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Extended summary

Characterisation of a Personal Learning Environment as a lifelong learning tool

Curriculum: eLearning

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Abstract. Over the last years, increasing attention has been paid to Personal Learning Environments (PLEs) as an effective framework for lifelong learners, and to the need for a smooth integration of formal and informal learning. A wider and wider range of open source and free learning applications on the web are offering lifelong learners powerful tools to construct and characterise their own PLEs. Technologically speaking, this change of perspective manifests in a learning web where information is distributed across sites. However, knowledge management becomes an issue, and personalisation requires the support of semantics applied to social components.

This thesis focuses on the characterisation of adult lifelong learners' PLEs by implicit and explicit tools of personalisation. The synergy of formal and informal learning in the dynamic construction of a lifelong learner's PLE has been explored. The *SSW4LL* (*Social Semantic Web for Lifelong Learners*) format has been devised, and the *SSW4LL* system, built on Moodle 2.0 integrated with an adaptive mechanism (conditional activities) and some tools of Social Semantic Web (Semantic MediaWiki, Diigo and Google+), has been designed, implemented and successfully validated as a device suitable to provide a dynamically personalised learning environment to the lifelong learner.

1 Problem statement and objectives

The diffusing lifelong learning (LLL) vision, emerging practices with social semantic computing technologies and research findings signal the need for more personal, social and participatory approaches that support learners in becoming active users and co-producers of learning resources, rather in gaining control over the learning process as a whole, and in pursuing personal life goals and needs. In particular, there is an increasing understanding that learning occurs for the most part outside the traditional formal situations, especially for adult lifelong learners.

Emphasis on the shift from formal to informal e-learning through knowledge management and sharing has been placed, with particular attention to PLEs as learner-centred spaces, against LMS as organisation-centred platforms that neglect individual differences and potential. Nevertheless, investigations are motivated by the numerous educational theories, implications and challenges that the concept of PLE has posed. Moreover, since research literature points out the role of scaffolding in activating higher order learning competencies [1], in-depth studies need to be carried out about how self-regulation can be scaffolded by a PLE.

The dichotomy LMS vs PLE has been transformed into models of integration of the two in some research literature [2], [3]. However, the smooth integration of formal and informal learning environments for adult lifelong learners, on the background of a student-centred framework, requires an attentive design of the underlying technological architecture. Indeed, this change in perspective towards student-centred technology-enhanced learning environments has brought about a rethinking of knowledge, knowledge management, teaching and learning, networks and the individual. Information overload, diversity and distribution highlight the necessity for content and infrastructure applications to interoperate and exchange data in order to better support lifelong learners' and educators' needs. Personalisation, trustworthiness and assessment on the collection of resources are actual research issues.

In relation to personalisation of learning, LMSs, the formal learning component of the integrated environment, are weak. Educational and psychological theories argue that learners have different ways in which they prefer to learn, and that students with a strong preference for a specific learning style may have difficulties in learning if the teaching approach mismatches it [4], [5]. On this basis, models for the detection of learners' learning styles need to be evaluated, and adaptive educational systems that could be integrated in a LMS need to be investigated.

Finally, trustworthiness and assessment on the collection of resources call for a thorough analysis of suitable Social Semantic Web tools to be adopted within the integrated learning environment.

2 Research plan and activities

The aim of this thesis is to devise and validate a format for the characterisation of adult lifelong learners' PLEs. In order to realise this goal, investigations regarding three research questions have been conducted:

1. How do adult lifelong learners learn?

The provision of a suitable format for the characterisation of PLEs requires a sound knowledge of lifelong learners' characteristics and learning profiles, first. In this thesis, European Union reports about lifelong learning policies and achievements, and relevant research literature have informed the development of the *SSW4LL* format, starting from its needs analysis and learning framework sections.

