

INTEGRATING NEEDS ASSESSMENT WITHIN NEXT GENERATION E-LEARNING SYSTEMS

Lessons learnt from a case study

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Abstract: In this paper we outline a method for systematically addressing needs assessment (QUALISEM-PEOPLE), alongside a case study of its use within a medium sized, German company. The method was designed in order to provide guidance in analysing skill and role competences, particularly when e-learning systems are being considered for training purposes. The method proved to be successful within the company and helped to profile actual and target qualification needs, as well as employee preferences. In addition, there were also a number of overall lessons that could be learnt from the case study. These mainly relate to the need to integrate needs assessment within the broader context of Human Resource Management (HRM) systems, as well as the importance of employee participation within the process. We end the paper with a discussion of possible extensions to our work as well as outstanding challenges within the area

Key words: Industry Training, Self-assessment, Software Engineering.

1. INTRODUCTION

A number of studies within the broad subject of e-learning have examined the evolution of different types of systems over time. First generation e-learning systems, for example, were often seen as a substitute for classroom training, on-line courses tended to be developed as direct analogues of conventionally delivered courses (Darby, 2002). E-learning was viewed mainly as an individual training tool that could be used to provide training in the learners own time, and at their own pace. One of the main drivers for the tools was the expectation that they could help organisations to save money on training costs. However, it soon became

clear that the outcomes from this type of e-learning often failed to meet company expectations. Knights (2002) for example, found that many employees were either not aware of the existence of on-line courses or found them very difficult to locate. In addition, much of the course material involved working through successive screens and modules that were laborious and did not support enjoyment or exploration of their content.

One response to these problems has been the development of e-learning systems that provide courses which are purposely designed for the particular instructional domain, make use of instructional e-learning design guidelines, and offer opportunities for cooperative learning (Darby, 2002). A second response is the move from support-driven towards demand-driven education by making optimal use of Information and Communication Technology (ICT) functionalities (Kirschner and Valcke, 1993). Students can make decisions in relation to two different fields, namely about the content of education and concerning the didactic elaboration. These systems incorporate an intake-module that measures individual learner needs, and learning styles. In addition, the more recent generation of e-learning systems offer possibilities to structure the informal learning process by bridging the gap between learning and professional practice. An example is the concept of the Virtual Business Team (VBT) (van Petegem et al., 2000) developed within the Dutch Open University. A typical VBT workbench provides tools to support collaborative work in a networked environment, tools for assessment and guidance, and tools for knowledge management. These later systems highlight the importance of focusing as early on as possible on the specific requirements and needs of the target population of an e-learning system. In addition, there is a need for methods and tools that offer systematic guidance and support in gathering these types of requirements. In this paper we describe one such method (QUALISEM-PEOPLE), as well as report some experience based upon its use within an industrial case study. The paper is structured as follows: a description of the e-learning needs assessment method QUALISEM-PEOPLE, a case study in which QUALISEM-PEOPLE was used; a discussion of the main lessons learnt and outstanding challenges presented by our research.

2. THE QUALISEM-PEOPLE METHOD: NEEDS ASSESSMENT FOR E-LEARNING

QUALISEM-PEOPLE is part of a larger-scale system (QUALISEM), which is a modular framework for the assessment, evaluation, and certification of software engineering qualification systems. Each module in QUALISEM offers services that help to facilitate decision making with

regard to training and development or to get insight into the quality of the choices that have already been made. The modules cover methods and tools for the assessment, evaluation and certification of various dimensions of a specific part of the software engineering qualification system (i.e., covering people, processes and products). One of the modules, QUALISEM-PEOPLE, deals with the assessment of qualification needs of employees involved in the software developing process. QUALISEM-PEOPLE makes use of a set of customisable standard skill profiles and consists of eight steps.

