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**Abstract.**
In order to help and support learning practices, the development of web-based Personal Learning Environments (PLE) is widely adopted. A PLE is a set of services customized by the student. Among these services, resource (either digital or human) recommendation is a crucial one. The paper briefly reviews existing approaches for recommending resources in PLE. Then it describes a novel approach implemented in the OP4L prototype. OP4L is combining Social Web presence data and semantic web technologies, based on an intensive use of ontological models to represent the learning context. Then the paper reports about qualitative studies that were conducted with students on the currently available version of the OP4L prototype. The aim of the study was to get students' feedbacks about new online presence services offered in a LMS.

**Keywords.** Web-based learning, social presence, online presence, social semantic web, ontology based resource recommendation.

## 1 Introduction

In order to help and support learning practices, the development of web-based Personal Learning Environments (PLE) is widely adopted in the TEL research community [1]. From the technical perspective, a PLE is a customizable set of services aimed at enhancing the learning experience and learning outcomes for a student. Among these services, resource (either digital or human) recommendation is a crucial one, given the number and the diversity of available resources on the web. In this context, various approaches have been proposed to customize the recommendation of resources to the learners' needs. They all rely on the use of a learner profile and include a more or less rich description of the learning context, often through ontologies.

The recent increase in the use of social software tools by learners leads to the inclusion of novel learning practices, such as collaborative tagging, into PLEs. The combination of Semantic Web and Social Web technologies allows to take these practices into account in an online learning environment. Moreover access to on line people is offered through chats and other synchronized means.

This paper reports on qualitative studies that were conducted with students using a PLE prototype developed in the scope of the OP4L project. This prototype offers recommendation services based on dynamic integration of online presence data and an intensive use of ontologies and web technologies. In section 2 we briefly summarize some results from previous studies that explored social semantic web and PLEs. Then, in section 3, we present the OP4L framework with a focus on the available social presence features. In section 4 we describe how we organized data collection in order to get initial feedbacks from master degree students and discuss the obtained results that have to be considered for improving the prototype. This is a work in progress, so we conclude about the planned forthcoming steps.

## 2 Social semantic web and learning resources

In her "vision" paper [2], Vassileva states that *the design of learning technologies needs to focus on supporting social learning in context.* She defines three main roles that should be performed by PLEs: *(1) support the learner in finding the right content (right for the context, particular learner, specific purpose of the learner and pedagogically), (2) support learner to connect with the right people (...) and (3) motivate/incentivize people to learn.*

To achieve these goals, researchers and developers build on experiences gained from several domains. The discovery and retrieval of learning resources is one of them and has been widely investigated, beginning with the work on metadata interoperability, then going on with the use of ontologies to better match the learners' needs and context. As social web applications, such as resources tagging, became available, solutions mixing both ontology- and tagging-based approaches were proposed. Meanwhile the recommender systems community developed powerful algorithms for the e-commerce sector and PLE developers tried to adapt them to e-learning purposes [3].

Social presence is another relevant research topic. It has been identified as a crucial success factor in e-learning for many years [4], [5], [6]. At the beginning social presence was mostly implemented through online forums and Instant Messaging tools that allowed for establishing and maintaining social presence in online learning settings. The wide adoption of social web applications, such as Facebook, resulted in the inclusion of online social networks and connections established in these networks into online learning environments. Though in theory students can interact with their entire social network, in practice they do not get any indicator about who is really available in the given moment and who is really competent for helping in the current task. Although recommending knowledgeable people for performing a given task is not new, it

has been mostly investigated in company settings such as reported, for instance, in [7]. OP4L project brings solutions for these last two questions as described below.

# 3 OP4L framework

## 3.1 Background and objectives

OP4L (Online Presence For Learning) [8] is a European SEE-ERANET project bringing together partners from 6 countries from 2010 to 2012. The project aims at exploring the use of web tools and services for supporting social presence in online learning environments and thus contributing to an improved learning experience. In this paper, we use OP4L to name both the project and the developed prototype.

