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SHARING SOFTWARE ENGINEERING RESOURCES AND OPEN SOURCE SOFTWARE ACROSS ENTITIES

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ABSTRACT

In the last 10 years Open Educational Resources (OER) have become established to provide free access to content. The Open Source movement has a well developed approach to software construction that has produced many successes. As open learning develops it is important to explore how OER and Open Source can work together, and learn from each other. In the OpenSE project an international consortium developed a learning framework to offer open courses based on OER that link learners with internship opportunities within open source projects, therefore allowing for authentic and deeper learning and connecting the motivation for learning with the enthusiasm for open software. This paper reviews the approach as a next stage in OER to offer both free and paid for learning opportunities. The OpenSE courses operate across formal and informal boundaries and provide an exemplar for a new approach to teaching particularly suited to information and computer science.

Keywords
Open Education Resources, OER, Open Source, Software Engineering, Formal and Informal learning.

1. INTRODUCTION

Formal education is often provided within a closed and password protected environment [1 and 2] which excludes informal learners and often business enterprises. Web 2.0 together with Open Source communities opens up opportunities for educators who teach Computer Science in a formal setting to align with business colleagues and provide an open exchange environment where formal and informal learners can build on each others project based work year on year. The OER movement is trying to meet the challenge of providing resources on a free and open basis for learning. There are growing signs of success in the range of content available as OER, however the movement has yet to reach the maturity of the open source software community. At a recent presentation [3] O'Reilly, widely credited with the first clear statement of Web2.0 [4] drew out 5 lessons that the open learning movement could take from open source. These were: 1. Think deeply about what it is you really do; 2. Smaller pieces, modular design; 3. Develop in public; 4. Provide affordances for community (think social); 5. Create more value than you capture! The first three points relate to how the movement needs to operate overall however the final two items provide useful pointers to where OER can take lessons from open source to encourage active participation.

The open educational framework for computer science Software Engineering project (OpenSE) has addressed the use of OER alongside open source by setting up an open learning framework for Computer Science Software Engineering. The project has been funded by the European Union Lifelong Learning Programme (ERASMUS) with the aim of encouraging co-operation between Universities and Enterprises. The project is formed of a large partnership from all over Europe (see section 2.1) and includes Higher Education Institutions (HEI), their students, open source projects/practitioners, business enterprises and involves informal learners from outside formal education.

The project aims to link HEI with Open Source Software and Software Engineering for the benefit of students and business enterprises. An open exchange environment based on an open learning framework for Computer Science Software Engineering enables the reuse of a student's project work for the benefit of the following year's students and informal learners. This effectively allows new students to build on the work of the students in the previous year. The intention in the environment is to capture what each student achieves within their internship and share what is achieved with other learners around the world [5]. The environment is also being applied to formal learners for whom the first step is to share knowledge between students studying at the same institution – then share it more widely. The work that the students carry out within their internship projects has the potential to solve actual problems that meet the needs of respective Open Source Software projects, and thus of the business enterprises that stand behind those projects. This allows the learners to

take part as genuine members of the developer community and to gain real life skills [6, 7]. This paper introduces concepts developed around open source software and OER aimed at Software Engineering.

2. BACKGROUND

The learning experience that can be gained from voluntary participation in Open Source development and participatory environments is in contrast with the usual learning settings found in HEI [6]. The OpenSE project builds on the project partners' vast experience from previous projects, and with novel learning environments [8]. Additionally the consortium is open to the possibilities provided by new opportunities for different forms of learning and teaching. The projects which have influenced OpenSE are given in figure 1 and discussed below.

NetGeners.Net – part of the FLOSSCom project (www.openedworld.net)
FLOSSCom project (www.openedworld.net)
The Edukalibre project (http://flossmetrics.org/edukalibre/index.html)
Free Technology Academy FTA
OSS Watch http://www.oss-watch.ac.uk
SELF project http://selfproject.eu
OSCOMM - Building Open Source Communities http://tutopen.cs.tut.fi/oscomm/

Figure 1 Projects which OpenSE builds upon

NetGeners.Net provided an experimental open environment where students could engage within Open Source projects. It consisted of open source software solutions and freely available web based tools and content. It was a small scale demonstrator project based on a course at Aristotle University of Thessaloniki (AUTH), Greece "Introduction to Software Engineering" [9].