2.1 Use of Standard Role-based Skill Profiles

In order to save time during the needs-assessment process QUALISEM-PEOPLE makes use of so-called “standard competence profiles”. Within the field of software engineering several accepted competence-based frameworks exist, for example:

- The Career-Space framework is a set of generic skills profiles covering the main job areas for which the European-wide ICT industry is experiencing skills shortages (<http://www.career-space.com>)
- APO-profiles, a German-wide initiative that is focusing on the description of job-profiles in terms of work processes, associated activities and required competencies (<http://www.apo-it.de>).
- ESF-Baukasten (<http://www.iese.fhg.de/ESF-Baukasten/>) describes role-oriented competency profiles for the field of software engineering.

2.2 Steps within QUALISEM-PEOPLE

The method involves eight steps, these are:

1. Selection of an adequate set of standard profiles, specific roles and employees within the company.
2. Tailoring of the standard profiles for each role in order to meet customer needs and to fit in with the specific company context.
3. Assessment of the target profiles based on a role-based questionnaire in which the employees and/or company managers rate desired performance levels for each of the specific competences that are listed in the standard-role-profile. In completing the questionnaire it is also important to take into account the future needs of an organization or department, as well as new methods that may be applied.
4. Assessment of the actual competences on the basis of a role-based questionnaire in which the employees rate their actual performance level for each of the specific competences that are listed in the standard-role profile.

5. Assessment of the qualification preferences on the basis of a role specific questionnaire in which the employee rate for each skill listed whether they wish to be further trained in that skill.
6. Data-analysis of the collected data per role, resulting in the description of actual and target skill-profiles for each role as well as a list of training preferences
7. Comparison and aggregation of the data from step 3 and 4 resulting in a skills gaps analysis at role- and organization- level. Balancing of the skill gaps and qualification preferences at role and organisation level.
8. Stakeholder workshop - the objective of which is to prioritize the skill gaps and identify the preferred ways in which to provide training for them.

3. QUALISEM-PEOPLE: A CASE STUDY

3.1 Background

A medium sized enterprise and market leader in the development of industrial printing machines took part in the study. The company was introducing new shopfloor machinery, and the main difference between the old and the new machinery was related to the complexity of the software that was built into it. Since most of the employees had a mechanical or electrical engineering and not a software engineering background, it was expected that although having coped very well with the software development and maintenance thus far, the new release might require more up-to-date competencies. The work involved the re-design of the software development process, as well as helping to determine employee qualification gaps.

3.2 Use of the Method

Roughly 10 person-days were needed for adapting the questionnaires, conducting statistical evaluation, and summarising and presenting the results. Two meetings with the main stakeholders were held at the beginning and end of the study. In addition, briefing interviews with selected employees were performed in order to reassure them of the value of the work being performed. The remainder of the data collection was done via e-mail.

3.3 Outcomes

During the initial interviews with stakeholders it was decided that the ESF-Baukasten was to be used as a standard set of skill profiles. Five specific profiles were selected as relevant. Table 1 shows the different roles that were involved as well as the number of employees for which a specific skill profile was expected to be applicable.

Table 1. Number of employees per role

Role-profile	Number of employees
Application programmer	17
Architect	6
Designer	11
Requirements engineer	12
Tester	5

Many employees occupied more than one role in the software development process and that it was not always easy for them to distinguish what kind of skill was needed for which role. In order to minimize the required time for completing the questionnaire, role-specific questionnaires were established which contained all of the technical and behavioural skills necessary to fulfil the role. The employees were then asked to perform a self-assessment of their skills, by rating for each competence area their respective development level (actual situation) as well as the needed development level (target situation). Individuals were also asked to state areas of competence that they felt they might require further training. The questionnaire contained information regarding actual, target and subjective qualification preferences for each employee.

The employees were informed about the objectives of the survey prior to receiving the role-specific questionnaires by e-mail. Completed questionnaires were sent back to the researchers and analysed in such a manner that individual characteristics of employees could not be identified. The results were summarized and presented to the management who then decided upon concrete qualification measures or activities.

4. LESSONS LEARNT

Our experience in using QUALISEM-PEOPLE provided us with a number of important lessons learnt. In particular, we point to the following lessons that should be taken into account when applying this method.

