Effectively Managing and Processing Personal Learning Content

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Abstract. Comparing the typical learner only about one or two decades ago and today, an undeniable difference is evident. By now, most of traditional learning has been moved into a continuum of blended learning, as defined by Jones [1]. In this context, especially ways for distributing learning material and contacting each other have completely changed. Learning Management Systems (LMS) are, in the majority of cases, employed to provide a basis for modern learning. Whether it comes to distance learning or not, all required material, including additional information for further reading and tasks controlling the learner's success, is provided online such that learners can easily access all desired information any time and any place. Communication has been detached from specific points or periods in time as well. This digitalization of the learning process also bears new challenges, which have to be faced by learners as well as lecturers.

The concept, introduced in this paper, addresses these facts by delivering a service to set the stage for a personal learning environment adjusted to the needs of a single user. Hence, it provides facilities for integrated maintenance and search in heterogeneous personal learning material.

1 Vision and System Characterisation

Briefly summarized, our experiences with LMS (cf. [2]) and their functionalities, often far from being satisfactory, lead us to proposing this system as described—especially if the shift from an institutional to a learner's perspective is desired. The vision of this approach basically lies in the provision of an environment, allowing a single user to administer his learning material including the corresponding learning context in order to facilitate learning insights. To get an idea of the scenario this system intends to support, just imagine the following picture:

A student is attending a lecture. As usual the lecture introduces different concepts, varying in depth. So, preparing and postprocessing the lecture, the student spends time collecting and browsing related information. This includes administrative tasks like downloading the provided slides for the lecture and going through his personal notes, but also following forum discussions on today's

M. Spaniol et al. (Eds.): ICWL 2009, LNCS 5686, pp. 363–366, 2009.

lecture or browsing additionally prepared link lists. Of course, it is also likely that our student searches the Internet for more information and—glancing over the first hits—stumbles across an article containing interesting insights.

A few weeks later, our student is attending a preparation group to study for the upcoming exam and realizes that he has some urgent work left in different areas of the lecture, because he is not as familiar with all details as he should be. He remembers that he already glanced through a good summary—one of the articles mentioned above—a while ago. Unfortunately, his first thought—to find the information in the slides provided for the lecture—turns out wrong. Also he does not have any additional locally saved files including the desired information. Logically he is now trying to find the particular information he is remembering only vaguely, knowing this is exactly what he is looking for. Next on the list could be a visit to and search in the course forums dedicated to this course. In worst case, he needs to restart his previous search, performed soon after the actual lecture, trying to find the information he already had, again.

Hence, the typical scenario where our concept and future system applies to, is a learner, who kept in mind he read the desired information somewhere, but does not remember where exactly. The system is meant to serve as assistance to find an exact information as easy and quickly as possible, while additionally showing correlations and context that the learner might not have been explicitly aware of before, as well as allowing comments, structuring the repository. Furthermore, the system is trying to assist in composing the big picture and support skimming through collected information, which is not satisfactorily supported by now. Put another way, the system is trying to build a personal learning space including all objects related to the learner and the qualification he is trying to attain.

Of course, the promotion of a personal learning space immediately suggests personal learning environments (PLEs). By general definition, a PLE is a system helping learners to control and manage their own learning: "A PLE is a single user's e-learning system that provides access to a variety of learning resources, and that may provide access to learners and teachers who use other PLEs and/or VLEs [Virtual Learning Environments]." [3] Mostly, these systems have their origins in the demand for learner-centred approaches. Using a classification developed by Schaffert and Hilzensauer [4], the system proposed in this paper can also be classified as PLE. However, PLEs, generally spoken, often focus on examining and actively controlling the learning process and progress, which is particularly not the main objective of our system.

2 System Components

This section describes the system and its three core components in more detail. By now, the system has not been realized in full depth and detail, for this reason descriptions need to be understood as conceptual sketches.

The foundation of our system are *learning objects*. Basically, a learning object is any possible physical representation of information, such as locally saved files in different formats or an online web page. These learning objects are assembled

and traditionally stored in a database by the *collection component*. Subsequently, the *preparation component* processes the assembled objects and extracts or assigns additional information. The interface enabling user interaction and offering the service as a whole to the user is formed by the *presentation component*.

In summary, the system realization is ought to adopt familiar Web2.0-paradigms such as a rich and user friendly interface and tagging in order to facilitate intensive usage. Additionally, the system is meant to smoothly operate in the background for most of the time by default; variations, adjustments and a more intensive usage are of course fostered for active users.

Collection Component. As basic component, the collection component is constructing an appropriate index. In order to entirely build the personal learning space, the collector needs to consider local as well as web content to be included into the index. As core feature, this component is not just extracting and processing textual information explicitly stored in *learning objects*, but handling three different index levels. The three index levels themselves are loosely connected and organised in two tiers.

The main index level *learning material*, constitutes the first tier and includes all learning content. Basically, this level is similar to known indexing components. Text-based content is processed according to traditional full text indexing mechanisms and an appropriate index is built. Hence, problems, approaches, and solutions of related areas, such as XML Retrieval described by Kamps et al. [5], are considered when implementing this level. Processing multimedia content is also desired and necessary, but not further specified at this time. Primarily, this level is employed to abstract from references to learning objects and substitute these references with file-independent references to nodes in this index level, since the technical granularity of *learning objects* is more or less arbitrary.

The second tier is composed of the two supplementary index levels *learning context* and *references*. The level *learning context* includes the context, as for example the subject, of a particular node in the main level learning material. Additionally, an independent classification of learning material can be stored in the third index level *references*.

As a result, the design of the collection component is closely related to issues of faceted search, as for instance examined by Henrich and Eckstein [6]. Using not only one, but three index levels—organised in two tiers—fosters personalization and learning insights by means of allowing an individual structure. Technically spoken this component uses a well-defined mix of existing technologies and frameworks, like Hibernate, Lucene, and Spring.

Preparation Component. Building upon the collection component, the preparation component uses the three different index levels of the previous stage, for a reasoning mechanism, adopting spreading activation techniques, such as described by Crestani [7]. Since every information in the levels of the second tier is connected to a particular node in the first tier, spreading activation models and theories can be employed to detect possible connections between single nodes of learning material. That way learning material not explicitly searched, however considered relevant, can be recommended to the user.

Presentation Component. Primarily, the presentation component offers the investigation interface to the user. Basic searching functionality like keyword search constitutes the foundation of the search element. Additionally, implementing an advanced search, the three index levels can be used as filters to narrow the search down by certain criteria. Principles of exploratory search, as for example described by Marchionini [8] need to be applied in order to satisfy traditional search activities like fact retrieval but in particular the search activities *learn* and *investigate*. Moreover, different visualisation components ought to be embedded into the search interface for additional presentation of various aspects. Search results can be visualised by tag clouds for textual information. The collection of learning objects can—based on a particular search or not—be visualised using associations of different levels, allowing browsing the repository on a visual level.

3 Work in Progress and Conclusion

In our opinion, the use and integration of a system as described, will soften the difficulties and challenges learners have to face due to the nature of modern learning. The overall effect needs to be carefully examined in subsequent user studies after the implementation is finished. At present, the collection component is designed in detail and implemented.

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