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Educational Innovation with Learning Networks: Tools and Developments

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Abstract: Professional Development is ill served by traditional ways of learning. It can profit from a Learning Networks approach, which emphasizes logistic, content and didactic flexibility. Learning Networks are online, social networks that have been designed and tooled to foster informal learning. Three European projects are discussed – idSpace, LTfLL, Handover - which have developed tools befitting networked learning. Each in its own way, the projects illustrate the benefits of a networked learning approach. This goes for all three flexibilities but in particular for the need to be didactically flexible. Finally, it is argued that formal education could profit from the tools discussed.

Keywords: networked learning, learning network, FP7, innovation, language technologies, idSpace, LTfLL, Handover
Categories: H.5.0, H.5.1, H.5.2, I.2.7, K.3.1, L.2, L.3

1 Introduction

Professionals cannot afford to stop learning after their graduation, they should learn incessantly throughout their professional lives. This is not a new observation, it has been made by many people [Sloep et al. 2011]. However, it is not easy to unpack all that it implies. At first sight, it seems plausible to rely on the educational establishment for this - schools, colleges, universities, and professional training providers. However, a moment's reflection reveals that one cannot just expect the rigid structures that they exemplify to exercise the flexibility that professional development demands [Berlanga et al. 2010a].

First, learning professionals need *logistic flexibility* that allows them to learn wherever and whenever they want as well as to take charge of their own learning.

Second, they not so much need set degree programmes, but rather agile learning opportunities. These should address their specific problem at exactly the right depth (complexity) and to exactly the right extent (scope); they should also be offered in ways that are commensurate with their preferred learning modes. This is *content flexibility*. Third, the metaphor of knowledge transfer between someone who is in the know (a teacher) and others who are clean slates (the students) is inapt in the context of professional development. Professionals are all experts in some way, be it all on slightly different topics and to differing degrees. So they are all peers who alternate between the role of teacher (guide, advisor) and learner (student, trainee), depending on the topic in question and who enquires about it. During peer conversations, professional learners seamlessly switch between discourse and reflection, depending on the situation at hand. This is *didactic flexibility*, the specific ability to conceive of learning as a social process of knowledge creation and exchange.

This list of demands shows why traditional forms of learning with one-hour lectures at weekly intervals in buildings of brick and mortar do not work for professional learning. There is limited logistic flexibility, if only because the institutional calendar dictates the students' calendar, rather than the other way around. There is no content flexibility as learning opportunities are packaged as lectures, courses and curricula. And finally, there is no didactic flexibility because teacher and learner are not roles but full-time occupations. It is our conviction that we should not start with educational institutions as we know them and wonder how we can make them fit the demands of modern-day professionals. Rather, we should develop – conceptually first, practically later – a novel learning environment that does suit the kind of flexible learning needed. This learning environment we have called a *Learning Network*, learning with it we refer to as *networked* learning [Sloep and Berlanga 2011]; [Sloep, Van der Klink, Brouns, Didderen and Van Bruggen 2011].

In a Learning Network, learners learn by accessing resources. The Learning Network's participants themselves are the primary resources, since they all act as sources of the expertise they happen to have. They thus adopt an *expert* role versus a fellow participant and in that capacity direct their fellow participants to (online) artefacts – presentations, videos, blogs, news feeds, shared bookmarks, relevant communities they participate in, or indeed other experts they know. However, they may also act as providers of various kinds of *support* – i.e. act as learning coaches, mentors, critical friends. Importantly, the potential of networked learning lies in exploring the weak links between the network participants, that is, in connecting people who may share a common 'friend' or indeed only a 'friend of a friend' [Christakis and Fowler 2005]; [Sloep and Kester 2009]. They are the as yet unknown sources of new knowledge and support. Since friends of friends are only weakly linked to each other, learners do not know whom to contact for what. Broadcasting request for help to the entire Network of course would rapidly clog up communication if not exhaust the participants' patience with this kind of learning. So participants need to receive requests for expertise and support that fit their profile, and recommendations that fit their requests [Sloep 2009].

This is achieved by equipping the Learning Network with a variety of request-and-recommend tools. To the extent that these tools function adequately the Network's continued viability is guaranteed. Many of these tools are similar to what existing

social network sites offer in the way of social media. However, standard social media typically leave something to be desired when it comes to their supporting learning (knowledge sharing and creation) functions. This should not come as a surprise as they have been developed with the intent to serve maximising income from advertisements, not fostering learning. Adequate social networking tools, that are unique to networked learning, therefore need to be developed specifically. Tools are needed that help some participant find fellow participants in the Network who can honour requests for expertise or support; that provide participants with formative feedback [Berlanga et al. in press]; that help participants find fellow participants who would be suitable to jointly form a topical community; that help participants find artefactual resources and perhaps concatenate them in sensible ways.

