In: Proceedings of the International Conference on Knowledge Management (I-KNOW '06), Graz, September 2006

Ontology-based Competence Management for Healthcare Training Planning: A Case Study

Christine Kunzmann
(Kompetenzen gestalten – Kompetenzorientierte Personalentwicklung, Germany
kontakt@christine-kunzmann.de)

Andreas Schmidt
(FZI Research Center for Information Technologies, Germany
Andreas.Schmidt@fzi.de)

Abstract: With the increased pressure towards economic efficiency, hospitals and other healthcare institutions need to reengineer their internal organization and processes. This challenges human resources development with increased efficiency of training in general. We have developed a competence management concept for training planning at a big German hospital with a special focus on critically analyzing the suitability of state-of-the-art ontology-based approaches and their operationalization into management processes for the area of nursery. Experiences from the case study show the general feasibility, but also crucial issues summarized in this paper.

Keywords: human resources development, competence management, skills management, training needs analysis

Categories: H.3.4, I.2.4, J.1, J.7

1 Introduction

German hospitals are currently undergoing a paradigm shift towards operating efficiency with the introduction of the German DRG (diagnoses related groups) system in which hospitals get a fixed amount of money for a particular illness. As far as human resources development is concerned, on the one side this paradigm shift requires well-trained employees in order to be able to improve process quality and to flexibly adapt to changed processes (as a result of quality management approaches); on the other side, training costs themselves are being put to test, both internal and external costs. These challenges can only be adequately met if training is made more efficient, more targeted to the most needed competencies.

Competency management as an approach for goal-oriented shaping and development of individual competencies in order to achieve organization-wide competence is promising, although hardly in place in hospitals so far. This has various reasons. One of them certainly is that skills management instruments as the operationalization of competence management are currently mainly used for project team composition or applicant selection [Biesalski & Abecker 2005], but not for training needs analysis, which is far more important for healthcare institutions with its importance of *continuous* formal training.

In order to explore how skills- and competence management concepts can be used in the healthcare domain, we have analyzed the situation at the Municipal Hospital of

Karlsruhe, Germany (SKK for short) with its 4.000 employees, developed a concept and deployed a solution at four pilot stations with about 50 employees. Further extension to the whole hospital is currently underway. A special focus of the case study has been the analysis and adaptation of existing process models for competence management and the identification of critical issues when rolling out a competence management concept. In this paper we want to present the major findings from analyzing the problem domain [Section 2], developing the solution [Section 3 and 4] and the pilot deployment [Section 5].

2 Analyzing the Problem

German hospitals are traditionally characterized by rather autonomous medical departments and wards and a weak central management, which make global optimization of processes rather difficult. Apart from the medical personnel, this especially applies to the area of nursery, which makes up the major part of the employees. If we consider the current practice in training needs analysis and program planning, we will find it being characterized by ad-hoc and reactive planning. Nursery at the SKK makes no difference in this aspect. The SKK has a training center, which annually sets up a training programme and organizes the individual training events. Starting point was an in-depth analysis of the current situation at the SKK based on semi-structured interviews with different groups, ranging from ordinary nurses to nurse management. This has identified shortcomings in the following areas:

- **Operational human resource development process.** Registration for training events is currently mainly employee-interest driven instead of needs-driven. Apart from accidental observation by the ward manager, there is no assessment of competency gaps or even training effects.
- **Operational needs planning.** The process does not ensure timely registration for training events so that there are over/under capacities for certain trainings. This is mainly the result of the employee-driven approach, combined with late coordination with staff allocation.
- **Strategic human resources requirements planning.** Although it is clear that hospital need restructuring, there are no instruments for ensuring that there are sufficient employee competencies for new structures, e.g. focus areas. This can be mainly traced back to the missing connection of strategic (hospital and nurse management) and operational levels (ward management).
- **Strategic training needs planning.** Unsystematic mid-term training needs analysis via open questionnaires yield unusable results because of very low response rates and incomparable feedback. This lack of motivation for participating in the needs elicitation process can be traced back to the fact that on the operational level, the needs elicitation is not perceived useful and that responses do not imply any form of commitment to the reported needs. Incomparability is mainly a result of using different and imprecise vocabularies and different levels of abstraction.

