald/Köhler 2009). During the practice of the profession, it is possible for Sifas to close knowledge gaps by visiting in the sectorspecific and cross-industry training seminars (formal learning). Alternatively, they can obtain the necessary knowledge independently through, among other things, the exchange with other specialists for occupational safety , literature review, analysis of legal regulations or through Internet research (informal learning).

Sifas can choose from an extensive range of training seminars. For professionals who only start their activities as Sifa many opportunities exist to expand their knowledge. However, these offers do not always cover the needs, which are continuously created by the dynamics of the working world. Especially on new types of hazards in enterprises existing regulations need to be applied, which is not always adequate

and productive. Furthermore, a training offer can train on new demands only with a time delay, that is connected on one hand with the development of new security regulations and on the other hand with the time needed to develop new seminars. There is therefore the need for a more agile training concept, which is similar to the dynamic working context of Sifas and can contribute to a timely coverage of the skills gap.

Because informal learning in adulthood occurs predominantly voluntary and incidental, it lacks a certain structure and methodology that mainly enhance the effectiveness of learning and that would facilitate recognition and certification of completed learning activities.

Despite high participation rates, for example, massive open online courses (MOOCs) display only a low success rate compared to formal learning methods. You can reach a large number of participants but only a fraction of the users remains in such an online course until completion. By analyzing studies on MOOCs and e-portfolios, as well as blended learning and e-learning, the critical success factors for an effective training concept for Sifas can be derived.

The analysis of an online survey amongst Sifas provided evidence that the professionals have to deal with an additional problem with their informal learning. They obtain missing information and the knowledge necessary for their work from numerous external sources such as different online portals. This decentralized allocation of information leads to a lower awareness on current issues.

Low Awareness in turn has a negative effect on the quality of work, because it results in unconscious incompetence. In this case, a person is not aware of the existence of a possibly relevant thread. For these reasons, research is carried out within this paper to develop a training concept specially adapted to the professional group of Sifas.

2.1 Competencies for Sifas

In today's society competence became according to Erpenbeck and Sauter the „economized version of the classic concept of education“ (Erpenbeck/Sauter 2007, p. 7). The future development of the professionals must adhere to changes in the fields of life and work. Erpenbeck and Sauter describe this constellation with the help of five points that have a direct impact on the competence, and four levels that have an indirect influence.

The criteria of competence include:

- Capacity for self-organization
- Value orientation
- Differentiation from qualification
- Usability
- Subject centeredness

These factors are dependent on the levels of complexity , networking , uncertainty and dynamics. In 2008, Kuhlmann and Sauter anticipated what learning culture in the 21st century might look like (Kuhlmann / Sauter 2008, p. 7). Aspects such as changing learning habits, changing learning processes, changes in media usage and changing learning requirements can nowadays no longer be overlooked. The learning habits changed in the way that formal learning is increasingly supplemented by informal learning.

Informal learning through information gathering by means of various media and the Internet depends in turn closely on changes in media usage. Altered learning requirements are for instance observable in the fact that nowadays a college degree does not guarantee immediate employment what was the case in the past (Brenke 2015). Altered learning processes in terms of continuous learning are by the ubiquity of the theme „Lifelong Learning „, no longer mere ideas, but are realized today in business. In the professional environment of the specialists for industrial safety, a specific competence setting has emerged. It can be divided into two areas: core competencies acquired during Sifa training; including amongst others: workplace analysis, workplace design, industrial safety, accident prevention, fire protection, ergonomics, security, risk analysis and safety technology. Skills that are acquired during the practice of the profession are for instance: Occupational Medicine, work science, safety of transport, customer service and customer care, noise and radiation protection, environmental protection and technology (BA 2016). This systematization is considered within the further education concept developed by the authors.

3 Approach

The proposal of the Commission of the European Communities entitled „Memorandum on Lifelong Learning“ addresses the issue of different learning facets that are completed by every person throughout his life - formal learning, Non-formal learning and informal learning. Each of the facets demands specific measures to develop and transfer knowledge. Currently there is a lack of solutions specifically designed for professional groups and combining all three facets of learning in a coherent learning environment. This paper presents a continuing education program, which is aimed at professionals for occupational safety and supports sustainable knowledge acquisition that promotes a life-wide continuum of learning (European Commission 2000, p. 9).

This paper presents a prototype of an application, that supports Sifas in their inservice training (non-formal learning) and in the phases of informal learning in three ways. First, the prototype should provide Sifas a way to get an overview of the current issues and problems that will be discussed within the Sifa community. Improving the awareness of updates in the professional field will help to identify personal shortcomings and to take further training. Secondly, the prototype enable Sifas to create a training portfolio, with the option to share the portfolio or its single elements with other specialists for occupational safety, to exchange views on and to promote collaborative skills development. Thirdly, the concept of further education should help, to certify or recognize the activities and learning processes that have been documented within the portfolio in the future.