Below we discuss three projects that each in its own specific way addresses aspects of networked learning. idSpace <www.idspace-project.org> ([Section 2]) was completed early 2010. It assumes the existence of a community of innovators, for which it has built an online platform that allows them to share and ultimately create knowledge. Even though it assumes a community perspective, the wider network of people to draw upon is never far away. LTfLL <www.ltfll-project.org> ([Section 3]), which finished early 2011, also takes a tooling perspective. The starting point is the availability of textual artefacts that are online accessible for (automatic) text analysis. The tools cover individual learning and collaborative knowledge building, either separately or jointly. Networked learners are then given targeted advice on how to proceed in their learning efforts. Handover <www.handover.eu> ([Section 4]) finished at the end of 2011. It is about 'handing over' patients between health-care workers. Such processes may be optimized through staff training. It is at the level of sharing knowledge about how best to do so (a meta-perspective) that the networked learning perspective bears fruit in this project. [Section 5] concludes the paper and discusses how each of the projects in its own unique way constitutes a contribution to the elaboration of the notion of networked learning.

2 idSpace: Tooling of and training for collaborative, distributed product innovation

Inventing and designing novel products or services requires collective creative performance, i.e. creative action in combination with collaboration. Creativity is being seen as a 'universal attribute, suggesting a need for greater creativity in order to both survive as well as thrive in the twenty-first century' [Craft 2006]. Over 90 creativity techniques - such as TRIZ, SCAMPER, Six Hats – exist, all aiming to encourage people's original thoughts and divergent thinking. These techniques try to steer thought processes and help the individual and group to find a structured approach to answer questions, to see problems in their entirety, to generate new ideas, and to arrive faster at better decisions.

Fostering creativity is increasingly seen as a key direction and focus for pedagogic approaches. While individual factors and initiative are important to creativity, social environments make the difference [Glor 1998]. According to [Amabile 1996] and [Beers et al., 2005], individual creativity can be mediated by the group and can be

supported by the social environment. Collaborative creativity requires: (i) generating new perspectives, (ii) articulating as yet 'tacit' knowledge, (iii) finding common ground, (iv) learning from each other, (v) evaluating ideas, and (vi) collaboratively 'constructing' new propositions. Acknowledging that being creative is a collaborative process, lends support to following a networked approach. It is in particular phases (ii) to (iv), however, that profit from it, in particular from the equity that the requirement of didactic flexibility imparts. People adopt a teacher role when they explicate their tacit knowledge and allow others to learn from it. Their counter-parts in this process adopt the student role. However, crucially, these roles alternate in unpredictably ways during the creative process, in particular so when attempting to find common grounds.

There appear to be very few creativity supporting tools that have been designed based on the principles of specific creativity strategies [Huang et al. 2007]. Existing systems that aim to support collaborative creativity processes are mere concept mapping or groupware tools. Usually, they offer real-time cooperation through a text chat or a shared workspace only. Thus the idSpace project sought to develop a web-based platform that would allow a distributed team of innovators to elaborate on existing ideas, to create and preserve new ideas, and to learn about them. The platform employs techniques for exploring new ideas and refining existing ones. It contains tools to support traceability among stories, mind maps, concept maps, goals, new product features, as well as company values and policies. Finally, it also preserves semantic relationships among the different viewpoints for later exploration, retrieval, and navigation purposes. The platform goes beyond mere communication and collaboration support in that it offers pedagogical guidance to its users throughout the creative process and elaboration on that process (see

Figure ***1***). Learning scenarios guide the use of the available creativity strategies, leading users to an effective and efficient session of creation and innovation. The idSpace platform contains tools with which group members may articulate, communicate, and process new ideas. It allows users to work individually and reflect on a given problem or to engage in a collaborative activity in a shared workspace (canvas). The platform aims to:

- allow its user to work at a distance on a problem or challenge
- provide a workflow for working collaboratively, which guides the users through creativity sessions while simultaneously supporting them with related information
- support the reuse of creativity projects that have been created with the platform (earlier projects can be used as input for new projects, thus transforming ideas into reusable knowledge).
- inspire users with ideas expressed in past projects, as well as recommend related ideas, suitable users, past solutions, and appropriate pedagogical strategies and creativity techniques
- support the entire process of project definition, creativity activities, evaluation, and solution formulation.

