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# Science 2.0: Supporting a Doctoral Community of Practice in Technology Enhanced Learning using Social Software

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## 1. Introduction

The STELLAR European network of Excellence (NoE) (http://www.stellarnet.eu) represents the effort of leading European institutions and projects in Technology Enhanced Learning (TEL) to unify their diverse and sometimes fragmented community. The Network is executed via a series of integration instruments designed to increase the research capacity of European TEL at all levels. One level is that of early career researchers, and in particular doctoral candidates, who are seen as key in establishing sustainable research capacity in TEL.

This paper focuses on the ways in which STELLAR supports doctoral candidates through the establishment of a Doctoral Community of Practice (CoP) in Technology Enhanced Learning as a STELLAR doctoral integration instrument for the doctoral stakeholder community. This TEL Doctoral CoP (DoCoP), officially established in Autumn 2009, is also instrumental in bringing together actors of engineering education research in academic institutions, as proposed in the USA by Streveler [1]. The paper discusses possible ways in which the DoCoP could be developed through the innovative use of Web 2.0 technologies, by outlining the characteristics of one such technology and describing the ways in which an imaginary PhD candidate might use the technology in their PhD journey.

## 2. Doctoral Community of Practice in TEL

In STELLAR a high priority is given to PhD candidates, i.e. early career researchers conducting their PhD research in higher education institutions and typically being enrolled in a doctoral program. PhD education is a key issue for strengthening TEL research, shaping the domain and preparing the next generation of researchers and TEL entrepreneurs. This is especially true in European countries where the majority of PhD candidates, particularly those involved in the more technical aspects of TEL, move immediately to companies after graduation. As such, the integration of PhD candidates into STELLAR creates the conditions for the long-term sustainability of TEL research and TEL impact on the economy.

The first instrument to support the doctoral community in TEL is the STELLAR Doctoral Academy, which includes selected face-to-face events that bring the community together for doctoral courses, workshops and seminars. Such events typically last between a few days and one week. The organized workshops and lectures focus on theoretical, methodological and technological issues of relevance to TEL research (for example activity theory, embodied cognition, individual, social & organizational learning processes, human computer interaction, Web mash-up, adaptive and personal learning environments, as well as knowledge and competence management). Organization committees can apply to get an event sponsored by STELLAR. Upon acceptance, the sponsorship acts as a quality label (STELLAR accreditation) recognizing excellence and attracting participants who may be awarded STELLAR scholarships for participation. Sponsorships are granted to events gathering the top experts in the field and showing a high potential for the integration of the multidisciplinary and multicultural TEL community. Experts, PhD advisors and PhD candidates meet in such events that rely on Science 2.0 infrastructure to be established and for sustaining further interaction between the participants. Science 2.0 infrastructure stands for Web 2.0 solutions applied for scientific purposes and enabling interaction between peers, as well as sharing of resources offered by the community for the community.

The second instrument is the Doctoral Community of Practice (DoCoP). Its purpose is to bring or keep together PhD candidates working on TEL research, offering them opportunities to share, discuss, and receive feedback on their research by peers and experts. In this respect, as the doctoral candidates ('newcomers') interact with each other and with expert researchers ('oldtimers'), they are learning how to become TEL researchers [2]. As Wenger [3] has explained, a community of practice has three characteristics, firstly a shared domain of interest (in this case TEL research), secondly a community in which members interact and learn from each other, and thirdly the practice "members of a community of practice are practitioners). They develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems—in short a shared practice. This takes time and sustained interaction". The DoCoP is supported by an on-line platform specifically designed for exchanges between doctoral candidates and researchers in the TEL field as part of the STELLAR Science 2.0 portal. The STELLAR Science 2.0 portal is presented in Section 3 below. A social software that could be integrated in the portal as an interaction space for the DoCoP is introduced in Section 4 and detailed in Section 5.