• The FLOSSCom project aimed at identifying factors that contribute to successful knowledge construction in informal learning communities [10, 11 and 12];

• The Edukalibre project explored the field of collaborative production of educational materials;

• The FTA project set up a virtual campus offering course modules on Free Software and Open Standards.

• OSS Watch is run by the University of Oxford and provides unbiased advice and guidance on the use, development, and licensing of free and open source software;

• The SELF project developed a platform to encourage creative cooperation and the sharing of educational materials and training, for Free Software and Open Standards;

• The OSCOMM project helps with initial and ongoing stages to promote successful open source projects.

2.1 The core project partners in OpenSE

OpenSE started with an initial set of core partners. The students at each institution have support from lecturers, learning facilitators and online support providers. AUTH is the largest HE institution in Greece and is highly regarded worldwide in the field of Systems and Software Engineering. AUTH has included their student population from the following undergraduate courses: Software Engineering and Object Oriented Analysis.

The Tampere University of Technology (TUT), Finland, has involved their students from the course 'Open Source Software Development'. TUT has provided a number of candidate open source projects that could be considered as learning subjects and have monitored students' participation in example projects. TUT's teaching of software engineering is based on their research.

The Rey Juan Carlos University (URJC), Spain, has extensive experience of teaching free, open source courses at the masters and doctorate level. URJC brings expertise in FLOSS technologies applied both to the study of Free Software and to the e-Learning fields. For OpenSE URJC has developed the environment and introduced their students from its current masters courses on free and open source software.

Sociedade Portuguesa de Inovação, SA (SPI) is taking the lead on the project management, evaluation and dissemination aspects of the project.

The Open University (OU) is acting as an intermediary and in an advisory capacity through its Open Learning network project (OLnet) providing synergy between the OpenSE framework and the wider OER movement.

The Free Knowledge Institute (FKI) has coordinated the running of the ERASMUS funded Free Technology Academy project which set up a virtual campus offering course modules on Free Software and Open Standards using Open Educational Resources. FKI brought FTA students from its Academy and their

experience of working with industry into the OpenSE pilot rounds. FKI's role ensures that the OpenSE framework builds on existing and related projects.

University of Maastricht/UNU-MERIT a joint research institute of the United Nations University (UNU) and the University of Maastricht has experience of research in FLOSS projects and of working with industry and online communities of learners. UNU-MERIT has focused on the Quality Assurance aspects of the project.

Ecole pour l'Informatique et les Techniques Avancées (EPITA), is an engineering school of Computer Science. The members teach core courses and advanced courses according to their research interests. They are also contributors to open projects like Xemacs, Bison, Autotools and an open educational project named l'Ecole Ouverte. l'Ecole Ouverte has been founded during the 90s dedicated to promoting the use of open software in education and focusing on teaching open software, including Linux system administration.

The University of Oxford's OSS Watch provides an open source advisory service which has been identifying key players in the open source movement from the educational, enterprise and policy fields for OpenSE.

3. APPROACH

The project runs for 25 months and started in October 2009 with two high level aims.

1) Develop the OpenSE framework:

- OpenSE organizational framework; OpenSE content framework; OpenSE technical (support) framework; OpenSE learner support framework