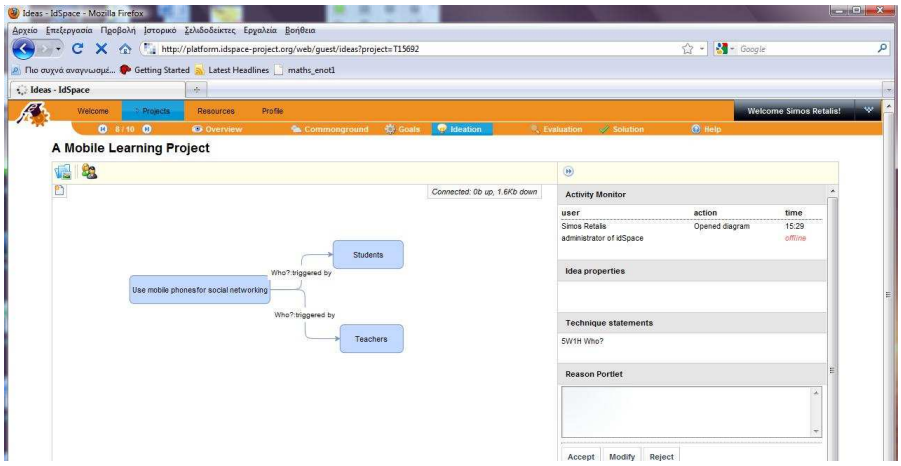

Figure 1: Screenshot of the ideation process at the idSpace platform

A typical task workflow in a collaborative scenario with the idSpace platform is shown in Figure 2 [Dols 2010]. It shows the main activities as well as the main actors (the circles). A circle containing an 'M', stands for the moderator, while a circle containing a 'G' stands for a group member. The idSpace platform emphasises the role of the moderator, who should i) choose a creativity technique from the available template list, ii) compose groups and subgroups for the various tasks at hand, iii) add a problem statement to the project that will help the project to get a clear focus and iv) monitor the whole process and intervene if needed.

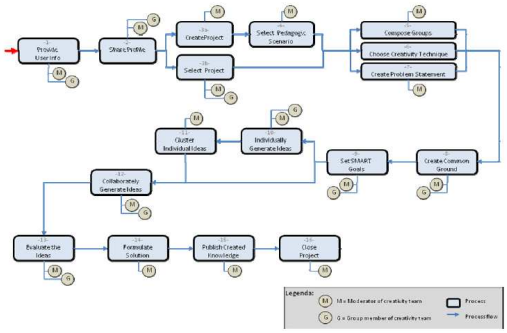

Figure 2: A typical task workflow in a collaborative scenario using the idSpace platform

Evaluation

idSpace was systematically evaluated [Hagemann 2010]. The evaluation focused on the identification of shortcomings in the system design that could hinder the users in the creativity process, and on the identification of problems related to the specific skills and expectations of the users. The main evaluation goals were:

- to evaluate the effectiveness of the idSpace system as a tool for supporting actively and in a context-aware manner the creation of new ideas
- to evaluate the effectiveness of the idSpace system as a tool for representation, storage, and management of ideas.

A mixed evaluation approach was followed with the participation of four usability experts and representatives of the end-user community. End-users of idSpace are designers of innovative products, who collaborate in teams at distributed work setting in private and public organizations and companies of different sizes. The set of evaluation criteria adopted was based on i) a list of the main Nielsen's general heuristics, i.e., effectiveness, efficiency, learnability and user satisfaction [Nielsen 1994], and ii) specific heuristics for Computer Supported Collaborative Creativity, such as supporting the visualization of rich material; the malleability of shared material and stimulation of variations; support of convergence within evolutionary documentation; smooth transitions between different modes of creative collaboration; integration of communication with work on shared material [Herrmann 2009]; [Warr 2007]. The following tools were used for data collection:

- Observer notes – observations made by the observers during the user trials
- System loggings - savings of the ideation results
- Post-Test Questionnaires – composed of rating scales and open questions to obtain user opinion
- Usability expert reports.

Five case studies were set up, jointly covering a variety of subjects:

1. A group of 3-5 software engineers (project management and engineering level) collaborated using idSpace in order to decide upon an idea for a project proposal as a reaction to invitation to tender.
2. Two software engineers, one technical manager, and a general manager used idSpace platform to do structured collaborative problem solving about how to increase sales through diversification of the products.
3. Two chief technical managers, one programmer and the general manager carried out a structured brainstorm to find new features for their tool.
4. Three engineers and one manager utilized idSpace for making a proposal on how to increase the impact of an international conference.
5. Four researches collaborated via idSpace to generate ideas for mobile applications for learning.

Each evaluation session lasted about 4-5 hours, and consisted of a briefing on the idSpace environment and the evaluation case study, a user testing, data collection and a debriefing. For the prototype that the idSpace platform was in its then current state, it suffered from various loose ends, bugs and inconsistencies. Before the end of the project, however, and in no small part thanks to the evaluation, most of these could be

remedied for the final release. In spite of the defects, all participants commented positively on the philosophy underlying idSpace.

3 LTfLL: Language Technologies for Lifelong Learning

The LTfLL project developed a set of loosely coupled, innovative tools with the intention to improve the understanding and analysis of learners' textual artefacts, narratives and conversations. The tools all use language technologies in some form or other. They were built around specific pedagogic problem statements, that are all related to contemporary approaches in technology-enhanced teaching and learning [Berlanga et al. 2009]. With the inclusion of Learning Networks in the form of people and content linked with these people, LTfLL capitalises on social media and the networks associated with them for their capacity to foster learning.