2. How can self-regulation be scaffolded by a PLE?

Through an extensive study of the theoretical background of the personalisation of LLL and relevant research literature outcomes, implications and challenges of the concept of PLE have been discussed. Further, the smooth integration of formal and informal learning environments has been proposed, on the background of a student-centred framework for adult lifelong learners. To this end, several models for the detection of learning styles have been sieved through to choose the most effective to be applied in the scenario of this research.

3. How can adult lifelong learners' PLEs be characterised?

The exploration of the synergy of formal and informal learning in the dynamic construction of a lifelong learner's PLE has started the evaluation of added-value technological components among many available in the web-based learning landscape. A range of adaptive mechanisms and Social Semantic Web tools have been considered, as applications for providing implicit and explicit characterisation of adult lifelong learners' PLEs. As a result, the *SSW4LL* system has been built on Moodle 2.0 integrated with adaptation (conditional activities) and Semantic MediaWiki, Diigo and Google+ as Social Semantic Web tools.

The *SSW4LL* format has been implemented and evaluated with respect to its efficiency in supporting adult lifelong learners and making the characterisation of their PLEs easier for them.

Within this thesis, two general aims concerning all three parts of research exist. First, research conduced within this thesis aims at proposing concepts and approaches which are suitable for adult lifelong learners in general, rather than for one specific target within. However, the concepts and approaches are implemented and evaluated by addressing a cluster of novice learners in the course domain, but professionals in a specific field.

Secondly, since the objective of this thesis is to devise a format for the characterisation of adult lifelong learners' PLEs by combining the advantages of formal learning environments with those of informal learning environments, the resulting technological architecture should not lose its simplicity and should still be easy to use for teachers-facilitators.

The thesis is organised in 5 chapters. In chapter 1 the motivation and problem statement of the thesis are discussed, and the research issues covered are introduced. Subsequently, the structure of the thesis is described.

Chapter 2 illustrates the current shift from formal to informal learning. An introduction of lifelong learning is provided, describing definitions and main policies in Europe, and lifelong learners' characteristics, needs analysis and expectations. The third section of the chapter develops a sound analysis of the theoretical background of personalisation of LLL: implications and challenges of the concept of PLE are discussed, as well as adaptive mechanisms and Social Semantic Web as tools for implicit and explicit personalisation of learning. Parts of this chapter were published as journal papers, book chapters, and conference papers [6], [7], [8], [9].

Chapter 3 starts the development of the characterisation of a PLE as a LLL tool by detailing the *SSW4LL* format. After an overview about the aims, possible scenarios and elements of the format, a motivated choice of adult lifelong learners' needs that *SSW4LL* aims to meet is developed. Subsequently, the chapter illustrates the learning paradigm and strategies that underpin the *SSW4LL* format. Then, the *SSW4LL* system, the technological architecture, is presented as a whole made up of components of formal and informal learning environments. The formal learning environment is devised by Moodle 2.0; a description and an evaluation of Moodle 2.0 features are provided, with a focus on the potential of its conditional activities as a suitable mechanism of learning adaptation. Concurrently, this part identifies the benefits of the Felder-Silverman learning style model (FSLSM), which was selected as the most suitable learning style model for the use in LMSs. The elements of the informal learning environment, Semantic MediaWiki, Diigo and Google+, are presented and their implications within the *SSW4LL* format are discussed. The next section of the chapter deals with the organisation of the format: the resources needed, a user case scenario and a flow chart of the steps of the format implementation are outlined. Finally, a SWOT analysis provides evaluation elements for the format. Parts of this chapter were published as journal papers, book chapters, and conference papers [6], [7], [8], [9], [10].

Chapter 4 reports the case study *SSW4LL 2011*: its design and implementation steps and issues are detailed, and outcomes are discussed. Parts of this chapter were published as journal papers, book chapters, and conference papers [6], [7], [8], [9], [10], [11].

Chapter 5 concludes the thesis by highlighting its contributions and discussing limitations and future directions.