4 Methods

In order to develop the prototype, this investigation combines empirical methods with user-centric development (Wilson 2013; Lambropoulous 2006). To filter out patterns of quantitative data an empirical analysis of an online survey of Sifas was conducted. In the next step a trend monitor has been developed which makes it possible to visualize, by statistical analysis of the posts from the Sifa-Community issues and their relevance or intensity of the debate over time. From the literature review and the case studies research and interviews with Sifas the first requirements of the training concept were determined in a design thinking process. Based on the first steps a prototype was developed and evaluated with a focus group with the help of user-centered design methods. As a result, a high-fidelity prototype was created as an extension module for the platform Sifa- Community.

4.1 Design Thinking

The methodological basis of design thinking approach was chosen for the development of Sifa portfolio because of its suitability. Design Thinking is an iterative and recursive problem solving approach developed by Winograd, Leifer and Kelley, and the Hasso Plattner Institute both taught and practiced it (Hasso Plattner Institute 2016). Design thinking originally is based on four steps: 1. observation 2. idea generation 3. prototyping 4. conducting tests (Norman 2013, p. 222). The method has been further developed and reached its maturity when the first step (observation) was divided in three steps: 1. Understand 2. Observe respectively Research and 3. find position respectively interpret results (Gabrysiak et al. 2011, p. 220). Design Thinking has emerged as an approach to problem solving, which is based on the basic idea of the design process, that is referred to by Norman as „The Double Diamond Model of Design“ (Norman 2013 , p. 220). The process of finding a solution is split into two sections. On one hand the problem section is defined, on the other hand the solution section. These two areas can be described as a problem space and solution space

The problem space is diverged at the beginning to identify the right respectively the actual problem to be solved. In the process of this divergence, the problem space is expanded to consider potential alternatives. In the following a convergence of the problem space will take place to identify from the extended space of the alternatives, the correct candidate. Once a specific problem to be solved has been identified out of the problem area, the second phase begins. This takes place in the solution space, that is in analogy first diverged or expanded to increase the number of alternative solutions, so that later in the convergence or constriction of the solution space, the right solution can be found (Norman 2013, p. 217–220).

The double diamond of design proposed by Norman has an intersection with the approach that is called by Leifer as „the dance with ambiguity“. This ambiguity refers to clashing worlds of analysis and design. Leifer describes the process of analysis as a mechanism of decomposition and disassembly. An item that is broken down into individual parts in order to be able to understand what it is made of and how the components relate to each other.

Design again is referred to as a mechanism of synthesis and of assembly. The analyzed and understood components are combined in the design process in a new unit. Since this process is always dependent on context, there is no „single correct design solution“ that can be applied to all problems. The process should be designed not only with consideration, but with the active involvement of the context (Leifer, 2012). Design Thinking was chosen as a suitable method for this work because it is oriented towards practice, takes into account the context of users and allows for iterative improvements.

4.2 Requirements Analysis

A questionnaire was completed in the testing phase in the summer of 2015 by 47 specialists for industrial safety, in paper form. The following question types have been implemented: in general, open, scalar, multi -choice and ranking questions. The survey was conducted during an information event where Web 2.0 applications, MOOCs and learning within social networks were discussed.

Within the questionnaire general information was asked for in the first part: the age, the duration of employment as Sifa and the size of the business in which the Sifas were appointed. In the next section participants were asked for their use of web 2.0 applications: Social networks, video telephony, instant messaging and chat, blogs, microblogs, content sharing and cloud services, Internet forums, and video community portals. The second part of the questionnaire dealt with the scenarios: „Training and MOOCs“ and „social network“. Respondents could enter their comments and remarks in a free text field. In the following the results of analysis are presented.

The average age of the 47 surveyed Sifas is 45.6 years. The youngest participant of the survey was 29 years old, the oldest 61 years old.

The average duration of the activity as a specialist for occupational safety among participants was 7.9 years. Eight participants were working as Sifa for only one year. The longest working experience reported three participants with 20 years Sifa - activity, one with 23 years and with 35 years of professional experience .

Concerning the use of different types of Web 2.0 applications, the survey provided the following results. Of the survey participants

- 57 % use video community portals - both privately and job-related.
- 55 % use social networks - both privately and job-related.
- 55 % use video telephony/VOIP - mainly privately.
- 53 % use Internet forums - mostly job-related.
- 31 % use blogs/weblogs - mostly job-related.
- 29 % use content sharing services - privately and job-related.
- 10 % used microblogging services - privately and job-related.