The design of the LTfLL tools has been guided by a scenario-based design methodology that includes the use of pedagogically sound scenarios. The scenarios were meant to build on theoretical underpinnings and to steer design requirements of the proposed service [Hensgens et al. 2008]. The tools were shown to have a positive impact on reflective student practice in that they allowed learners on-demand feedback during narrative or dialogistic learning processes, even without any tutor involvement. Feedback from LTfLL is of an advisory nature; it aims to support independent learners in their respective tasks and to allow suitable interventions. The tools cover three specific areas of application.

(1) *Positioning of the leaner*: The automated analysis by the positioning tools of concepts missed or covered not only helps learners to reflect on the domain coverage of their written texts, but also to compare their reflections on the texts with those of their peers. Combining this analysis with the resource discovery tools (see item 3), learners could directly be referred to potentially valuable learning objects.

(2) *Dialogue analysis*: LTfLL developed a specific tool for analysing the polyphonic (with multiple participants) discourse in collaborative, online conversations in chats and forums. The tool observes parallel but intertwined discussion threads and focuses on the implicit 'voices' that are inherent in the utterances. It returns feedback at three levels, all regarding concept coverage and user interactions: at the level of the entire discussion, at the level of each individual participant, and for each single utterance. Through this top-down analysis, every user's needs are catered for.

(3) *Resource discovery*: LTfLL's social resource discovery service crawls and harvests a user's social network for relevant learning resources. It relates resources and actors to each other and to a selected domain ontology, thus creating semantic relationships between them. To achieve this, a method for iterative ontology enrichment from social media sources was developed. It allows enriching an existing (formal) domain ontology with the additional concepts and lexicalisations that are used by a community of practice represented through social media (i.e., bookmarks, videos, slides). As a result, the service allows learners to acquire an overview of the domain (see Figure 3).

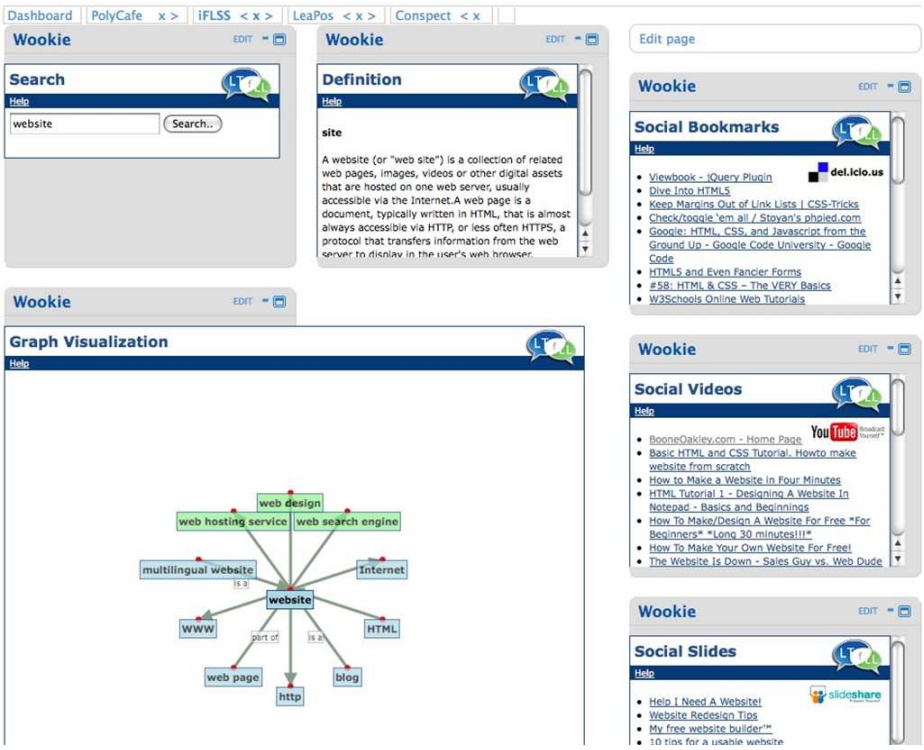

Figure 3: LTfLL: The resource discovery tools

Table 1 provides a summary of the LTfLL tools. Their type is also shown as: P=Positioning; D=Dialogue discovery and R=Resource Discovery.

Evaluation

LTfLL helps learners and institutions unlock their abilities to access and master content and to position themselves in a topic domain. Through validations, the tools have been shown to lower the cognitive load, to raise the quality of educational production through live feedback, and last but not least, to increase motivation for self-directed learning. 531 participants (316 learners) took part in the validation pilots, which used LTfLL tools based on five different languages. The average timespan of the pilots was three weeks and involved learners, tutors, teaching managers, the LTfLL team and Technology-Enhanced Learning experts. Results demonstrated the areas of strength and weakness of each tool, highlighted their selling points and barriers to adoption for the exploitation strategy, as well as suggested possible further contexts of use. All tools addressed burning issues for organizations, but further improvements to accuracy from a user viewpoint are required.

