Requirements for Personal Development Planning in ePortfolios supported by Semantic Web Technology

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Abstract: This article deals with a special type of ePortfolio, the Learning and Personal Development Planning Portfolio (PDP). It explores the technical challenges deriving from pedagogical requirements of PDP processes and discusses how semantic web technologies can contribute to an integrated "ePortfolio-PDP System".

1 Introduction

During the last fifteen years an "old" didactical method, namely portfolio work[1], has gained great attention in all educational contexts as method for supporting learning, acquisition, assessment and presentation of competences and skills. "New" for educationalist is now the use of digital media, web-publishing tools and/or LMS/CMS systems for creating, documenting and presenting digital / electronic portfolios. Inspired by the Bologna Process and Life Long Learning Strategies, Higher Educational Institutions (HEI) are also becoming aware of the benefit of digital portfolios for students, planning their studies and developing lifelong learning strategies. However, in the Portfolio Forum Austria 2005, it has become evident that besides organisational challenges with portfolio work, also technical questions need to be addressed, e.g.: *Which learning and knowledge management technology can adequately support the different ePortfolio processes? How can ePortfolio software be integrated with existing university administration and eLearning systems?* [2]. In this article we concentrate on one special ePortfolio type, namely, the *Learning and Personal Development Planning Portfolio (PDP)*[3], which is increasingly used by HEIs. We explore the technical challenges deriving from pedagogical requirements of PDP processes and discuss how Semantic Web technologies can contribute to an integrated "ePortfolio-PDP" system for HEIs to be developed in future.

In the following, we firstly deal with the concept of PDP in Higher Educational Institutions (HEI) and highlight why the use of web technology makes

[1] Already in the beginning of the 20th century Maria Montessori introduced the concept of a "Pensum-Book" as alternative assessment method.
[2] see http://eportfolio.salzburgresearch.at; [Attwell, 2005]
[3] PDPs are often referred to as working portfolio [Barrett, 2005]

a difference. Secondly, we describe selected pedagogical processes of a PDP scenario and identify current technical challenges in designing an integrated "ePortfolio-PDP System". Thirdly, we discuss the potential of the Semantic Web in meeting these challenges and conclude further research issues thereof.

2 PDP and Technical Challenges

2.1 The concept of PDP and added value of technological support

Forerunner for PDPs is a national educational initiative in the United Kingdom, which has been started to improve the quality standards of universities with respect to the development of students as autonomous learners who understand how and what they are learning and who are able progressively to take responsibility and control of their own personal and academic development. The process by which these qualities are developed has been termed "Personal Development Planning" (PDP): PDP is *"a structured and supported process undertaken by an individual to reflect upon their own learning, performance and / or achievement and to plan for their personal, educational and career development"* and is part of a ẅider concept – the HEI Progress File. Such a Progress File includes both an institutional record of learning and achievement (*transcripts*) and an individual's personal records of learning and achievements, progress reviews and plans. These records are used to clarify students'personal goals and provide a resource for them from which material is selected to produce concise personal statements (e.g. CVs and application forms) required by employers and admissions tutors (see *Guidelines for the Higher Education Progress File 2001*[4], 07-04-2006).

We suggest that webbased ePortfolio systems can be used to support personal development planning (PDP) and technically enhance the underlying process of creating, collecting, assessing and sharing the digital objects of such Progress Files (in the following called "ePortfolios"). [Barrett, 2005] highlights that new technology differentiates from paper-based portfolio work especially as it enables new ways of archiving, linking/thinking, story telling, collaborating and publishing.

A digital portfolio system offers the advantage of archiving different ePortfolio artefacts (e.g. assignments, courses, certificates, grades, project results, research papers etc.), publishing them with web technologies and sharing them with others by means of collaboration tools or other social software e.g. Wiki/Weblogs (see also [Kalz, 2005]): In our view it allows

- to integrate a huge amount of digital artefacts addressing different senses by an auditorium by means of using different media formats (e.g. text, pictures, sound, video, animation)

[4] http://www.qaa.ac.uk/academicinfrastructure/progressFiles/guidelines/progfile2001.asp

– to display artefacts very flexibly, adjusting them to different contexts and re-use them for different purposes