In creating and sustaining a doctoral community, the DoCoP has the potential to support doctoral candidates in three key ways. **First**, it can support researchers who may feel isolated, who work in small labs without a critical mass of PhD candidates or without staff with interdisciplinary skills, by integrating them into the STELLAR community in particular, and the TEL community in general. **Second**, the DoCoP could also serve as a platform for doctoral candidates and their advisors to find informal or formal co-advisors or jury members for the PhD thesis. **Third**, it is possible that, through engaging in the DoCoP, PhD candidates will be able to identify key research groups and companies whom they might want to visit as part of a mobility programme brokered by STELLAR. Such visits will help doctoral candidates to integrate collaborative research or testbed validation in their PhD thesis, and will also contribute to STELLAR's aim of developing capacity beyond institutional boundaries.

## 3. STELLAR Science 2.0 Framework

STELLAR adopts the perspective that in establishing effective communities of practice and stronger research communities in TEL, mutual learning of the participants is enhanced by supporting knowledge sharing and facilitating the advancement of one's own competences and knowledge while researching in TEL. In order to scaffold these processes, STELLAR uses the STELLAR "Science 2.0" concept which federates a variety of communication channels to ease internal exchanges within the scientific STELLAR network as well as beyond it to reach the general TEL community. These communication channels also aim to make research results known to the European and international TEL community.

STELLAR opens its framework and instruments to interlink with relevant scientific communities and people, and to support knowledge construction within the TEL research area. For this purpose, it aims at providing efficient access to the research outcomes of colleagues and peers in one's own and related disciplines, using Web 2.0 approaches that leverage the links between people as well as the links between documents, using a combination of pull and push techniques.

The STELLAR Science 2.0 portal is grounded within the context of the above objectives, integrating Web 2.0 tools, services and social software publically available or offered by the STELLAR community members. The Web of the second generation adds collaboration and communication mechanisms to scientific research resources by designing and implementing tools to support, follow and track discussions, argumentations and the whole history of a process which participates in the building of science. Blogs, forums, Wiki-pages and RSS feeds have become popular means for lightweight exchange, discussion and syndication of knowledge and opinions. Advanced TEL-oriented social networking or communication tools will be integrated together with analysis tools that will enable evaluation of the usage of the portal and the evolution of the community.

As mentioned in Section 2, the doctoral stakeholder community and its related doctoral community of practice are central to reducing fragmentation of research in technology enhanced learning in Europe. As a consequence, special components of the Science 2.0 portal have to be designed and dedicated to the DoCoP. These components aim at virtually complementing and sustaining interaction between face-to-face events such as TEL doctoral schools, workshops, and doctoral consortia.

An informal survey carried out during the 2009 Joint Summer School on TEL (a doctoral event sponsored by STELLAR) has demonstrated that the doctoral community members in TEL use a huge variety of tools, resources and repositories. It has also highlighted the needs for better integration and sharing in contexts and on purposes. STELLAR does not aim to create an additional tool to meet this need, but to adapt solutions developed in previous European projects to integrate in a space of the Science 2.0 portal all the digital and social ingredients of a successful PhD recipe in TEL. For example, the *Graaasp* social software developed for supporting Communities of Practice in the framework of the European PALETTE research project under the *eLogbook* name appears to fulfill simultaneously the need to have a single aggregation place for global resources and to have a unique personalization mean to organize such aggregated resources by contexts and by purposes. In addition, *Graaasp* also supports workflow management as requested when implementing and conducting doctoral school events or visits supported by mobility scholarships. It may be that STELLAR will adapt this software for use by the DoCoP. The remainder of this paper explores how *Graaasp* might fit with STELLAR's agenda.

## 4. Constructing a Web 2.0 DoCoP interaction space

Successful Web 2.0 solutions result from the implementation of a proper participatory design approach and also from the recognition that the Darwin theory of evolution applies to them. In other words, only the Web 2.0 tools and services (species) that fit to the environment (user's contexts, expectations, and adoption thresholds) can survive and spread. They spread thanks to mass adoption, open source licensing, shared features or APIs (as the DNA of the best individuals).

Preliminary participatory design results can be derived from the analysis of the practice in the target community; in our case the community of PhD candidates and advisors in TEL. The objective is to define and construct an interaction space (component) of the Science 2.0 portal for supporting the DoCoP, as well as to improve the features of the *Graaasp* social software, which is a candidate solution as Web 2.0 DoCoP interaction space. The robustness of the Science 2,0 portal to the natural evolution of the Web 2.0 solutions is not considered here. It is supported practically by relying on standards and choosing solutions as open as possible, either for being integrated as component or feeds in other platforms, or for integrating other components or feeds. In effect, in the Web 2.0 realm, people and platforms are simultaneously consumers and providers.

