A Participatory Design Approach for the Support of Collaborative Learning and Knowledge Building in Networked Organizations

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Abstract—**Engagement in collaborative learning and knowledge building activities is still a big challenge for many workplace-learning designers. Especially in highly competitive environments people might be reluctant to give away too much of their tacit knowledge. A feeling of ownership and an involvement of the individual in the planning of the learning activities can be important motivational factors. In an international research project called IntelLEO – Intelligent Learning Extended Organization we intend to follow a participatory design approach involving individual workers from the very beginning of the development process. The planned user participation will range from the first conceptual design phase through the different development stages until the final validation of the system. Our hypothesis is that this involvement will increase the motivation of the individuals for collaborative learning and knowledge building activities.**

Index Terms—**participatory design, collaborative learning, extended organization, self-direction.**

I. INTRODUCTION

Motivation is one of the key success factors for adult engagement in learning and knowledge sharing activities. In his theoretical work on andragogy M. Knowles [1] pointed out the importance of involving adults in the planning and evaluation phase of learning activities in order to enhance motivation. An advanced theory of Knowles andragogical concept, called heutagogy puts even a stronger focus on self-determined learning and *recognizes the need to be flexible in the learning where the teacher provides resources but the learner designs the actual course he or she might take by negotiating the learning.* [2] Still, it remains a challenge for educational experts to successfully involve individuals at workplace in collaborative learning and knowledge sharing activities. Senge [3] assumes that organizations learn only through individuals who learn, however individual learning is not a guarantee but rather a prerequisite of organizational learning and thus essential for any learning organization.

In an international research and development (R&D) project we are tackling this problem by harmonizing personal objectives with objectives at organizational and group level and by providing a learning landscape for the individual that supports this harmonization process. An additional challenge in the project is the fact that we are designing learning and knowledge building activities and its according technological support infrastructure in Intel-

ligent Learning Extended Organizations – IntelLEOs. An IntelLEO represents a community that emerges as a temporary integration of two or more different business and educational institutions with different organizational cultures (industrial, research and educational). Thus we are not looking at a closed system, but at rather transitory networked constellations for learning and knowledge building.

In the following we will outline the context of this R&D project and elaborate on the theoretical concepts that guide our educational strategy. We will then present the basic ideas that shape our approach for user involvement and describe some first steps that have been initiated in implementing a participatory design approach. Finally a short outlook as to how we plan to continue this process during the course of the project will be given and some very initial feedback from the user involvement will be outlined.

II. RESEARCH CONTEXT

The project IntelLEO (http://www.intelleo.eu) aims to support learning and knowledge building activities of adult learners that act under specific temporal conditions and in specific contexts. An IntelLEO is defined as a community that emerges as a temporal integration of two or more different business, educational communities and organizational cultures (industrial, research and educational) and leverages ICT technologies to support *Learning and Knowledge Building (LKB) Activities*.
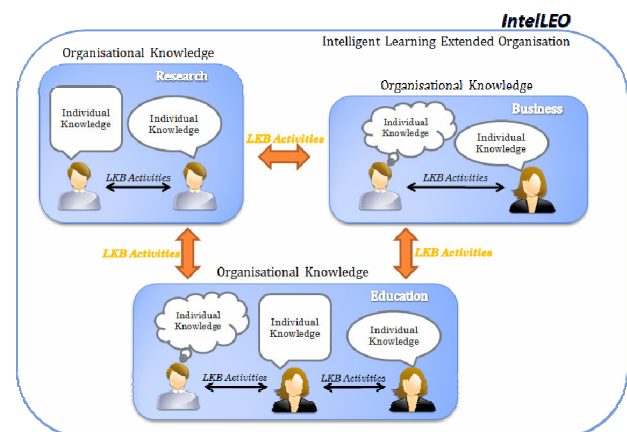

Figure 1. IntelLEO Concept

The objective of the research and development endeavors in IntelLEO is to explore supportive technologies for cross-organizational collaborative learning and knowledge building activities. The technological developments will be embedded in an andragogical framework that puts a special focus on the harmonization of individual and organizational objectives.