– chronological documentation and presentation of a learners biography

– initiation of learning process in groups by using web based collaboration tools

– intensive participiation and transparency in the reflection process [Hornung-Prähauser, 2006]

A major technical challenge is to provide an ePortfolio System that supports students in the (semi-)automatic identification, search and retrieval, and exchange of the information objects accumulated in a personal ePortfolio and have that sustainable for more than one educational career . Thus, in the following, we select three major pedagogical processes occurring recursively while students are working on his/her study PDP and discuss what information objects and exchange processes take place. These requirements impose technical challenges if designing an ePortfolio system that integrates the major PDP functionalities: *planning a learning strategy*, *developing the learning path*, and *validating and assessing the learning outcome and process*.

2.2 Planning a Learning Strategy

2.2.1 Reference to Competence Classification Schema

Among the first steps in personal development is planning of the studying process and definition of individual learning goals and learning paths. In our scenario the assessment of individual competencies is based on the prior knowledge and experiences of students. Based on a (pre-defined) descriptive competence schema, provided externally by the university (e.g. competence levels for courses), the students can identify their prior and current work suitable to this schema and define their point of departure and get information of how to go ahead.

One example for such competence schema is the "self assessment grid" of the European Language Passport,[5] where language competencies are narratively described according to different competence areas and increasing competence levels within these areas.

Technological Challenges. Integrated ePortfolio systems are required to be able to represent flexible competence schemes and allow to associate and automatically match information objects about students prior learning outcomes (i.e. ePortfolio artefacts) with them so as to support the learner in planning and reflecting about his/her development. In addition, an ePortfolio system should be able to modify and newly define the competence classification schema during the development of the learner, as requirements may change.

[5] http://europass.cedefop.eu.int

2.2.2 Defining Learning Paths

Using such a schema, a student should be able to relate the current knowledge level to the intended development goal. Such matching can either be done by the learner him-/herself, or by a third party and allow to plan individual learning paths. They guide the learner towards his/her development goal and can involve many different steps, e.g. presence or online courses, tasks and assignments, examinations, or even an excursion. Assuming that learning targets can be achieved in various ways, students have to define individual elements to address the target. Doing so, they have to:

- define the learning target (according to their context, their capabilities, and the competence classification schema)
- make a SWOT analysis[6] of their situation and their learning plans: this method can act as an analysis of the environment, which is very helpful for the identification of obstacles and opportunities on the way towards the learning target.
- plan individual steps: defining future steps of the learning process helps learners to plan and schedule (and in the end to monitor) their work and individual learning process.

Technological Challenges. ePortfolio systems need to assist the user in both, classifying their current and desired skill levels and in defining appropriate learning paths. For the first, they should be able to determine skill levels based on digitally available certificates and prior work within the ePortfolio. For the latter, they should be able to take into account existing material, courses, etc. and accompanying meta-data and derive possible goals within a certain timeframe.

2.3 Developing the Learning Path

ePortfolios can support the following aspects of developing by reflection: *collection* (of learning artefacts), *reflection* (of the learning process), *interpretation* (of the learning process) and *presentation* (of selected learning artefacts). ePortfolios can play an active role in these processes by supporting learners in developing/adapting individual learning paths and documenting learning steps.

2.3.1 Collection of Evidences and Artefacts

For documenting the different stages in the development process, all relevant artefacts are stored in the ePortfolio system, regardless whether they are used as

[6] SWOT: strengths, weaknesses, opportunities, and threads – a method originally developed for strategic business planning

"input" materials by tutors (e.g. articles, assignments, ...) or "output" materials by the learner him/herself (e.g. documents, thesis, personal excerpts, comments).
Technological Challenges. ePortfolio systems need not only be able to store artefacts, they also need to offer the possibility to link artefacts with each other, to add additional material related to an artefact (e.g. comments, descriptions), and to share artefacts with other learners and tutors. A challenging issue is to additionally collect artefacts that are related to the learning process but stored in different systems (e.g. learning management systems, discussion forums, bulletin boards, Wikis, Weblogs, Webquests, ...).