Name	Description	Type
LeaPos	LeaPos allows tutors and learner candidates to establish a specific definition of required training units and corresponding learning methods. Learners can evaluate their own positions and identify their strengths and weaknesses. The provision of detailed and optimised hints for the learning path provides many benefits (learner saves time, learners and tutors will be more satisfied and motivated).	P
Conspect [Berlanga et al. 2010b]	CONSPECT provides a means by which a learner's conceptual development can be monitored and feedback opportunities can be promptly and effectively provided. It monitors conceptual coverage of topics based on an automated analysis of textual evidence presented by learners, in comparison with others or over time, to identify shortcomings, or misconceptions. It uses textual products from individuals and groups of learners, such as essays or blogs, to establish a visual representation (e.g., concept maps) of how learners relate concepts to one another. Learners are able to compare their own model with an emerging group reference model in order to identify differences, or to get feedback on where to seek advice from their tutor.	P
PolyCAFe [Trausan-Matu 2010]	The PolyCAFe tool aims at offering the learners and teachers real-time feedback, support and recommendation regarding their activity in a web discussion (chat, forums). It also provides improved visualization of the discussion and implicit link detection between utterances in order to assess collaboration - one of its objectives being to stimulate the collaboration of users in web conversations.	D
PenSum [Dessus et al., 2011]	PenSum supports learners in the automatic assessment of their essays (summaries, syntheses) in order to let teachers focus on higher-level activities (e.g. individual learner guidance or course design). It analyses how well learners understand course texts as shown by their textual productions; it provides frequent just-in-time feedback on the on-going writing activities, giving indications of the relevance of written sentences, inter-sentence coherence of the synthesis, résumé of each course sentence.	D
Learning Support System [Westerhout et al. 2010]	Learning Support System, LSS for short, offers various browsing and searching functionalities: a simple text search returns documents with a varying degree of relevance; Semantic search makes the results more relevant, by using different wordings of a concept and exploiting implicit semantic relations in the text; and ontology browsing that helps the teacher to organize taxonomically his/her curriculum. The searching results are annotated automatically, and learners or teachers could compile manually a curriculum, a glossary and a test for the learners that will take into account the learner's profile (as a group and individually). Communication is facilitated through the use of social networks and new communities of learners can be established through the recommendations provided by the system.	R

Table 1: LTfLL: Description of the tools

Part of the evaluation was an investigation of the capability of combinations of the tools to support more complex learning workflows. For example, CONSPECT (see Table 1) identifies concepts that are shared and unshared among learners. The results of this identification can be used to structure a discussion using PolyCAFe. In informal, professional learning settings this may take the form of a negotiation process between peers whereas in traditional, formal learning settings it may be a deliberate decision of the teacher. Thus a teacher may create teams to evoke a *cognitive conflict* [Dillenbourg 1996]; [Dillenbourg 2002] by selecting as team members students who use similar concepts.

In order to explore these kinds of workflows, compounded tasks were designed by means of user scenarios and flow charts. The user scenarios were created based on an initial list of activities, an example scenario and a flow chart. For instance, in the case of the example just given, the following initial list of activities was described:

- Create common ground for multi-disciplinary project teams
- Support specialisation in homogeneous groups
- Project group composition and teambuilding
- Assess knowledge level of discourse for future re-use
- Support collaborative writing
- Analyse tagging to infer knowledge levels.

In the case of the 'create common ground for multi-disciplinary project teams' activity, which addresses the issue of creating common ground for project teams [Alpay et al. 1998]; [Beers et al. 2005], the following problem scenario was used:

In current business practice multi-disciplinary project teams are installed to manage complex problems. The strength of the contributions from different members gets lost if the team lacks common ground to enable successful communication. Students shave to acquire soft skills to collaborate in (multi-disciplinary) teams. The educational institutions train these competences with project based tasks. The possible contexts in formal learning are Problem or Project-Based Learning, virtual business learning, soft skills training. In informal learning contexts, clearly, finding common ground matter no less. It is, for example, an early phase in the idSpace workflow (*cf.* section 2.1). The solution scenario proposed is that students use PenSum to write a synthesis based on the papers allocated to them. The resulting texts are then transferred into CONSPECT to visualize individual and group maps. These results, and especially the group model, will be discussed using PolyCAFe. The final goal is to create a common ground of the topic.