For successful collaborative learning and knowledge building activities the motivation of the individual is crucial [4]. Important motivational factors for collaborative activities and knowledge sharing are ownership, autonomy, positive feedback, trust, personal contact, etc. Ownership of proactive learning and knowledge building behavior is more willingly obtained if the employees are involved in grounding their personal perception of the organizational objectives and goals, of the organization as a whole and of their own rules when planning and developing their learning activities [5]. Thus, the project's research design builds on participatory design practice.

The andragogical experts in IntelLEO will define a framework of activities and processes that take these factors into account and will create an environment where the individual as well as the organizational needs are equally considered.

The envisioned services that the IntelLEO technological framework will support are currently: management of social interactions, management and provision of learning resources across organizational boundaries, provision of appropriate learning and knowledge building activities for individuals and groups, scaffolding of the learning process of individuals in accordance with organizational objectives and policies.

The new services will be explored and validated within three different IntelLEO environments each involving various actors from business and educational organizations. Since the three contexts for validation are very heterogeneous a main challenge for the IntelLEO researchers and developers will be to identify a set of common services that can be enhanced by specific customizations for each specific case.

Finally, the project will also take a look at the broader socio-economic context – beyond the context of the three specific cases – in order to identify the possible applicability and transferability of the proposed IntelLEO approach.

Within the context of this R&D project we will follow a participatory design approach in order to involve all relevant actors from the beginning in the design of the intended interventions. The R&D team will continue the dialogue with the intended users during all phases of the project, from the conceptual phase through the design and development phase until the final evaluation. Compared to other international research projects that claim to follow a participatory design approach [6] [7] [8] we depart from three distinct, but very specific cases, each with a clear problem definition. Thus a successful interplay between the participatory activities and the IntelLEO framework design is essential for the project.

III. CONCEPTS

In the following we would like to discuss some of the theoretical concepts that are relevant for our approach.

A. Motivation, ownership and self-management in learning

In the last few years Technology Enhanced Learning (TEL) research in Europe has been putting a strong focus on what we would like to subsume under the term "self-management in learning". A broad range of literature currently deals with aspects of self-regulation, self-organization, self-direction or self-guidance of learners. [9] [10] [11]. Depending on the context these terms are either used synonymously or have a slightly different connotation. An important characteristic of all these concepts is the shifting locus of control. The learner is taking control and responsibility for his/her learning activities. In his comprehensive meta-analysis of the Anglo-Saxon literature on this topic, P. Candy [12], for example, offers an overview of the various strands of research that can be found under the label of "self-direction" in human learning. It ranges from ideas of programmed instruction, emancipation and citizenship, to autodidactic efforts of adults outside any formal educational system. A relevant distinction that is usually made when it comes to research on this topic is whether one applies a process view, e.g. looking at the autonomous actions that learners take in planning, performing and evaluating their learning, or a product view, where the point of interest lies in the dispositions of learners to direct their own learning [13] [14]. For our work in IntelLEO we are interested in both aspects, but clearly the second aspect, namely the learner's disposition, is extremely relevant when it comes to motivational aspects. In order for adults to engage in a conscious learning process motivation is one of the main influential factors.

As educational researchers and designers we believe in the importance of ownership in technology–rich innovation processes and consider ownership as a driving factor for motivation and for supporting learner autonomy [5]. In this sense we are in line with andragogical and advanced heutagogical concepts [1] [2]. The perception of autonomy and the possibility to get appropriate feedback are supporting the notion of ownership. These two aspects should also be considered when it comes to defining the technological support.