2.3.2 Reflection about Studying and Career Development

Reflection is generally considered an important part of a learning and development process (cf. e.g. [Dewey, 1910, Hatton and Smith, 1995]). According to [Hatton and Smith, 1995], reflection is about "framing and reframing complex and ambiguous problems and testing different interpretations", "looking back upon our actions some time after they have taken place", "group discussions", and "consciously accounting for the wider historic, cultural, and political values or beliefs in framing practical problems".

In the context of ePortfolios, reflection plays a major role. Reflecting a learning process always means a personal perception of oneâs own progress. Consequently, a constant revision and adaptation of the initial development plan is necessary. This might in particular also involve the redefinition of goals as well as methods and the adaptation of learning paths. All this happens naturally in a learning process. The challenge is to provide a system supporting learners by entering the relevant data and assisting them by editing the documentation.
Technological Challenges. Similar to personal knowledge management tools, ePortfolio systems need to be capable of presenting learning artefacts to the learner in a way that encourages reflection. Also, they need to provide support for (re-)structuring and organising, linking between, and commenting on these learning artefacts. As reflection happens during the whole learning process, ePortfolio systems also need to be flexible enough to support iterative processes, e.g. by tracking changes and giving access to previous versions of artefacts.

2.3.3 Collaborative Processes

In ePortfolios, the interaction of a learner with his/her peers and tutors is of major importance. Other learners can share their own learning artefacts, provide different perspectives and interpretations on the learning process, and discuss and comment learning artefacts. Works like texts etc. can be developed collaboratively and learning artefacts from different learners can be linked and combined.

Technological Challenges. To support collaboration, ePortfolio systems need to be able to integrate content and functionalities from different external and existing collaborative tools (like discussion forums, collaborative workspaces, etc) and should provide a common interface to these tools that gives the learner easy access. Integrated ePortfolio-PDP systems can thus be seen as the "next generation social software".

2.3.4 Documentation of Assignments

Another step in our PDP process is the completionof the assignments. These assignments can be assigned by tutors, but also by oneself according to the learning plan as described above. While learning, working, reflecting and adjusting the learning path, the fulfilment of tasks and subtasks must be set by allocating elements of the learning process to the planned stages of the learning plan.
Technological Challenges. An ePortfolio system needs to give an overview over the learning stages, the assignments, and the status of the individual studying progress. The system should allow the learner to associate learning achievements with elements of the learning plan. Once a specific task is completed, learners should be able to assemble their elaborations, their reflections and their documents (according to the learning plan and the competence schema) and provide this information to their tutors for assessing their work.

2.4 Validating and Assessing

Due to the sheer mass of material produced during a study, the assessment of the whole learning and development process is a complex task. Study coaches or tutors are not able to comprehend a "complete" portfolio that includes all pieces of work, reflections, and development stages. Instead, learners need to assess their own development by selecting those artefacts that they consider as important evidences of their learning progress according to their personal development plan. This includes connecting the artefacts to their learning path and to the competence classification schema, and again reflecting about the items and their relevance in the learning process. The selected artefacts should then be presented in an aggregated view to a tutor for final assessment.

The assessment documentation area will probably also contain a "final seminar document" or a written thesis, but with all the accompanying documentation of the competence profile of the learner, it is easier to identify which artefacts contributed to the development of this final document.
Technological Challenges. ePortfolio systems need to support the assessment process by providing a student interface for identifying, selecting, and connecting relevant learning artefacts according to the initial personal development plan. Furthermore, a tutor interface is required that gives tutors an overview over

students and their selected artefacts. Finally, it must be possible to âfreezeâ and certify the state of a studentâs portfolio that resulted in the actual grading, and possibly connect that with an institutionâs student management system.

3 ePortfolios and Semantic Web Technology

The term "Web 2.0" is not clearly defined and comprises a multitude of different technologies. An important part is the so-called *Semantic Web*. The Semantic Web is a research endeavour aiming at making Web content accessible to machines in a way that goes beyond mere presentation and rendering of content. Its goal may be briefly described as enriching the existing Web with meta-data and (meta-)data processing so as to provide Web-based systems with advanced (so-called intelligent) capabilities, in particular with context-awareness and decision support, strengthening a person centred, everyday use of the Web.