2) Conduct 3 pilot studies

The OpenSE organizational framework builds in the main upon three key resources: the partners' experience in teaching Software Engineering using open source projects; a demonstrator (based on the previously developed NetGeners.Net), a participatory learning environment and on the partners vast experience in the domain area. The framework developed collaboratively at the partners first meeting is shown in Figure 2.
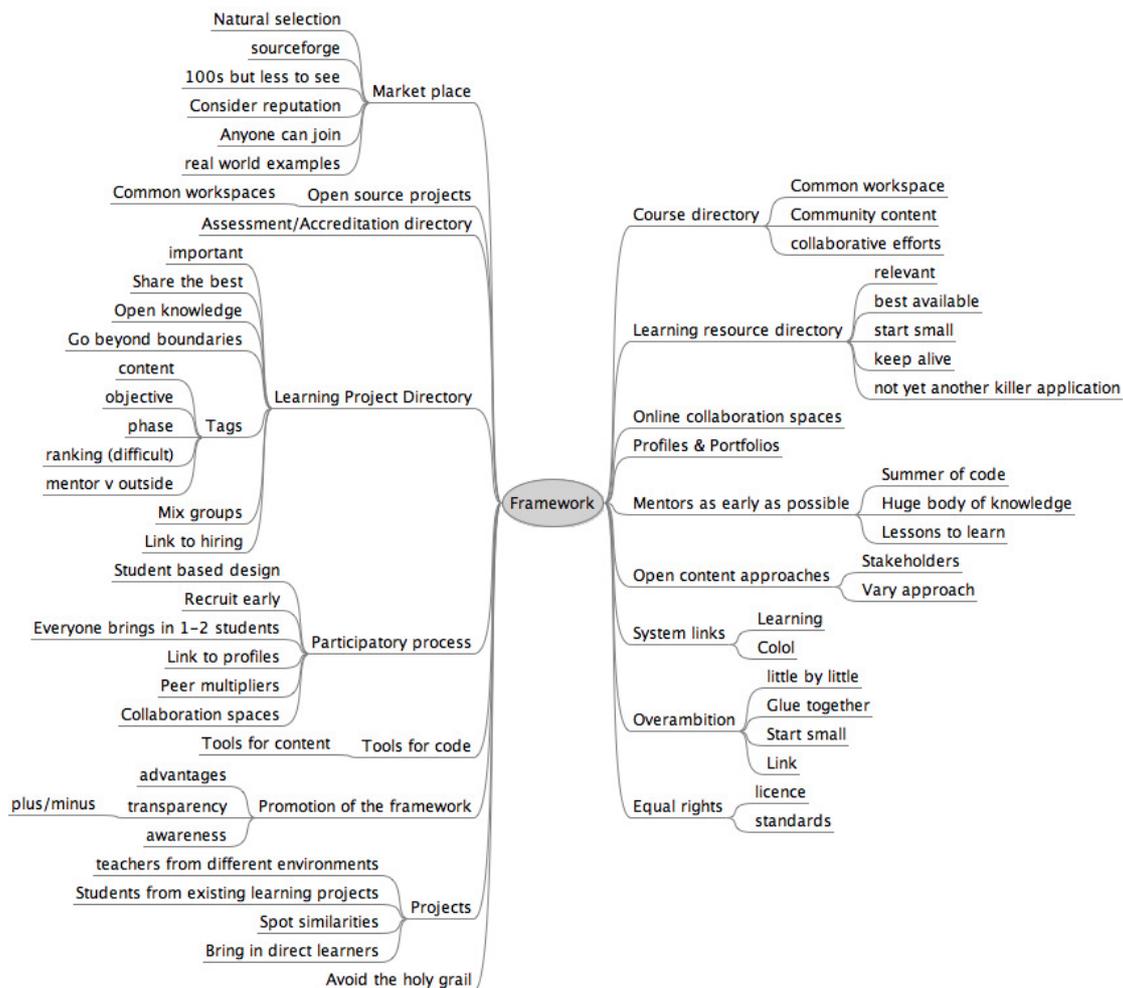

Figure 2 Collaboratively developed framework for OpenSE

The OpenSE content framework provides a comprehensive structure of instructional and learning materials for SE students, including currently used content from SE courses (usually in the partners respective languages), content provided by open source projects/enterprises in this field and the contents made available by FTA. The initial instructional and learning materials were released prior to the first pilot round in March 2010.

The OpenSE technical (support) framework provides a comprehensive technical framework that supports a seamless interplay of the different involved virtual environments: OpenSE environments, SE course environments, open source project/enterprise environments or FTA environment.

The OpenSE learner support framework provides a comprehensive learner support framework for formally enrolled students, fellow students and informal learners.