For design purpose in our Science 2.0 context, it is important to reflect on the practice of PhD candidates in TEL, in terms of social networking, communication and online resources. As a seed for reflection, one can ask if PhD research in TEL is different from PhD research in general, and, if yes, in what sense and what are the consequences in terms of practice. There are at least two distinctive features of TEL research. First, its youth and second its interdisciplinary nature.

One impact of the youth of TEL research in terms of practice is that it is difficult to find and to assess relevant scholarly resources and experts. Workshops, conferences and journals are not yet fully established, indexed and recognized; thus putting more burden on the candidates' shoulders and their communities to point out relevant material of good quality. In view of this difficulty, the STELLAR Science 2.0 portal should direct PhD candidates towards the proper scholarly places to find references and also to publish their work. As a matter of fact, collaborative recommendation driven by the TEL community through the portal should give access to the most relevant scientific contributions in the field. Also, best practices on what a PhD thesis in TEL is have still to be fully established. The portal should point to all published PhD thesis in TEL and enable interaction and communication with TEL researchers, TEL experts, TEL PhD advisors, and TEL Research Alumni.

The impact of the interdisciplinary nature of TEL research is quite deep [4]. First of all, it is still difficult to carry out research tagged as TEL in most academic institutions. Moving from "Thesis in Computer Science with Application to TEL" or "Thesis in Education with Application to TEL" towards "Thesis in TEL with Application to … Education in Computer Science (as example)" requires the full leveraging of the TEL research community. In that sense, supporting a strong visibility of the DoCoP senior and successful faculty members through the STELLAR portal is instrumental to enabling high-level PhD research in TEL. As TEL research requires multidisciplinary competences infrequently owned by a single individual, the role of the community as a coach to PhD advisors can be seen as stronger in TEL than in other research fields. This shows again the importance of supporting the DoCoP properly and highlights the importance of interaction in the community, as well as peer or

expert recommendation, possibly supported through the Science 2.0 portal.

Research in TEL is a niche that can be expanded considering the closeness between TEL and modern knowledge management practices. Currently, as a niche, in most institutions there is not the critical mass to establish a doctoral program in TEL. As a matter of fact, we claim that it should be avoided to fully build on the interdisciplinary nature of TEL. Hence, the DoCoP and the STELLAR science 2.0 portal should enable the operation of a virtual, distributed and informal doctoral program in TEL. This should integrate the existing face-to-face doctoral events only accessible to a subset of the DoCoP members and the associated resources. This program should be informal in the sense that it should not be built as a competitor of institutional programs, but as an additional resource for which the client institutions should grant ECTS credits themselves. Associated resources offered through the STELLAR Science 2.0 portal include pointers to *YouTube* or *FlashMeeting* videos of talks, seminars and lectures, as well as the associated slides and handouts available for example on *SlideShare*, where they can be tagged and rated.

## 5. The *Graaasp* Web 2.0 social software and an imaginary PhD journey through it

The *Graaasp* social software envisioned as an interaction space for the DoCoP can be described as a Web 2.0 application that can serve simultaneously as an aggregation, contextualization, discussion, and networking platform, a shared asset repository, as well as an activity management system.

*Graaasp* is built on the 3A interaction model [5] which is particularly focused on describing and designing social and collaborative environments. It was developed in the framework of the Palette European Project (http://palette.ercim.org/) following a participatory design approach: interviews and questionnaires with communities of practice such as *Learn-Net*, *Doctoral Program Lancaster*, *InCorPorate* and *Adira* helped identify their needs and translate them into design requirements. The 3A model accounts for three main constructs or entities: **Actors** are entities capable of initiating an event in a collaborative environment. They can be humans as well as virtual agents. Actors create collaboration spaces where they conduct **Group Activities** to reach specific objectives. In each of these activities, actors can take different roles, each of which consisting of a label and an associated set of rights. Furthermore, Actors produce, edit, share and annotate **Assets** in order to meet activities objectives. Assets can consist of simple text files, RSS feeds, wikis, videos or audio files. In addition, an activity can possibly have a well-defined planning of expected assets with concrete submission and evaluation deadlines, predefined evaluators and submitters. This is particularly useful in project-based learning communities and online educational environments. The model accounts for Web 2.0 features: entities can be tagged, shared, commented, linked together and rated. By design, *Graaasp* can serve not only as a networking platform, a repository of assets and an activity management system, but also as an aggregator bringing together content and services from other Web 2.0 applications. Internal tracking and notification features enable *Graaasp* to provide awareness to users on ongoing activities and participation.