Semantic Web technologies are likely to significantly enhance future Web applications. On the "Semantic Web", Web applications and services can more easily communicate with each other, and data can be more easily exchanged between different systems. In the following, we briefly outline our vision of how a future ePortfolio system can benefit from Semantic Web technologies.

3.1 Formal Description of Artefacts

Semantic Web technologies, like RDF and OWL [W3C, 1999, W3C, 2004], can be used to formally *describe* the artefacts in an ePortfolio system. Such descriptions can have several different facets [Behrendt et al., 2005]; the most relevant in the ePortfolio context are:

- the *content description* includes descriptions of the subject area and topic, required and acquired competencies, etc; such descriptions can e.g. be used to automatically classify artefacts for easier search and retrieval or to match artefacts to learning goals;
- the *presentation description* describes how artefacts are supposed to be displayed and edited; for instance, text documents require different means of presentation than video material;
- the *community description* describes the involved contributors, intended audience, and access restriction of artefacts
- the *security and trust description* describes the trust in an artefact, e.g. a digital certificate about the successful passing of an examination

3.2 Interoperability between Systems

In a realistic learning environment, most learning will take place outside of an ePortfolio system and using a multitude of methods and tools, e.g. presence

seminars and courses, learning management systems (LMS), Wikis, Weblogs, e-mail, etc. To collect artefacts and evidences of the learning process, the ePortfolio system hence needs to inter-operate with a plethora of other tools on the Web. Also, a learner will probably not use a single ePortfolio system throughout his life, but rather different systems at different phases, e.g. one at school, another one at university, and yet others in post-university vocational training. In order to realise the vision of a lifelong "personal portfolio", it is thus also necessary that different ePortfolio systems are able to interact and exchange data.

The wide adoption of Semantic Web technologies can be significant enablers for this goal, and the possibilities are virtually unlimited: For instance, the personal development planner of a student's ePortfolio system could "speak" with the university's course management system in order to identify courses that are relevant for the student. Formal descriptions – e.g. in form of so-called *knowledge content objects* (KCO) [Behrendt et al., 2005] – of articles written by the learner and published in scientific journals could be used to collect and integrate these articles (or rather, descriptions of these articles) in the ePortfolio, classify them properly, and link to the actual publication. And courses in a learning management system could be automatically assembled based on the formal descriptions of the contents in the learner's ePortfolio. Finally, the "personal portfolio" could be defined as a "view" on several data sources.

3.3 Knowledge Management

Collecting and organising learning artefacts in an ePortfolio system is a knowledge management task. The potential of Semantic Web technologies in knowledge management is widely acknowledged (e.g. [Davies et al., 2002]) and already exemplified by numerous projects (e.g. [Schaffert, 2006, Völkel and Oren, 2006]). Using Semantic Web annotations, the learning process is supported by allowing learners to categorise, structure, and connect learning artefacts for reflection and assessment, browse and navigate through their "knowledge space", and search for relevant learning artefacts. Learning artefacts can also be linked to criteria in the personal development plan, thus providing support for assembling the relevant material for the assessment phase.

3.4 Recommender System

Perhaps the most significant Semantic Web functionality is the support for *reasoning*. Reasoning means deriving new, implicit information from existing data based on an underlying set of axioms and rules. Reasoning can support the personal development planning task in numerous areas, of which we give but a few examples. First, it could be used in the planning phase to match existing and intended competencies with e.g. course descriptions of courses offered by a university and propose different "learning paths" that a learner could take to reach

his goals. Then, it could be used during the learning phase to automatically match learning artefacts with learning goals and verify their appropriateness, supporting the learner in reflection and self assessment. Finally, reasoning could be used for integrating data from different sources using different terminologies.

4 Perspectives and Conclusion

From what has been outlined above and supported by the recent survey on ePortfolio software (JISC, 2005), we argue that static ePortfolio systems do not fully meet the requirements for implementing PDPs of high pedagogical value in HEIs. As mentioned before, the major technical challenge is to provide an ePortfolio system supporting students in the (semi-)automatic identification, search, retrieval, and exchange of information objects. Moreover, ePortfolio artefacts are archived in many different learning systems that students and universities use throughout a study. Semantic Web technologies have potential to integrate these learning systems, but more research is needed both in defining different PDP-processes and develop an ePortfolio PDP systems prototype.

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