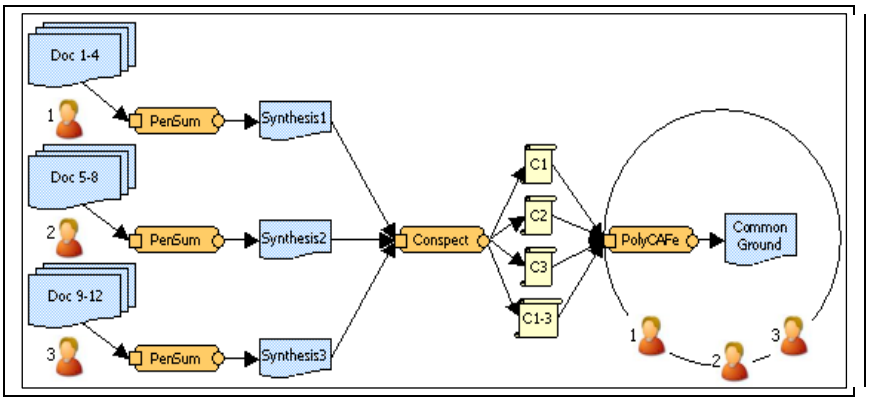

Figure 4: LTfLL – Example of a flowchart user scenario

Stakeholders welcomed this kind of approach when asked during the formative validation. Several other combinations have been suggested and documented; see [Armitt et al. 2011] for details.

4 Handover: A Novel Patient Handover Processes in Europe

The main objective of the Handover project is to optimise continued clinical patient care. More specifically, Handover means continuity of care either at a patient's referral to hospital by a primary care specialist or at a patient's discharge from the hospital. It does so by (i) identifying the barriers and facilitators to effective handover processes, (ii) creating safe and effective practices for such processes, (iii) creating generic tools and training related to handovers. To support effective handover processes, the project developed intervention-training packages. These interventions were at first meant to consist of e-learning modules. The modules then should (a) offer new knowledge and tools about handover; (b) share this knowledge and tools with a wider audience of key users; (c) and provide opportunities for training customization. Later, but still in accordance with these requirements, the idea of Learning Networks was adopted. Thus, the Handover toolbox (see Figure 5) is a learning environment that provides logistic, didactic and social affordances for supporting networked learning on handover.

The Handover toolbox offers tools and supportive information about the following topics: design of training, skills, knowledge, attitude, protocols, and checklists, empowerment of patient, external and organisational factors, methods of training, evaluation of training and use and dissemination of toolbox. For each topic there is a small community of practice, called *group*. A member of the Handover toolbox can join more than one group. Members of the Handover toolbox not only can find information and tools they need for designing effective training in handover (a formal approach to learning), but they are also able to share and discuss information with peers, search for and find expertise on particular topic, rate and annotate tools and

information, and create an own group if they need to do so (an informal learning approach). In addition, the Handover toolbox allows co-creation; that is, members not only can find and share tools and information that are already available, but they may also adapt existing tools to better fit conditions of the training or even create original tools. For example, rather than using a standardised protocol, the members of a group can create a new handover protocol.

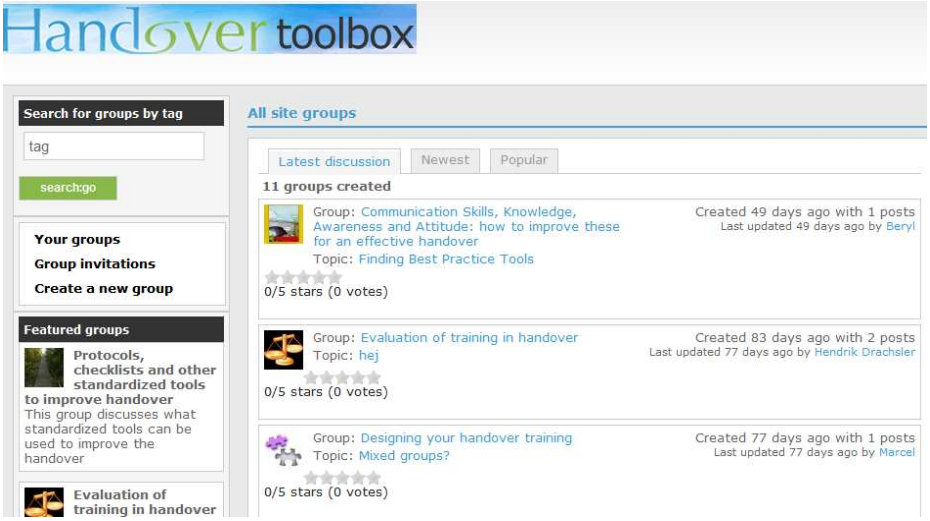

Figure 5: A view of the Handover Toolbox

As indicated, the design of the Handover toolbox was inspired by the idea of a Learning Network. The design approach used comprised design methods such as literature review and search for best practices in handover, interviews with training specialists in health care, definition of personas, group concept mapping, plus, minus, interesting evaluation method, software walkthrough, and a questionnaire.