OP4L defines online presence as a temporary description of a user's presence in the online world. It can be considered as an image that a person projects about him/herself into the online world. In this project we explored online presence in the context of the DEPTHS PLE [9]. DEPTHS (DEsign Patterns Teaching Help System) is designed for a Design Pattern course in Software Engineering – Computer Science – master level. It makes use of ontologies as a common base for the integration of different systems, services and tools in a common environment for collaborative learning of software design patterns. OP4L extends DEPTHS services by online presence data at the semantic level.

## 3.2 Functional description

A complete technical description of the OP4L framework can be found in [10], [11] as well as in deliverables available on the project's web site. However, it is necessary to draw an overall picture of the system and the ontologies that make possible the provided services.

From a functional perspective, the primary aim of the project was the development of a *context-aware* PLE by integrating *learning context* data from different learning systems/tools/services, using a flexible *ontology-based* model [14]. We define learning context, i.e., the context of a given learning situation as an integration of the following main components:

- the learning activity that was performed or the learning-related even that occurred,
- the content that was used and/or produced during the learning activity,
- the individual(s) involved (e.g., learners, teachers, experts),
- the (online) environment where the learning activity took place,
- the time when the learning activity took place.

The notion of learning context is formally modeled through an interlined set of ontologies collectively named LOCO (Learning Object Context Ontologies) framework [9]. These ontologies served as the foundation for the development of the DEPTHS PLE with the following main features:

- Integration of data and resources from diverse learning applications that students interact with;
- Context-aware recommendation of resources on software design patterns from online repositories, learning artifacts produced and shared by peers, software projects, discussion threads, chats, etc.;
- Context-aware recommendation of other students, experts and/or teachers to offer help in the given situation.

Within the OP4L project, the notion of learning context is extended to include the notion of Online Presence. Accordingly, links have been established between the LOCO ontologies and the Online Presence Ontology (OPO) [13] to allow for explicitly defining the semantic of this extended notion of learning context. The integration of LOCO and OPO ontologies served as a foundation for the development of online-presence-aware educational services within the DEPTHS PLE. These services make use of users' online presence data when providing learners with recommendations about whom to ask for help or collaborative work. These data are periodically "pushed" towards the PLE by specific software modules developed for that purpose. Within the online presence data, a key indicator is the "online status" [12] as declared by the user. For instance, a peer whose online status indicates that he/she is busy in the given moment will not be recommended; on the other hand, the system would recommend a face-to-face study session with a peer who has just checked in the same building and whose status indicates that he/she can be freely contacted.

For course designers, one of the main challenges is to adapt interactions to the students' state of presence and to provide services so that interactions can be established smoothly among the participants.

### 3.3 Main features of OP4L prototype

OP4L services are implemented within the existing DEPTH PLE. They are accessible through a dedicated Moodle platform. The services become available after a student selects a course to study (e.g., the Design Pattern course) and a learning activity (e.g., updating patient's data problem UML modeling tool). Fig.1 shows the OP4L on line presence services as presented to the student in the user interface. Specifically, they appear in the form of an online presence box in the upper left side of the screen. The box indicates who is competent and available online for help or collaboration. It also indicates how to contact potential helper(s)/collaborator(s), either on the Moodle platform itself, or via Facebook or Twitter. Services linking Moodle to Facebook and Twitter have been developed so that each student remains using his/her current application, for instance, Moodle for the student looking for help/collaboration and Facebook for the student being contacted. Based on the online statuses declared by the peer students, the learner who is looking for help/collaboration will know in which manner he/she can communicate with the peers. In the case presented on Fig.1, all of the peers can be contacted on Facebook and by email. The platform shows several other services as described below.