To understand the potential role of *Graaasp* in enhancing the learning experience of PhD candidates in TEL, their interaction with one another as well as with senior researchers, we examine a scenario about an imaginary person, namely Pat, who has just started her PhD in the TEL field. Pat is invited by her PhD advisor and/or colleagues to register to *Graaasp*. Just like any other Web 2.0 social software, *Graaasp* has a low entry barrier; registration only requires a valid email and a password, or an OpenID. With time, Pat's profile can be gradually built up.

As initial action, Pat types in the search field "trust and reputation in Web 2.0 applications", which will be the subject of her thesis. As a response, the system relies on content and linked-based analysis techniques to propose a list of relevant group activities, assets and actors. For example, *Graaasp* proposes a LinkedIn group entitled "Trust & reputation in Web 2.0". Pat decides to join the group. Consequently, *Graaasp* uses the LinkedIn application programming interface (API) to send an adequate Web service request on her behalf. As assets, the system returns relevant documents, archived discussions threads saved and annotated in *Graaasp*, embedded *YouTube* videos such as conference talks on trust and reputation in Web 2.0, external papers from the IEEE and ACM digital libraries and the STELLAR open archive (http://www.telearn.org), as well as aggregated new feeds relevant to Pat's query. It also recommends a list of actors that are keen on the requested topic, ordered by relevancy and reputation. Actors include appropriate PhD candidates and senior researchers that are already

*Graaasp* users, as well as external people that have written relevant papers and/or participated in relevant group activities. For actors who are logged in to *Graaasp*, the system shows presence awareness to encourage interaction. Since actors do not only consist of people but also of agents and tools, *Graaasp* also suggests to Pat useful online systems related to TEL. The system also asks Pat if she wishes to be notified about the creation of any new activities and assets relevant to "Trust and Reputation in Web 2.0". Pat responds in the affirmative.

In the mean time, a professor from Germany creates a group space called "Privacy, trust and reputation challenges in Web 2.0" in order to conduct collaborative activities related to the subject. The activity space is public and anyone can become a member. Pat is notified of the creation of the space, and decides to join it. She takes the role "PhD candidate". Her membership is announced to other members. Another senior "PhD candidate" takes the initiative of opening a conversation with her and gives her hints on how to start learning about the field as well as references to assets (i.e. discussions, papers, online course notes) and group activities that can best introduce to the field. They also speak about the PhD process in general. Seeing that the discussion is interesting, Pat decides to save it as an asset, post it in the activity space and tag it "tips for beginners", "TEL", "PhD in TEL". It will serve as a reference to her and other new PhD candidates. Afterwards, Pat is notified of the creation of a new sub-activity space within "Privacy, trust and reputation challenges in Web 2.0" dedicated to a summer school whose topics and application process are described in the space wiki. A plan for expected assets is created, specifying submission and evaluation deadlines. By a simple click, Pat downloads the submission deadline to her calendar. She intends to work hard to be able to develop her knowledge in the field, submit a position paper and eventually participate in the summer school.

After a discussion with Pat, her thesis advisor decides to create an activity in *Graaasp* that helps his candidate progress her PhD in TEL and facilitates follow-up. They define for this activity a plan of expected assets. First, Pat is expected to read material related to TEL, raise and discuss the challenges that she thinks are important to consider and solve. These discussions are to be submitted as assets for the thesis advisor. Once the submission is done, the advisor is notified by the system. He then reviews and comments the submitted asset before a scheduled face-to-face meeting. After the meeting, Pat uploads minutes of meeting report and links it to the asset that triggered the discussion.