From this analysis, we identified the following challenges in the context of employee competencies: (1) how to systematically assess employee competencies and plan training activities and (2) how to connect the strategic planning processes with the operational processes of human resource development activities.

3 Overview of the Approach

3.1 Strategical and Operational Competence Management

Although there has been a lot of research on skills and competence management [Berio & Harzallah 2005; Biesalski 2005; Dittmann & Zelewski 2004; Reinhardt & North 2003], there is no reference process model for using it in the context of training needs assessment and human resource development planning. Even the generic models usually do not consider the different levels, for which a clear separation of roles and responsibilities is crucial in real-world settings. So we have set up such a process model based on the operational model of [Klemke et al. 2003] and extended it with the strategic and normative layers in [Fig. 1] (layers according to the St. Gallen management model; [Rüegg-Stürm 03]), where the operational part corresponds to the notion of skills management.

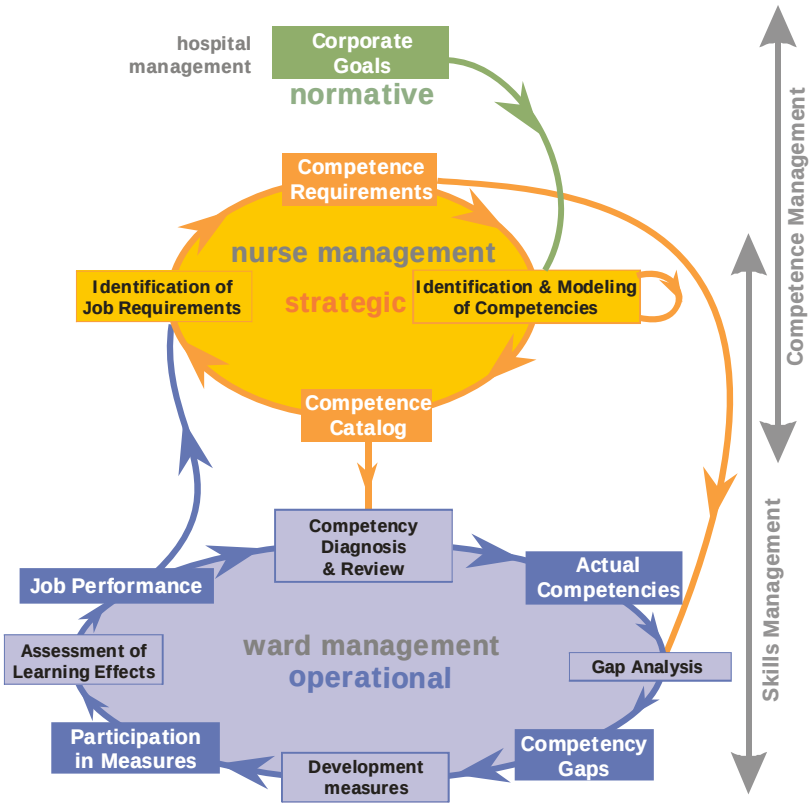

Figure 1: Levels of Competence Management and their Interconnections

Core of this model is the **strategic layer**, which focuses on the instrument of a competence catalog, specifying the vocabulary (or ontology, cp. [Biesalski & Abecker

2005]) for talking about requirements and employee competencies. Additionally, on this layer job requirements are specified, which are based on experiences with job performance, ideally measured in the context of quality management. The **normative layer** (responsibility of hospital management) mainly defines the goals (e.g., the hospital wants to specialize in specific areas), which influence the relevant competencies. On the **operational layer**, competencies of employees are diagnosed based on observable job performance using the competency catalog as a vocabulary. In a comparison with the requirements specified for the job role, the competency gap can be determined. Training measures are selected, which have these competencies as objectives. After the participation of the employee, the learning effects can be measured (in the form of assessments within the training activity) and afterwards the effects on job performance can be evaluated, which can lead to an augmented competency profile for the employee.