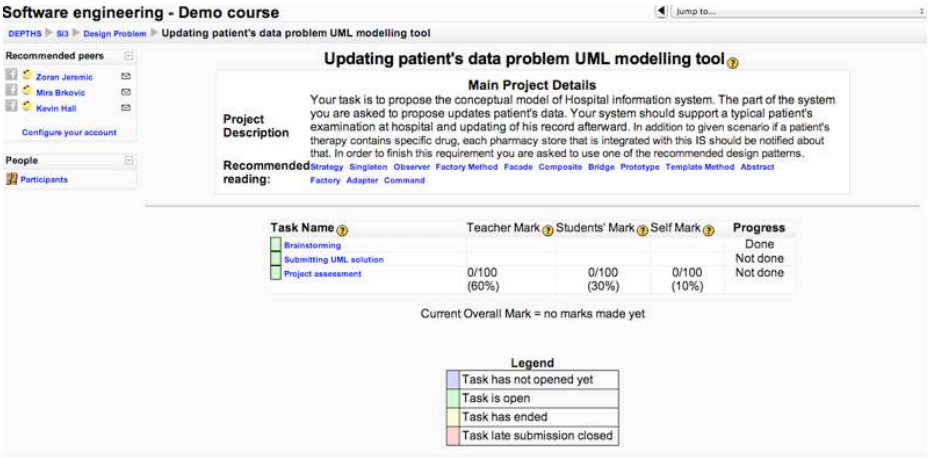


**Fig. 1.** Inside the prototype with recommended peers on the left

The platform recommends appropriate contents related to the topic of the course (Fig. 2). Its originality is to augment the digital library with the resources brought and built by the students during the course.

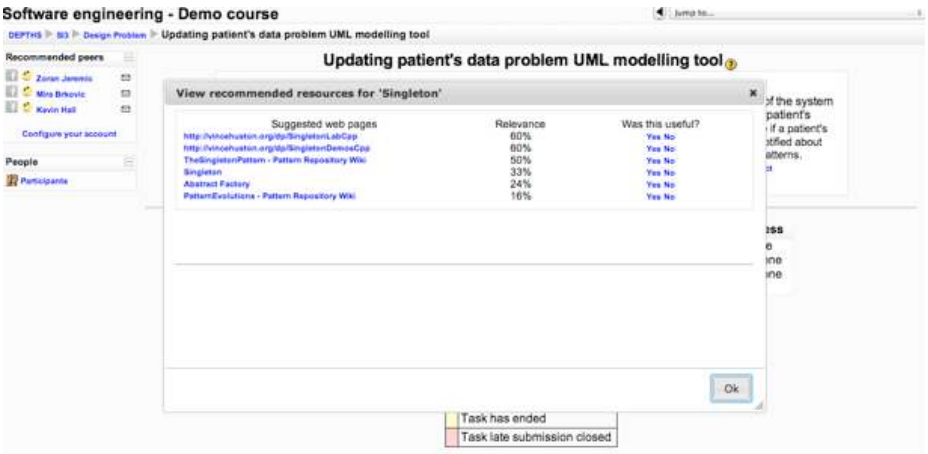


**Fig. 2.** Interface illustrating recommendation of digital resources

For enhancing collaboration, students are also given a brainstorming tool where ideas can be annotated and rated. Finally, students can upload their work on the platform and benefit from a system of peer evaluation. They can assess other proposals only when they have uploaded their own solution as shown in Fig. 3.