Design and analysis approach

The project started with a review of research on and best practice of handover training. To identify emerging topics and thinking patterns in the literature about educational aspects of handover, cognitive mapping [Eden 2003] was applied. Cognitive mapping is a qualitative data analysis technique that imposes unified rules of coding (the ideas and their relationships are presented as a causal network of arguments built in a hierarchical manner) but it also allows quantitative analyses such as cluster analysis, domain analysis, and measuring centrality. 36 interviews with training specialists in health care were conducted. A combination of grounded theory and content analysis, supported by (open-source) software for qualitative data analysis (Wef QDA) was used for the data analysis. The data from the interviews were used to construct three personas.

Writing *Persona* is a technique that helps designers to understand who to design for [Cooper 2004]; [Cooper 2007]. Personas are richly presented, highly detailed descriptions of the typical user of a product. A Persona is a synthesis of elements drawn from several users who share common job roles, demographics, and user need characteristics. The Handover project composed three personas: Maria for Spain, Janusz for Poland and Dirk for the Netherlands. The Handover toolbox was designed with these three concrete personas in mind, not the much less specific category 'users'.

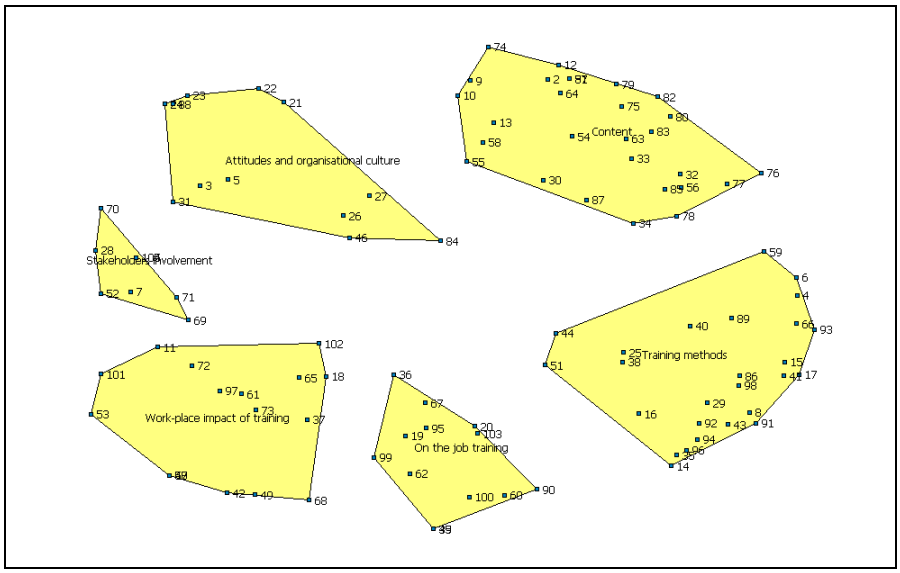

Figure 6: Results of the Group Concept Mapping

Group Concept Mapping was used for further analysis. It applies a structured approach to facilitate groups of stakeholders to identify and arrive at a consensus about a particular issue [Stoyanov 2010]; [Trochim 1989]. This analysis, which applies multidimensional scaling and cluster analysis, depicts, in the form of thematic groups, the common understanding of the participants of how data can be structured. A Group Concept Mapping approach was used to define the characteristics of effective training in handover. From the literature review and interviews 105 statements were extracted that referred to different aspects of handover training. 36 experts from within and outside the project consortium were invited first to sort these statements into groups according to their similarity and subsequently to rate them on importance and feasibility. First, the analysis (see Figure 6) identified the thematic groups of the handover toolbox; second, the statements in the clusters Content and Training Methods prompted ideas for different handover training set-ups; third, a clear distinction was made between the world of formal training and other handover interventions (e.g. changing attitudes and organisational culture); and fourth and final, the analysis suggested that formal training would have a limited impact on handover practice unless support for workplace learning is provided.

Evaluation

As a matter of principle, the software engineering cycle of the Handover toolbox was not evaluated separately. The evaluation activities, rather, cut across the various stages of conceptual design, functional design, development and implementation. For example, to evaluate the conceptual design of the Handover toolbox, data were collected and analyzed in the ways described in the previous section (review of the best practices, interviews with training specialists; writing personas and group concept mapping), using such evaluation methods as (a) Plus, Minus, Interesting [De Bono, 1990], (b) software walkthrough with think-aloud and interview [Kuniavsky 2003], and (c) a questionnaire.

The purpose of the Plus, Minus, Interesting exercise was to facilitate, in a simple and quick way, high-profile experts to generate information about the Handover Toolbox, to analyse this information and to use it to improve the next version of the tool. The PMI data collection was conducted over two separate sessions, one with experts internal to the Handover project (project partners) and another with invited experts. 62 experts participated in the Plus, Minus, Interesting exercise. Of them, 22 represented the Handover project's partners institutions (internal experts) and 40 were invited (external) experts. The data analysis applies card-sorting method supported by the websort software <websort.net>. The cluster analysis through websort identified five clusters of issues that needed to be resolved: Purpose, Content, Target Group, Usability and Technology Platform.