The final question addressed the hurdles that exist in companies and could prevent Sifas from using Web 2.0 tools. As most prominent obstacles firewalls and regulations were specified, as well as system constraints to impede the use of Web 2.0 applications in some companies. Enterprises deploy security mechanisms to protect internal knowledge and IT systems from outside access. It showed in the context of data analysis, that the protective mechanisms affect access to content, which may be used to gain knowledge. This effect can be long-term negative effect on the company's market position. Recommended are agreements respectively conditions that would promote knowledge expansion throughout the company.

In the second part of the questionnaire, the participants were asked to evaluate two scenarios that were presented and explained to them beforehand. The first scenario involved trainings through MOOCs, the second approach the use of social networks created around personal profiles. These scenarios were assessed in terms of support for skills development as well as feasibility and usefulness of the approach as a means of expanding training possibilities for Sifas. The majority of respondents believes that the approach of training through MOOCs is a good addition to skills development, can be realized in practice and supports practice in the field of occupational health and safety. The approach „social network“ has been judged even more positively (positive answers by nearly two thirds of the participants). From this generally positive assessment it can be subsumed that Sifas are open towards new approaches to training and networking supported by new media.

5 Sifa Trend Monitor

Requirements for the Sifa portfolio were determined partly based on the analysis of results, which were created by the Sifa-Community Trend Monitor. The Trend Monitor is a functional prototype developed specifically for the purpose of analyzing postings within the Sifa-Community. It is a text mining tool, by means of which the Forum Posts, are statistically analyzed and visualized in consideration of the time dimension. Development of the trend monitor was based on the approach of Bensberg (Bensberg 2012 p. 434), who determined future training needs by means of a systematic analysis of job posting. Within this approach careers were analyzed using text mining tools to determine the need for experts on various subjects. With support of the trend monitor the Community Posts were analyzed from the period between 01.12.2013 to 30.06.2015. The data to be analyzed included 125,273 records and was extracted from 1127 forum discussions. Each record included the term, the date of publication, the author's nickname, category, respectively the subject in which it was written. After export from the Sifa community the data was processed in Excel and visualized using the data analysis program tableau. The goal in designing the trend monitor was to allow an analysis of all topics by visualizing the frequency of words from all community contributions. The aim is to support the identification of seasonal trends or newly arising topics, regular repetition of themes and the intensity or the frequency with which the issues were discussed.

To create the trend monitor text mining methods were applied which allow to discover contextual patterns in large amounts of data and visualize the relationships. This methodology makes it possible to create visualizations that have a large information content, which is displayed in a compressed manner. For the analysis, a quantitative approach (Content) is combined with the qualitative approach (context). The evaluations that are generated by the trend monitor have a diverse character. On one hand purely statistical information can be visualized, for example, number of posts per month, number of published words per year or the number of words an author has published in a defined time span. Secondly, the visualizations include a contextual component, taking into account the time dimension, thereby producing a richer information. As an example, the activity of individual authors on specific topics can be visualized over time. Alternatively, the frequency of topics discussed in each month of a given year comparing over several years could be displayed.

Within the time period between 01.12.2013 and 30.06.2015 1127 topics or questions were discussed in the forum on the website of Sifa community. In the following, a visualization is presented, which addresses the frequency of given words over time (figure 1). Although a data volume of several thousand subjects would be advantageous in order to derive reliable information, still a pattern can be seen already when analyzing about thousand posts and debated issues. Themes like:

- Employees—in the months of December of 2013 and January 2014 discussed just as often as a year later than December 2014 and January, 2015.
- Community—was picked up particularly intense in June and September 2014 as compared to months before and after.
- Cost—the cost issue was discussed comparatively strong in months December 2014 and March 2015.
- ASR—abbreviation in the context of „Technical regulations for workplaces“ was much more discussed in May 2014 and in February 2015 than in other months during the period selected.

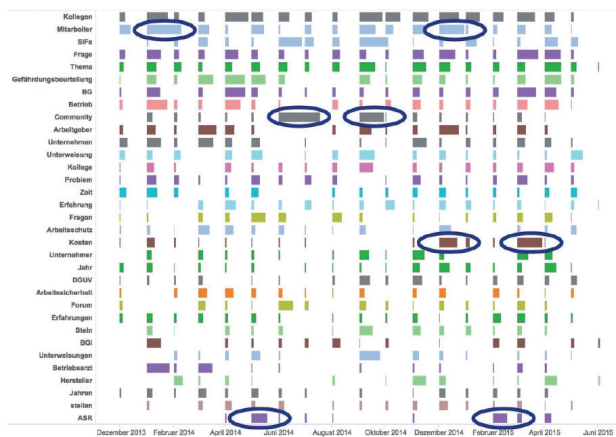


Figure 1: Frequencies of Keywords used in Sifa-Community discussions

6 Design Concept

The schematic illustration of Sifa portfolio architecture (figure 2) illustrates the type of portfolio creation, the portfolio presentation and cooperative learning which is aimed at through the concept developed. In the center of the architecture are the individual learning artifacts created by Sifas. The artifacts may have an individual character, in which they are visible only to the author, but they can also be shared so that each professional within the Sifa community can find it. The shared artifacts can be included in the portfolio of another person and commented from another perspective thus creating a personal view and perspective of the artifact.