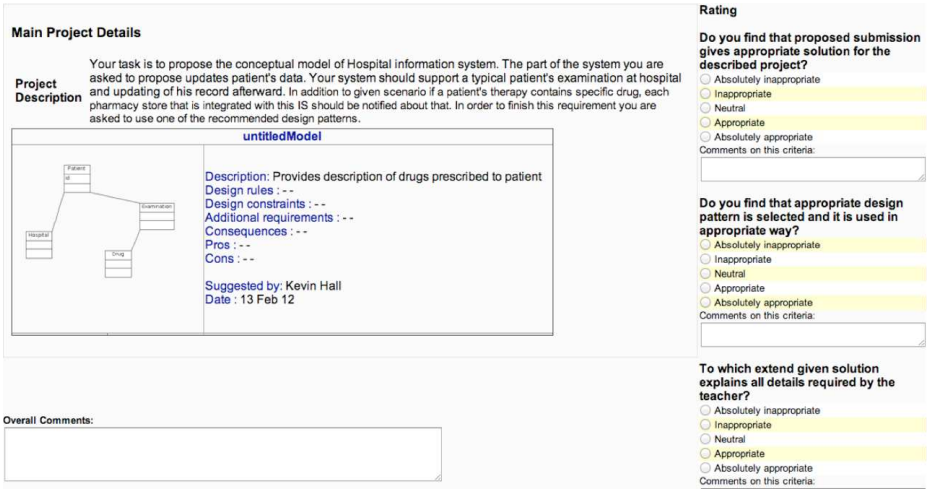


**Fig. 3.** Rating other students' work.

# 4 First feedbacks from students

In this paper we report about two studies performed between January and May 2012 with the first versions of the OP4L prototype. The first study was performed with master students who were not studying Software Engineering at Université de Lorraine (France). The second one was run with Computer Science students (several levels) at University of Skopje (Republic of Macedonia).

## 4.1 Experiment at Université de Lorraine

**Objectives and method.**

As explained in section 2, previous research work related to the notion of social presence and its role in online learning did not consider the use of Online Presence educational services. So we do not have data about the expectations of students as they never used such a set of services. As Brooks et al. stated in [15], we believe that "there is no substitute for constantly trying to test techniques in the real world of students' learning". Our method was to test the OP4L environment with students in order to analyze how end-users use, like or dislike, and benefit from the newly provided features.

**Experimental population and settings.**

Our population included 15 students and the study was conducted in February 2012. Whereas the DEPTHS environment is designed for a Software Patterns course, namely a course for Software Engineering students, the students participating in the study came from several master courses on other subjects. Indeed it was important for

the project to get a feedback about recommendation services not only from software engineering students, but also from students studying other subjects in several countries.

The students' profiles, organized in 5 categories, are:

Cat. 1. Bachelor (year 3) in Communication

Cat. 2. Master (Year 1) in Laws and European right

Cat. 3. Master (Year 1) in Chemistry

Cat. 4. Master (Year 2) in Digital Design

Cat. 5. Bachelor (Year 2) in Medical Sciences

The data collection was run into three steps.

Step 1: A first questionnaire (see results below) was passed in order to get some descriptive data about students' understanding and current use of web based and social network services.

Step 2: We demonstrated the OP4L-DEPTHS prototype, especially the online presence services; then, the students were free to analyze more deeply the services. We remind that they were not students in Computer Science and consequently we were not able to assign the software engineering tasks available in OP4L-DEPTH.

Step 3: We passed the second questionnaire in order to get the students' feedback about the features of online services. In order to know more about their expectations concerning the inclusion of such services, they were also asked to describe a scenario including the kind of services they would dream about. Finally, they were invited to provide free suggestions.

**Students' feedback**

*The participants' use of technology according to the first questionnaire is as follows:*

Frequency of Moodle use: less than one time a week (except Master in Laws: about 3 times per week)

Frequency of connection to a personal social network: daily

Frequency of using email to contact others students: never or less than one time a week

Frequency of cell phone use to contact others students: two times per week.

*An example of scenario created by students is provided hereafter (translated from French).*

"We are students in Communication, Laws, Sciences and Medical sciences and Digital design, we have to realize a project on a specific domain, but we cannot understand some of the technical terms and Wikipedia cannot help us (the articles are not adapted to our problem).

We have to contact people not only in our curriculum but others in connected domains who will be able to answer to our questions with "students" words and/or adapted vocabulary (easier to understand). The different services (more specifically, brainstorming tool) could provide opportunities for exchanges, collaborations, details and advices given in peer-to-peer mode."