OpenSE has been running three consecutive pilots (the third currently in operation) within the environment (www.opense.net) whilst implementing and testing a hybrid approach to SE. The environment provides learners and educators with both, a basic 'on-board' set of communication and collaboration tools including a personal (learning) space and a connection to the 'outside worlds' of e.g. fellow HEIs or Open Source projects. The three pilots bring together the different involved stakeholders (HEI, open source projects/enterprises, students/informal learners outside of formal education) and allow their virtual collaboration in a 'semi-structured' way.

4. FINDINGS

The OpenSE project offers real world practical experience with Open Source software to solve problems for industry. The project has brought together HEI, open source projects and enterprises across Europe and other continents. FKI created a structured guide/template for all partners to adopt to ensure similarity between all course descriptions in the OpenSE site. The OpenSE platform itself has provided collaborative tools to facilitate interaction between the learners and teachers involved in the three pilot courses. These have included: forums, wikis, synchronous chat facilities, highlighted events, search feature, links to content, download options; and perhaps most importantly directories with repository functionalities to allow for the systematic availability of (1) access to computer science courses and mentored internship programmes that are both externally hosted with the respective HEI or open source project, (2) internship project reports from past students that show what they have done and achieved, and (3) second level supportive documents like guides or manuals. General support is currently provided via the learner guides [link] and forums [link]. Discussions are in progress about the introduction of a Community Game which simulates a real open source community project. This would provide a safe environment in which learners could experiment with open source development processes, tools and methods.

OpenSE conducted the first pilot with two courses at AUTH. All students found the materials very useful even though the courses were presented in English rather than in Greek. After the first pilot concluded, there was a suggestion that some modularity was needed and that a task focus should be adopted for courses so that they can be easily assessable by anyone.   At the nine month point in the project a number of open courses were aligned and published within the OpenSE environment. The project also managed to recruit the Virtual Software Foundation with their structured mentoring programme and a number of African key players to expand the international dimension. At that point the project hoped to see a lot of open learning taking place in the follow on 18 month period. It was envisaged that students would gain practical experience and practitioners would be enabled to improve their academic background in a fun environment that would be of mutual benefit.

A second pilot ran in September were each partners courses were described on the OpenSE platform within the OpenSE course template. The institutions worked together and learners not associated with an institution joined the courses as non enrolled students. The OpenSE website was redesigned after feedback from the first two pilot courses and re-launched on 26 April 2011. It had been found that the students' workload had been high as information had been duplicated on both the respective learning management systems of the partnering HEI and within the OpenSE platform. Also some technical difficulties were experienced when porting the Netgeners site for use as the initial OpenSE platform. The re-launched site was simplified, has become more user focused, and now clearly distinguishes between internal and external spaces through the directories with repository functionalities that have been implemented.

The OpenSE platform points learners towards projects with organizations such as the Apache Software Foundation (ASF) with the objective to move second level support away from them and into OpenSE. Second level support is not unique to a given open source software project or higher education course, and so would typically run the risk of a duplication of effort. Using OpenSE as a common space for second level support therefore could help to avoid such duplications.

A self print badge has also been designed which shows what a student has accomplished within the internship. This badge provides a hyperlink to the student's project report available through OpenSE and therefore allows

third parties to understand what a student has achieved. The concept of badges for representing learners authentic experiences in a way that can be reviewed and judged mirrors the reputation model the already exists in open source, where the actions of participants are valued rather than the accreditation. The Mozilla Foundation is supporting an extension of the concept that is in early stages of development [13] but suggests that there is a reasonable chance that approaches for exchange of badges will be supported in the future.

5. FUTURE DIRECTIONS

The developed OpenSE framework and its content can be adopted by others as it is built upon freely available open web 2.0 tools, with the content being released under a creative commons license thus allowing free reuse and modification. In the longer term the open learning framework could be transferred to other disciplines and is informing a parallel project openED 2.0 which addresses business and education skills.

The sustainability framework will further increase the project's positive impact since it would allow other educational institutions to not only draw on the lessons learnt, but also provide pathways to maintain such systems in a self-sustainable manner.

6. ACKNOWLEDGEMENTS

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