4.1 The importance of viewing needs assessment within the context of larger systems

In our case study we found that the result of the gaps analysis showed that some gaps were not explicitly related to the newly introduced processes and appeared to have existed for a longer time. In order to guarantee a more continuous tracking of the qualification needs it would be advisable to incorporate the needs analysis in a more comprehensive approach towards reviewing and assessing the larger HRM system within a company. The determination of qualification gaps and associated needs is not a one-shot process, which occurs at one point in time. Instead it may occur at numerous points during the cycle of changes to the work process, the analysis of skills-gaps and the generation of new training requirements for example.

4.2 Application of standard role-based skill profiles

Working with standard profiles within needs analysis is often helpful in gaining time during the overall qualification process. However care has to be taken that the activities allocated to a skill profile within the company correspond to those allocated in the standard set. In other words, the standard-set should be used only as a starting point that might have to be adapted in the light of other information that may only be available later on in the overall process.

4.3 Employee involvement

The main purpose of this survey was to elicit the general level of skill gaps among the employees working in software development. An important lesson was that this should be done by the employees themselves through self-assessment of their skills. Using this procedure they were more directly involved in the planning of their own qualification processes and therefore felt a high degree of ownership of the outcomes. An important factor for the data collection was that their contribution was anonymous and confidential. The involvement of employees in the needs assessment was vital in overcoming any potential problems in terms of confidentiality and anonymity that could have potentially arisen during the study.

4.4 Capturing employee preferences and other data

One of the most successful aspects of the use of QUALISEM-PEOPLE proved to be the stage of the method that involved employees rating their own

preferences for qualifications and new competences alongside actual and target ratings. One benefit of this approach was that employees felt that the resulting skills gap analysis was not something that was being imposed upon them by managers within the company. Employees correspondingly felt a large degree of ownership of the outcomes derived from the method. This could potentially prove beneficial in the later implementation of new competences and training programmes within the company.

5. SUMMARY AND OUTSTANDING CHALLENGES

At present, QUALISEM-PEOPLE is a method that helps to identify skills and qualification gaps on the basis of an assessment of the actual, target and preferred competence-based needs of employees. The method represents one way in which to systematically analyse and evaluate these types of requirements and provide companies with guidance. In particular, it can be used as the basis for making decisions regarding the form, content and type of training programmes (e.g., e-learning, blended learning, classroom instruction). The method helps to fill a gap in current practice where the use of systematic approaches to the assessment of skill and qualification needs in the context of e-learning is often piecemeal and incomplete. This is particularly the case in industries such as software development where new roles and competences emerge over very short time periods. An additional strength is that it is relatively straightforward to use and actively involves employees in the process of needs assessment.

The case study we described illustrated a number of important lessons that can be learnt from the use of methods such as QUALISEM-PEOPLE. In particular we would highlight the importance of integration with other HRM activities within companies and the need to view skills assessment as a continuous and iterative process rather than a discrete output. A second lesson is that employees should be involved as much as possible in the change process as this can provide a number of benefits.

There remain a number of outstanding challenges that go beyond the scope of the present work we have described. In particular we would point to the need to develop systems, methods and tools that provide guidance in selecting different types of learning (e.g., the choice of blended vs. traditional classroom learning) and assessing their suitability in the light of the results of needs analyses, the personal preferences of the individual learner, as well as other criteria which may be relevant (e.g., type of instructional material). We believe that QUALISEM-PEOPLE is only a

small step towards such a goal but it also provides a good basis for improving future generations of e-learning.

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BIOGRAPHY

Dr Dieuwke de Haan has a background in educational innovation and technology, with a focus upon educational assessment and testing in higher distance education. As a scientist at Fraunhofer IESE, her main interest is in research and development of models for quality assurance of (in)formal learning and in assessment of competence needs, all within the area of software engineering. Dr Patrick Waterson is a scientist at Fraunhofer IESE. His background is in work psychology and human-computer interaction. His current research interests focus upon workplace learning and the integration of concepts from work psychology into software engineering training and education. Sonja Trapp holds University degrees in Linguistics and Adult Education. She joined Fraunhofer IESE in 2001 where she has been working in research and industrial projects on e-learning and ICT skill profiling.

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