Table 1 summarizes students' answers to the second questionnaire about several dimensions of social presence in online learning environments. Students' categories are as described above. Students were asked to rank each of the proposed dimensions from 1 (the most important) to 8 (the least important)

**Table 1.** Students appreciations about dimensions of social presence in online learning environments

| Proposed ranking by students categories | Cat1 | Cat2 | Cat3 | Cat4 | Cat5 |
|---|---|---|---|---|---|
| To know who is online on the platform | 1 | 2 | 2 | 3 | 1 |
| To know what are the others doing? | 5 | 4 | 1 | 5 | 3 |
| To know who is available for discussion | 2 | 1 | 4 | 1 | 4 |
| To know who is not available and does not want to be disturbed | 6 | 3 | 3 | 2 | 2 |
| To know where is someone | 7 | 5 | 7 | 7 | 8 |
| To know what are the feelings of the others (stress, tired, etc.) | 8 | 7 | 8 | 8 | 7 |
| To know what are their subjects of interest | 4 | 6 | 5 | 4 | 5 |
| To know what they like or not | 3 | 8 | 6 | 6 | 6 |

*Students' suggestions and comments.*

We provide hereafter additional suggestions and comments written by the students.

- "To create and display detailed users' profiles including curricula, centers of interest and whom they helped and in which domains. This gives us a possibility to have a better knowledge of the people who could be contacted for help"
- "To have in the list of recommended peers, not only our friends in our social networks but also people who have the appropriate profile to help us."
- "This tool can be useful to help us identifying the appropriate additional contents, to collaborate on specific topics and to get advices on the already done work. There is a true social aspect (peer-to-peer) which could really help us".
- "The overall ergonomic design is quite good, clear and well organized. It is really user friendly".
- "This tool could give the possibility to ask questions and to collaborate with other students who have the capability and the availability to answer to questions. To have all contacts and friends in the platform will bring a gain of time. Three important remarks:
  - to know who is available
  - to know who cannot be disturbed
  - to know who is online."

- "Thus, we can only discuss with people who are ready for discussion or to answer question. This gives the possibility to directly access to the appropriate person without using Facebook or Small Messages Services. Further more, if these persons show that they are ready to collaborate, they will answer quicker and in a better mood. The consequences will be: gain of time."

**Preliminary conclusion.**

We can already notice that the students immediately show an interest in contacting peer students for the kind of project they have to complete for their master degree.

The hypothesis was that providing students with online presence recommendation services in a LMS could significantly help them in performing their learning tasks. The analysis of the students' current use of communication technologies shows that they are not daily users of the university's Moodle environment. However, they join each other preferably through social networks. Given that context, their appreciation of the prototype is quite encouraging as they immediately understand the benefits that such a tool could bring to them in one of the tasks they have to achieve for their master degree, namely the project they described in the proposed scenario. Moreover we collected their appreciations (ranking) about the main dimensions of online presence. The results again show their interest. The rankings deserve additional studies, but knowing who is online and who is available are the most appreciated. Finally among the positive points they mention several times a gain of time in achieving their tasks, which is certainly an important criterion for students as well as for academic staff.

### 4.2 Evaluation at UKIM-FEEIT

**Objectives and method.**

Our objective was to provide evidence that the developed PLE can be successfully used by students for collaborative problem solving activities. In that context, testing scenario considered project-based learning with collaborative learning support where a teacher defines a specific problem to be solved in a workshop-like manner. The scenario required from the learners first to present their ideas for solving the given problem, comment on each others' ideas, discuss the ideas with the peers and rate them, and then to provide solution and to evaluate others students solutions. To perform these collaborative learning activities, students had to use developed services: Recommending peer (on-demand and proactive suggestions regarding other students, teachers or experts as possible collaborators) and recommending reading (provide suggestions for relevant learning content to be consulted and/or used when working on the problem's solution).

**Experimental population and settings.**

The evaluation of the system was performed at the Faculty of Computer Science and Engineering, Ss. Cyril and Methodius University in Skopje in period between February and May 2012. Students from two faculties: Faculty of Computer Science and Computer Engineering and Faculty of Electrical Engineering and Information

Technologies were involved in the testing process. The students were divided in two different groups who performed the same testing scenarios with different tasks. The groups profiles are:

Group. 1. Students enrolled at Software Engineering master study program. The group was formed by the 22 students enrolled to the course Design Patterns. The evaluation process was incorporated into assessment of the course. In that context, two of five course homeworks students were obliged to do using the system. The course lessons were already finished when the students received their assignments.