What is most important in this model is the continuity of the processes on both the strategic and the operational layer. Competence management is not a one-time activity. Rather the benefits are only realized through its continuity.

3.2 Training Needs Planning

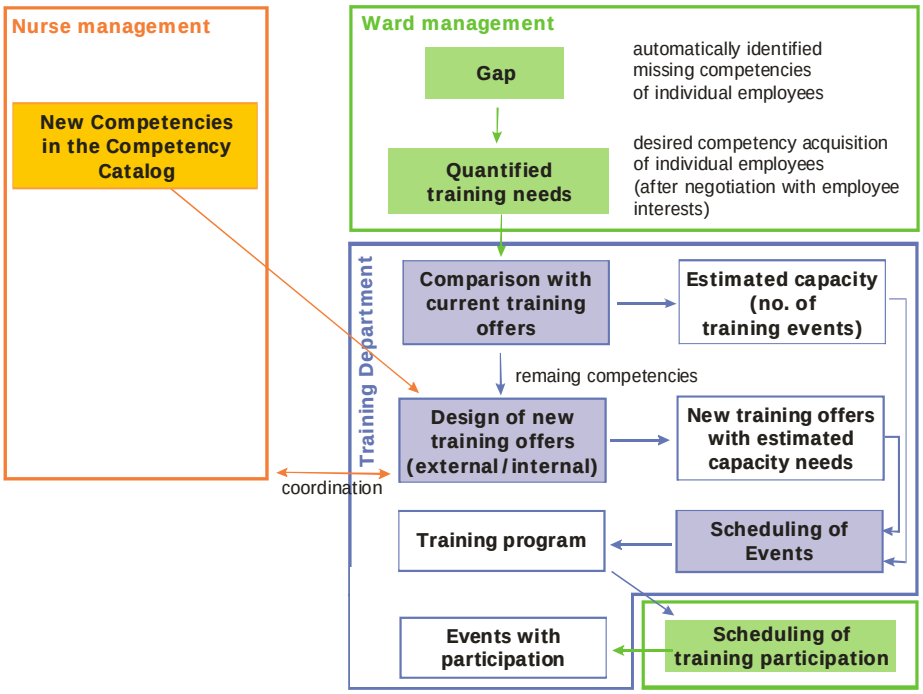

Figure 2: Competency-based training needs planning

Starting point is the competency gap of each employee [Fig. 2], which is automatically determined by comparing the actual competency profile with the

requirement profile of the job roles. This automatically determined gap is not sufficient, because not everything can be automated. The ward manager uses these gaps as indicators for individual development decisions in the course of appraisal interviews, which also take into account the interests of the individual employee. These decisions yield quantified training needs, i.e. for each employee and the coming period the competencies that are desired to be acquired.

The training department can compare the desired competencies with the current training offers. If this can be handled, the algorithm already yields the quantified need allowing for capacity planning. Otherwise new training offers have to be designed together with the nurse management. There is also a dialog about new competencies, and how they should be trained. After new training offers have been created and their capacity estimated, the training center can schedule individual training events, which gives the training program. The wards that reported certain competency needs are then asked for fixing the participation in these events.

4 Implementation and Lessons Learnt

4.1 Modelling the Competence Catalog

The competency catalog had to be modelled completely from scratch. We have followed a highly interactive development methodology. In a first step, we have conducted semi-structured interviews with all ward managers and several nurses on the pilot stations. With this information, a series of workshops was held with the nurse managers in which the competence catalog was iteratively developed. In the end, we have come up with a competency catalog of about 700 competencies, which cover general competencies and the special competencies of the pilot stations as well as a majority of competencies which are shared among some departments.

The workshop discussions and ward interviews have shown that competency modelling needs multi hierarchies as the primary modelling construct. Mono hierarchies turned out to be not suitable because of many cross-references among disciplines. In order to increase usability on the operational level, a view definition mechanism was suggested as very helpful with the help of which the display of the competency catalog can be personalized for the different working areas (especially for ward managers). With the growing competency catalog, however, additional semantic relationships should be introduced in order to support navigation in the catalog.