Participating Sifas can decide which artifacts they release from their own portfolio. Furthermore, it can also be determined which artifacts are included in a public portfolio that is intended for presentation purposes outside of the Sifa Community. The public

portfolio is extended by a skills index and Badges area. For the administrators of Sifa community an area was designed in which access is available to additional functions of the trend monitor, and statistics on the activities of the authors and the variety of categorized learning artifacts created by Sifas within their portfolios.

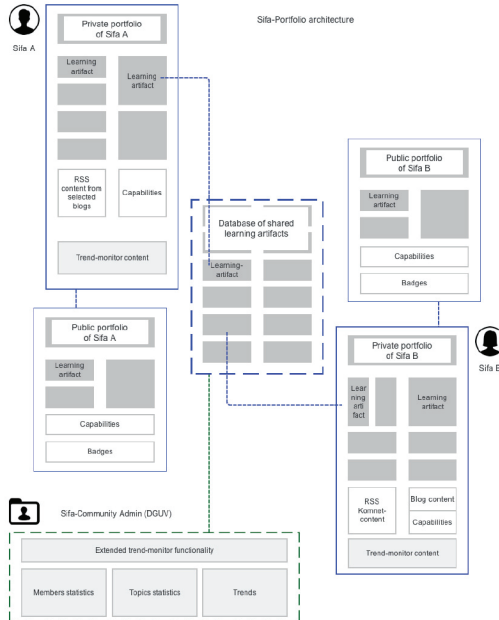


Figure 2: Sifa-Portfolio architecture

7 Conclusion and Outlook

The evaluation of a prototype of the Sifa-Portfolio, which was carried out with active public service Sifas, provided feedback on the concept and raised new questions. Based on feedback discussions some insight could be gained. It has been confirmed that the Sifas have a great interest in documentation of training activities, both formal and informal. The main concern was not about the hoarding of learning artifacts so that they fill the database, but in learning new skills, the knowledge gained and the potential possibility of documenting learning activities for the purpose of self-promotion and professional positioning to use.

In the first interviews, which were conducted to determine the requirements of the training concept, a certain dissatisfaction with the private providers of seminars was expressed. The concerns were primarily the poor quality of training, which was observed only during the participation in the training but not in advance. It turned out that the Sifa portfolio could also provide a positive contribution to the exchange of information on different trainings between Sifas. By intensive communication and cooperative learning by learning artifacts that can be shared and discussed within the Sifa portfolios among themselves, it is possible to filter out providers of low quality seminars of the vast amount of training opportunities.

The systematization of the requirements of the training concept in categories: 1. learning artifacts, 2. arrangement 3. rights and access, 4. ranking and quality, 5. career /self-promotion and 6. connectivity, reveals factors that can contribute to the training of Sifas. The concept is closely linked to the Sifas workplace activity. Thus, it can play an expanding role for Sifa skills. The personalization of learning artifacts helps to memorize the new knowledge in the long term and it makes its use more likely, because it touches the affective learning level.

The multiple perspectives on the portfolio elements expand the understanding of the learning material in the own professional context. At this point, the concept can benefit from the integration in the Sifa community. By extending the platform by the Sifa portfolio new possibilities of use open up for the registered members. Also the operators and administrators of the platform get enhanced insight into the learning activities of Sifas what may be promoting the development of future training. By Sifa portfolio a learning platform is established in the form of a Personal Learning Environment, which in turn creates an opportunity to analyze the learning behavior (learning analytics).

The integration of the trend monitor within the Sifa community and the Sifa portfolio promotes awareness on critical issues that are discussed between the members of the community. This can be useful to determine the right action measures, especially in the ever-changing field of regulation and legislation. The interviews have shown that especially when regulations are changing it comes to uncertainty, because the amended standards cannot always easily be implemented in and adapted to the individual business context. Therefore, it usually requires a period of time for the adaptation of new or amended regulations. Increased discussion on such issues can be identified in a timely manner within the trend monitor.

The advent of mobile and Internet-enabled devices in everyday life enables remote access to the contents that are stored in Sifa portfolio. This ensures access to the content and the possibility of contact with other specialists for occupational safety, not

only in the workplace. The survey showed that at an average age of 45 years, not every Sifa copes well with latest applications and Web 2.0 knowledge transfer methods. In this regard, an adaptation period is necessary, but the trend shows a fundamental interest of Sifas - regardless of age.

Particularly the use of text mining tools to visualize the Posts of Sifa community proved to be helpful. This approach can serve both new and experienced Sifa community members as an auxiliary tool to identify topics of intensive discussion and promote knowledge sharing.

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