Group. 2. Undergraduate students on the course Human-Computer Interaction. 14 students from the second and the third year of Computer Science and Engineering undergraduate study program, voluntarily applied to participate in the evaluation. Again, the course marks are obtained as combination of results from exams, quizzes and independent project. In this case, participation in testing is treated as independent course projects.

The testing scenario was the same for both groups although the students from the second group do not have or have limited knowledge of Design Patterns. The difference between the groups was in the tasks they should solve. Evaluation scenario for both groups consisted of

Step 1. All students filled a motivation questionnaire (MSLQ).

Step 2. Working with the system. In this step, each student got two tasks from Design Patterns and for each task he/she has to do three actions:

Proposing and submitting the idea for solution, discussion and grading ideas proposed by the colleagues

Proposing solutions that included development of an UML model using ArgoUML case tool

Assessing their own solutions and solutions of other students

Step 3. Each student filled questionnaire related to the tasks. Questions from the questionnaire were concerned with: the habits of using Facebook, its chat and Web sources, the experience in OP4L learning environment, the collaborative learning and using Facebook in favor of collaborative learning.

Students in regular situations can use the help of a teacher and/or other students, but this time they were encouraged to perform this communication using the system.

**Preliminary results.**

Students were positive about the system' services which include:

- Possibility to discuss with peers (more than 50% stated that this discussion helped them to solve the problem)
- Recommending reading (more than 50% reported that reference materials helped them to solve the problem)

But, the results showed that the students are not keen to use Facebook, its chat and applications for learning. On the question do they use DEPTHS' Facebook connection only eight answered positively. 18 students answered that they did not use this service. Students answers related to the use of Facebook can be grouped as follows:

- Seven students even don't have a Facebook account.
- Those who have Facebook's accounts, usually use the Facebook for fun or for "private matters" as one of students declared.
- Some students didn't use this possibility because of testing scenarios. In fact, students had access to the solutions of others, so for them it was enough to solve the problem.
- One student reported that the complete use of the system was too difficult and that was the reason why he/she did not try this option.

**Preliminary conclusion.**

Considering the answers in the questionnaire we can conclude that the developed PLE can be successfully used by students for collaborative problem solving activities. Generally the students as most positive assessed the service Recommending reading and "offline" discussion with peers (providing ideas for solution and commenting and assessing the ideas and the solutions as well).

The results have shown that the use of Facebook, its chat and applications did not increase after period of working with the system. It was for us not an expected result because the students usually use the Facebook chat to communicate with teaching staff (personal experience and experience of my colleagues) for matters connected with the courses. But the evaluation showed that majority used their Facebook accounts as they had used before the study, which mainly includes fun and communication.

## 5 Lessons learned and further work.

We have described the OP4L services as implemented in the DEPTH PLE. The main originality of the OP4L project is to recommend digital resources and human resources through the same ontology based process by dynamically integrating online presence data from other social web applications such as Facebook or Twitter. This study reports about the first use of the OP4L prototype with students. Those from France were not the specific targeted population whereas those from Macedonia were Computer Science students. Both do not belong to the implementing team.

Such a study only aims at providing a qualitative analysis of the provided functionalities. Other evaluations of OP4L learning services are currently under way by other partners. They adopt a software engineering perspective using the SUMI (Software Usability Measurement Inventory) approach.

We noticed a strong interest in the provided services as well as low real use of Facebook integration in Macedonia. Next step would be to improve the software developed in order to be able to deploy it in more universities and to provide authors with ways to add new lessons and new courses. We remind here that in OP4L advising human resources for a given task relies on the provision of task domain descriptions through ontologies. Providing the corresponding ontologies for a new domain as well as describing resources – digital and human - is a very time-consuming task. So intermediate solutions could be welcome. The students' ranking of the proposed dimen-

sions of online presence, the services effectively used could help making intermediate choices easier to implement. Then further evaluation in larger learning settings (longer period in the academic year, lower dependency to exam ratings, etc.) should take place.

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