It is worth mentioning that the system allows users to enforce an order in the submission and evaluation of expected assets. This means, for example, that the research plan cannot be submitted before the submission and the successful evaluation of the asset discussing TEL challenges. Some time later, and always with respect to her PhD progress, Pat types in the search field "PhD dissertation". *Graaasp* proposes *AWSOME Dissertation*, an online project that other users have registered as a tool and tagged with the keywords "PhD dissertation" [6].

Last but not least, as Pat uses *Graaasp* more regularly and visits other actors' profiles, she starts seeing the added value of completing her own profile information. She fills in information related not only to her academic background and current position, but also to the skills and competencies that she already has and the ones that she aims to acquire or develop. Pat also augments the profile of other actors she interacted with by giving personal feedback through comments and ratings. As is the case for tags, the system suggests skills and competencies that have already been added by other actors, to Pat. This helps her discover skills worth developing, build a common TEL vocabulary, and/or reach people with similar learning objectives. As Pat's profile is gradually completed, and as she uses the collaboration platform more frequently, the recommendations rendered by the system become more and more personalized. As a matter of fact, as the system suggests resources, actors and group activities to Pat depending on her working context, it draws on information about Pat's previous interactions to discover her preferences, her trusted network of actors, and the kind of actors, resources and group activities that are best fitted to her learning needs and goals.

Figure 1 below provides a mock up of the *Graaasp* interface, showing with a large orange banner and as current context the activity created by Pat. It is entitled "Pat's PhD Research Follow up" (central left-hand side) and integrates a wiki with the description of the activity and a field for free comments that could be added by users having sufficient rights to access it. The current context is selected from the Favorites or the Clipboard area by clicking on the desired color rectangle. It could also be chosen among the results of a search query. Once an entity is selected as current context, related personal entities explicitly associated to the current context by the user are automatically displayed in three dedicated columns (central right-hand side). Hence, *Graaasp* can be seen as a contextual browser showing in a single screen all the relevant information aggregated by the user in the current context.

Feeds relevant for Pat's PhD research are only visible in this context, not in her other space dedicated to the theatric performance she is organizing with friends. In addition to these preselected entities, recommendation of external ones can be provided taking into account their existing relations with the current context and their relative importance in it (bottom left-hand side) [7]. By clicking on any rectangle, the user automatically trigger a change in context and all the interface components are updated. New relations can be created by dragging and dropping entities or by clicking on the relevant grey rectangles.
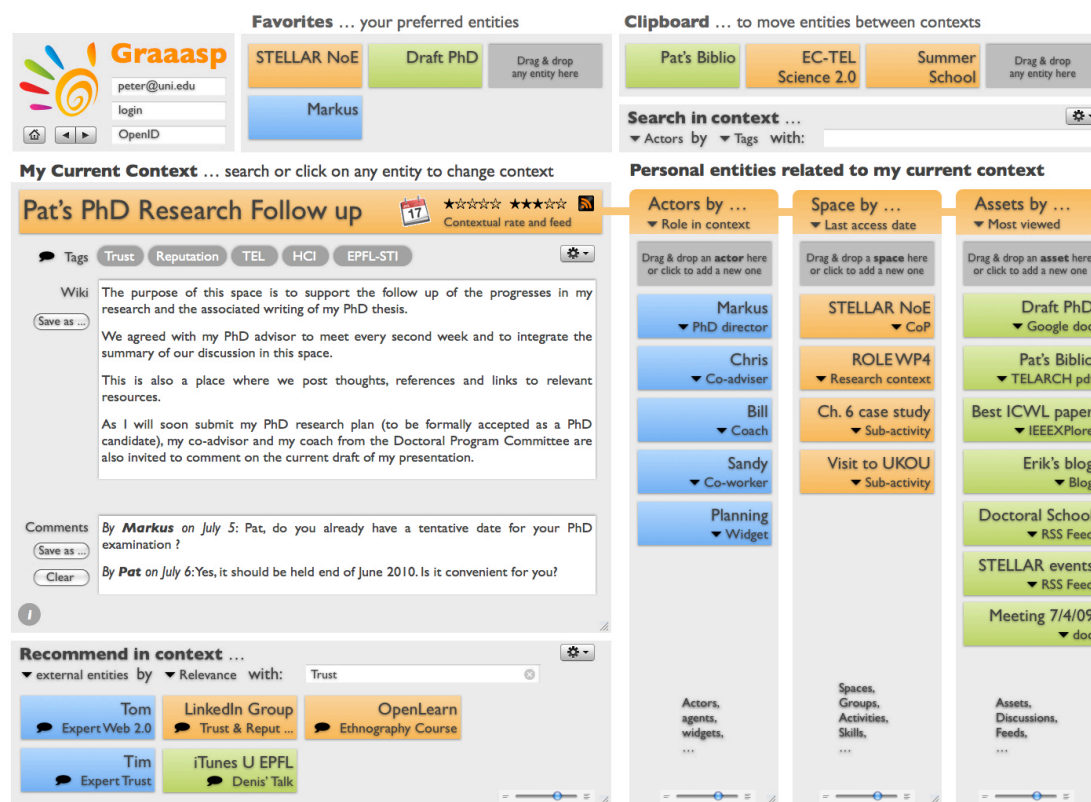
Figure 1. Recent Mock-up of the *Graaasp* interaction space.