3 Analysis and discussion of main results

The diffusing LLL vision, emerging practices with social semantic computing technologies and research findings signal that learning occurs for the most part outside the traditional formal situations, especially for adult lifelong learners. Lifelong learners are self-regulated learners who need to be supported in gaining control over the learning process as a whole, and in pursuing personal life goals and needs. Thus, more personal, social and participatory frameworks have to be adopted.

Since in relation to personalisation of learning most LMSs are weak, recently some researchers have successfully implemented adaptive plug-ins in Moodle 1.9, in which adaptivity is based on the detection of learners' learning styles by the FSLSM as the most acknowledged model in this kind of application. Anyhow, no similar research experiences seem to have been developed yet with Moodle 2.0; further, none of the adaptive plug-ins that have been reported in chapter 2 have been adapted to Moodle 2.0 yet, nor have been devised learning formats that exploit Moodle 2.0 conditional activities as an adaptive mechanism.

The *SSW4LL* format offers an adaptive, modular, flexible and integrated architecture, compatible with future Moodle releases and easy to use for teachers-facilitators. The influence of the informal learning components of the *SSW4LL* system is strong: where social software gives users freedom to choose their own processes and supports the collaboration of adult lifelong learners *anytime, anywhere*, Semantic Web technology gives the possibility to structure information for easy retrieval, reuse, and exchange between different systems and tools.

The format is conceived to empower adult lifelong learners by facilitating the acquisition of some of the skills necessary for the 21st century.

The *SSW4LL* format has provided a guided and personalised delivery of the course, but it has also allowed learners to move freely according to their interests and needs once the limited time of *restricted availability on a date* feature had expired for the various activities/modules. Secondly, a comparison of the learners' percentage feedbacks along the course has shown an evident improvement of their awareness and achievements

The outcomes of *SSW4LL 2011* have validated the format implemented. This experience has confirmed that, beyond professional determinants, lifelong learners are self-regulated learners that appreciate the assistance of an adaptive mechanism within a learner-centred framework (especially when topics are complex and unfamiliar) and of user-friendly SSW tools in characterising their PLEs. By fully exploiting Moodle 2.0 adaptation features, this LMS can deploy a personalised scaffolded learning environment for self-regulated learners. Further, social software can be smoothly integrated in the architecture by widgets and by allowing login sessions to never expire.

4 Conclusions

This thesis has focussed on the characterisation of adult lifelong learners' PLEs by implicit and explicit tools of personalisation. The synergy of formal and informal learning in the dynamic construction of a lifelong learner's PLE has been explored. The *SSW4LL* format has been devised, and the *SSW4LL* system, built on Moodle 2.0 integrated with an adaptive mechanism (conditional activities) and some tools of Social Semantic Web (Semantic MediaWiki, Diigo and Google+), has been designed, implemented and successfully validated as a device suitable to provide a dynamically personalised learning environment to the lifelong learner.

Results of a comprehensive literature review and the outcomes obtained from *SSW4LL 2011* come to support the effectiveness of the format implemented. The integration of social software into formal learning environments can make a qualitative difference to giving adult lifelong learners a sense of ownership and control over their own learning and career planning, and can aid them to be effectively self-directed and self-regulated. In technological systems for education a change of direction of technology is evident: technology is not only a means of social exchange, but it turns into the joint design of learning and organisational strategies, and into the growth of learning communities. This approach arises the strong social, pedagogical and technological relation between LLL, e-learning and knowledge management.

This research could open ways for advanced learning systems, which are able to meet the learners' needs and characteristics, merge assets of formal and informal learning environments, and provide learners with dynamic personalisation of their PLEs. In the future, further improvements of the *SSW4LL* system include enabling the integration of additional social semantic tools to tackle differently knowledge management, syndicating resources and trustworthiness, that are actual research issues related to the enhancement of dynamic PLEs. Moreover, in-depth observation could be conducted on how the learning outcomes improve by transferring responsibility for the choice and configuration of the learning environment from the teacher to the learner by social semantic tools.

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