The purpose of the walkthrough-with-think-aloud-and-interview evaluation round of the Handover Toolbox, was to collect information from healthcare training experts and medical professionals about what works and what does not work for them while they are using the software. The procedure required the participant to try out three realistic tasks with the Handover Toolbox. While performing the tasks, the participants are asked to 'think out loud' about their experience with the Toolbox and to answer some questions. At the end of the evaluation session, the participants filled in a short questionnaire. The results from the walkthrough-with-think-aloud-and-interview evaluation clearly indicated that the participants felt comfortable with performing different tasks in the Handover toolbox. Although some interface issues still need to be addressed, the healthcare experts and medical professionals found the Handover Toolbox useful for getting information and sharing experiences. In addition, they indicated the Toolbox saves time and requires less effort.

5 Discussion and conclusions

As indicated, thinking about professional development in terms of networked learning - in terms of collaborating and connecting online through social media, existing and purpose built - amounts to taking a non-conventional perspective on learning. Even though conventional, formal learning may profit from the tools used for a networked learning approach – this much must have become clear in our discussion - all projects particularly highlight the benefits of such an approach for informal learning. All projects vividly illustrate the benefits and viability of honouring the demands for flexibility discussed in the introduction.

Thus all three projects profit immensely from the logistic flexibility that a networked approach affords. It allows people to learn from each other and share knowledge when and where it suits them best, be it with the intent to innovate, merely to learn on their own with social support from others, or to improve professional (handover) processes. Content flexibility is crucial to all three.

The networked approach, at least in principle, also allows for the delivery of customised content, through artefacts or people. This kind content flexibility is crucial to two out of the three projects, LTfLL being the exception. Since this project is mainly tool oriented, it is agnostic to it, although its tools are highly instrumental in providing content flexibility. In idSpace, on the other hand, the stock of past projects that the platform has stored, are an obvious content resource, but so are the people as knowledge carriers. In its present form, idSpace was not set up to take full advantage of content flexibility in the form of people, as the project simply took the existence of a (distributed) team of innovators for granted. However, team formation precedes this phase and it is here that content flexibility in the form of people bears fruit. Not all teams are created equal. Heterogeneity, for example, is strong predictor of innovativeness. A networked approach allows a team manager (moderator in idSpace aspeak) easily to recruit thus far weakly-linked individuals, on a temporary or a longer-lasting basis, who because of their profile should be able substantially to contribute to an existing team's performance [Sie 2011]. So being flexible at the team formation phase pays off. Handover, finally, is similar to idSpace in that it creates a close-knit community that will provide mutual support. Training materials by their mere availability, of course, provide content. Flexibility is incorporated in their design, which can subsequently be enhanced by allowing for user modifications.

Didactic flexibility is arguably the most important form of flexibility. It is guaranteed by the very adoption of a networked learning perspective, by emphasising the social dimension of knowledge sharing and creation. This kind of flexibility is paramount in the idSpace project, one of the main underlying assumptions of the LTfLL project, and a key driving force behind the kind of change that the Handover project seeks to bring about. Clearly, the overall design of the Learning Network ultimate determines its quality as an environment for professional development. If the network design leaves to be desired, any potential for knowledge sharing and creation that is hidden in the participants will not come to fruition. The tools discussed, however, all represent attempts, each in its own way, to optimise the design.

As already suggested, the projects discussed are to some extent a mere haphazard sample of projects in which the notion of networked learning is elaborated, researched and validated. Their takes on networked learning are 'tooling for learning', 'tooling for innovation' as in idSpace and 'tooling with language technologies' as in LTfLL, as well as experiences with an integrated environment for networked learning (the Handover toolbox). Opportunities for further elaboration of tools as well as a critical examination of its instantiations abound. Systems for the recommendation of content and peers, for creating, rating, annotating, and tagging of content, for rating activities of peers are needed beyond the simple form in which they were introduced in the Handover Toolbox [Sloep, Van der Klink, Brouns, Didderen and Van Bruggen 2011]. Research into the efficiency and above all effectiveness of learning in networked environments is needed, in particular into the role reflection

plays. And finally, research into the information exchange between specific networked learning environments and the Internet at large is needed: how can specific environments such as the Handover toolbox profit from their incorporation in the Internet, or, put differently, how do online learner identities built up in the Internet at large carry over to project-specific Learning Networks [Berlanga and Sloep 2011]?

Finally, we began our story by pointing out that the kinds of flexibility needed for professional learning and exhibited by the projects discussed, are alien to traditional, school-based forms of learning. Let us hasten to add that this is not a matter of logical incompatibility. The ideas behind networked learning and the tools that are needed to implement it, may profitably be used in such environments as well. Actually, it is our conviction they should. Indeed, the sections on LTfLL and Handover in particular already point out instances of how the tools and services developed in these projects stand formal education to good stead.

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