As competencies are never yes-no properties, it is important to distinguish between different competency levels. We have chosen the five level scale of [Dreyfus & Dreyfus 00], because five levels are known to yield the highest validity [Cooper 00].

Although the involved group of nurse managers was at first sceptical about the ontology-based approach, it turned out that it was very constructive for discussions among the different departments. The need to specify a common vocabulary revealed the lack of understanding. Because of the need of precise definitions, discussions have become quite constructive, although – not surprisingly – competency modelling has turned out to be a hard task which needs both profound domain knowledge and modelling competencies.

4.2 Tool support for Competency Modelling

An evaluation of current tools supporting competency modelling in the context of human resource development has been quite disappointing, given the fact that such tool support is essential for ensuring acceptance among non-IT-specialists in the nursery area. The main problem with these tools are (1) they seem to be designed for small competency catalogs (up to 100 competencies) where navigation does not play a prominent role and (2) they only support mono-hierarchies (i.e. trees), which are not adequate for structuring the domain. They seem to view competency modelling as an administrative process, rather than a creative and collaborative process in activities to operationalize goals and strategies.

Due to the inadequacy of these tools, we have chosen, similar to [Lau & Sure 02], a mind mapping tool (MindManager X5) and are currently working on a plugin to allow for smooth ontology evolutions in cooperation with the other components involved in the process. The mind mapping technique proved very effective, especially because of the ease of navigation and rapid changes in the structure. This supported the middle-out approach that starts on a medium level of details and both generalizes and particularizes the identified competencies. The lack of formality of mind maps needs to be compensated by a moderator in the process with modelling know-how. The most serious limitation of the approach, which gives a strictly mono-hierarchical structure, was the awkwardness of representing poly-hierarchical structures.

4.3 Describing Requirements and Gathering Actual Competencies

In a similar manner to the competency modelling, we also analyzed how requirement profiles are to look like. It turned out that the approach taken by HR solutions like SAP personnel development module is sufficient, where requirements are assigned to job roles and individual employees can have one or more such job roles. In our case study, we basically needed three levels of profiles: a general nurse profile for somatic departments and one for psychiatry. For each clinic (e.g., internal medicine), we had special requirements. The next specialization level was the level of individual wards. The individual profiles had between 5 and 30 competencies, taken exclusively from the competence catalog.

Within the profiles, we have distinguished between essential and desired competencies. Essential competencies must be acquired as soon as possible, while desired competencies indicate the direction of development and their acquisition has to be balanced with the training budget. Although we originally wanted to prioritize the desired competencies, it turned out that the additional complexity outweighs the benefit by far.

While formalizing the requirement profiles, it was also discovered that not all requirements can be assigned to individual job role profiles, but some have the form of "on a ward, at least two nurses must have the competency X". To accomplish this, we have introduced absolute ("at least 2") and relative ("50 %") constraints on the set of instances of job roles, which can be assigned to organizational units.

Both the requirement profiles and the aforementioned constraints are used to generate a simple controlling instrument for the ward manager based on Microsoft Excel. First experiences have shown that ward managers appreciate it as useful for

their operational work. For the hospital-wide rollout of the system, it is planned to implement it within SAP HR, which is already in use, probably with an addon tool that overcomes the usability problems identified in a first evaluation.

The gathering of actual competencies is done in a mixture of self-assessment and assessment by the ward manager. The negotiation between the two perspectives takes place in combined appraisal interviews (in the context of management by objectives).

4.4 Thinking in Competencies

Thinking in competencies is probably the most challenging issue when implementing competence and skills management in hospitals. Although experienced with formal training on a very large scale, they are used to thinking in qualifications as certificates for having successfully attended training events. During the process of modelling the initial competency catalog they were always prone to making it the basis for checklists ("has attended the training event X").