## 4. Concluding remarks

This paper has argued that TEL doctoral candidates have a particular need for support, and has described the structure of STELLAR's organizational commitments to provide this support in the form of doctoral events and a Doctoral Community of Practice (DoCoP). It further argued that the DoCoP should support its members through mutual learning and knowledge building, introducing the *Graaasp* social software, and explaining through an illustrative example how Web 2.0 features could be used to meet the aims of the DoCoP.

As a matter of fact, supporting a Doctoral Community of Practice (DoCoP) in Technology Enhanced Learning (TEL) is more a question of pointing to the right resources, services and people from a single place than a question of platform and technology. However, because of the large set and the variety of the digital assets and online communities involved, the way these entities are integrated plays a key role for adoption, appropriation and identification. In effect, building a strong community identity is also a must to position TEL in the worldwide research arena and to strengthen exchange in its multidisciplinary community. A single Web 2.0 interaction space bringing together the most relevant people and resources is instrumental in that perspective.

We believe that *Graaasp*, or similar social software, could provide an online environment that would support doctoral candidates and would provide the 'space' where the members of the DoCoP would interact, building on their relationships initiated and consolidated at face-to-face doctoral events. We believe it is important to work towards developing this software so that it becomes the first choice of

the members of the DoCoP, so that the space becomes well populated with group activities, actors and assets. We recognize, however, that populating such a tool depends on the commitment of the individuals involved and perhaps the greatest challenge for the STELLAR network is to encourage committed doctoral candidates and academics (such as their supervisors) to 'get the ball rolling'. We suggest that once the 'ball is rolling', the value of the tool will grow and be recognized by all individuals in the DoCoP, in STELLAR and in the network of stakeholders.

## References

[1] Streveler, R.; Smith, K.; and Miller, R. 2005. Enhancing engineering education research capacity through building a community of practice. In Proceedings of the ASEE annual conference and exposition.

[2] Lave, J.; and Wenger, E. 1991. Situated Learning, Legitimate Peripheral Participation. Cambridge University Press, Cambridge.

[3] Wenger, E. 2006. Communities of practice: a brief introduction (http://www.ewenger.com/theory). Accessed September 6, 2009.

[4] Pallas, A.M. 2001. Preparing Education Doctoral Students for Epistemological Diversity Educational Researcher, Vol. 30: pp. 1-6.

[5] El Helou, S.; Gillet, D.; Salzmann, C.; and Rekik, Y. 2009. Software for Sustaining Interaction, Collaboration and Learning in Communities of Practice. In Solutions and Innovations in Web-Based Technologies for Augmented Learning: Improved Platforms, Tools, and Applications, Advances in Web-based Learning (AWBL) Book Series. pp. 300-316.

[6] AWESOME Dissertation. Academic Writing Empowered by Social Online Mediated Environments (http://awesome.leeds.ac.uk). Accessed August 22, 2009.

[7] El Helou, S.; Salzmann, C.; Sire, S.; and Gillet, D. 2009. The 3A Contextual Ranking System: Simultaneously Recommending Actors, Assets, and Group Activities. In Proceedings of the 3rd ACM Conference on Recommender Systems, New York, USA, October 22-25.