An agile methodology is highly recommended in order to promote the idea of thinking in competencies and to ensure that the outcome of the modelling process will be relevant for the later operational work. Start with the most essential items and provide tools to make use of it to the ward managers. In a next cycle, refine the catalog.

Also it turned out to be a mental paradigm shift that job requirements consist of two types of requirements (essential vs. desired competencies). This implies that usually nurses do have gaps and never fully satisfy the requirements. This corresponded to an uneasiness of assigning competency levels to individual employees.

5 Conclusions and Outlook

Competence management for a systematic planning of human resource development activities in the nursery domain is both feasible and reasonable. The presented process model allows for an integration of strategic and operational aspects, which is of crucial importance for the acceptance. The common vocabulary at its core provides the basis for systematic human resources development in an environment with an institutionalized formal training system.

On the operational level, ward management has received a simple instrument for keeping track of their employees' competencies with a combination of self-assessment and management by objectives. On the strategic level, the discussion is structured around and targeted towards a common vocabulary, which makes the process much more efficient. What was extremely disappointing was the quality of existing tools for (collaborative) competency modelling. From our analysis, none of them appeared to be adequate for more complex catalogs, which are required for knowledge-intensive domains like nursery. Given the fact that the competency modelling is actually the most crucial part, an improvement in this area is definitely on the agenda.

Successful introduction of competence management needs a bootstrapping phase in which a "thinking in competencies" is established. In environments where formal training dominates, people are tempted to mistake participation in training events with

competency acquisition. But still it seems much harder to establish competence management in companies with less formal training organization. Competency-based learning on demand as presented in [Schmidt 05], combined with competency development in informal learning processes [Ley et al. 2005] seems to be a promising approach for these type of companies, which are very common in the ICT domain for example.

References

[Berio & Harzallah 05] G. Berio, M. Harzallah: Knowledge Management for Competence Management. J.UKM 0(1), 2005, 21-28

[Biesalski & Abecker 05] E. Biesalski, A. Abecker: Human Resource Management with Ontologies. In Professional Knowledge Management. Third Biennial Conference (WM2005), Kaiserslautern, Germany, Springer 2005, 499-507

[Cooper 00] K. Cooper: Effective Competency Modeling & Reporting, New York: American Management Association, 2000

[Dittmann & Zelewski 04] L. Dittmann, S. Zelewski: Ontology-based Skills Management. In Proc. of the 8th World Multi-conference on Systemics, Cybernetics and Informatics (SCI 2004), Vol. IV, 190-195

[Dreyfus & Dreyfus 00] H. Dreyfus; S. Dreyfus: Kompetenzerwerb im Wechselspiel von Theorie und Praxis. In: P. Benner: Stufen zur Pflegekompetenz – From Novice to Expert, Bern/Göttingen: Hans Huber, 2000, S.45-68

[Klemke et al. 03] R. Klemke; P. Kröpelin; C. Kuth: Ganzheitliches Kompetenzmanagement. Personalwirtschaft 2003(2), 26-31

[Lau & Sure 02] T. Lau, Y. Sure: Introducing Ontology-based Skills Management at a large Insurance Company, In Modellierung 2002, Modellierung in der Praxis - Modellierung für die Praxis, 2002, 123-134

[Ley et al. 05] T. Ley, S. Lindstaedt, D. Albert: Supporting Competency Development in Informal Workplace Learning. In: Professional Knowledge Management. Third Biennial Conference (WM2005), Kaiserslautern, Germany, Springer 2005, 189-202.

[Reinhardt & North 03] K. Reinhardt; K. North: Transparency and Transfer of Individual Competencies - A Concept of Integrative Competence Management. In: J. UCS 9(12), 2003, 1372-1380

[Rüegg-Stürm 03] J. Rüegg-Stürm: Das neue St.Galler Management-Modell. 2nd ed., Bern, 2003

[Schmidt 05] A. Schmidt: Bridging the Gap between E-Learning and Knowledge Management with Context-Aware Corporate Learning Solutions. In: Professional Knowledge Management. Third Biennial Conference (WM2005), Kaiserslautern, Germany, Springer 2005, 203-213