Motivation is a key to successful knowledge work [4]. In complex knowledge intensive working contexts it is important to define adequate informal learning environments where the individual's autonomy is respected without interfering with organizational goals. Individuals may take various roles and perspectives in learning and knowledge building processes in different institutions and networks. When participating in collaborative activities that follow different institutional and group objectives the individual need to harmonize her personal objectives in order to stay on track and be intrinsically motivated. Someone's intrinsic motivation may be increased by strengthening the perception of autonomy e.g. via positive feedback about a specific contribution from this person. The feeling of competence may grow if a person feels responsible for the outcome of a specific activity. Individual training offers as well as the opportunity to get personal contacts across different organizational, cultural and hierarchical borders (face-to-face or virtually) may be additional motivators for knowledge workers to stay on the knowledge-creating track.

Latest information and communication technologies may have a supportive role in these processes. Digital environments enabling social responsiveness may increase the possibility to get appropriate feedback, also over distance. Individuals may be better supported to document, monitor and self-regulate their cross-institutional activities. It is the challenge of the IntelLEO project to design learning scenarios and responsive technologies based on the above described theories and assumptions.

B. Knowledge conversion

A lot of previous and recent work on workplace learning and knowledge generation builds on the work of Nonaka et al. [4] [15] [16] and the concept of knowledge conversion. The IntelLEO project also makes reference to this model, but with an additional challenge caused by the specific extensions beyond organizational boundaries [17]. Thus the knowledge conversion from tacit to explicit knowledge and its spiral progression will be integrated into an innovative IntelLEO context. Figure 2 depicts the knowledge conversion model taking into consideration the added complexity by crossing organizational boundaries such as dealing with different organizational cultures, norms and visions.
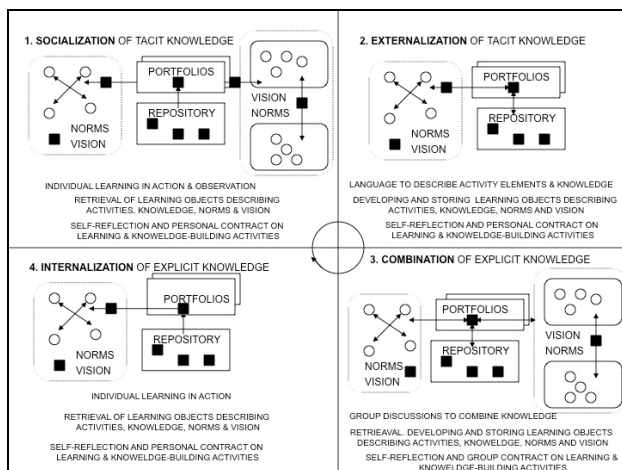

Figure 2.   Knowledge conversion model

The knowledge conversion model that we will apply in IntelLEO circles around four stages that may all be supported by specific services:

1. **Socialization of tacit knowledge:** Individuals are prompted to accumulate knowledge in an apprenticeship manner, through physical proximity with colleagues, and transfer the tacit knowledge they have acquired from others to their own mental frameworks. In this phase it is important that individuals have access to organizational resources, rules, values, objectives that help them to direct their efforts. In the case of IntelLEO, where the LKB activities expand beyond the borders of one organization, mutual accessibility to this type of learning resources and certain social grounding mechanisms for synchronization need to be supported. Technically, this means that services are needed to support requests for organizational rules and objectives, as well as for relevant content filtering.

2. **Externalization of tacit knowledge into explicit**: Individuals are prompted to create concepts through abductive thinking, to use metaphors for concept creation, and to use models, diagrams or prototypes to articulate tacit concepts. This is mostly an individual process that can be technologically mediated if the individuals are provided with a certain standardized language that supports the externalization processes. We envision such a language to be visual and it should offer important elements to describe both, people and their objectives, norms and value systems on the one hand and interrelations among people, activities, tools and objects of the knowledge building process on the other hand. Currently, advanced organizations have been experimenting with such attempts, e.g. via a portfolio approach. The standardization endeavor for externalizing tacit knowledge should however not be too rigid and it is important that the individuals maintain control and ownership over their versions of knowledge objects**.** The former can be supported by personalized services for learning content creation and storing. The latter may be achieved by using a portfolio type of software.

3. **Group-based combination activities of explicit knowledge:** in this stage cross-border group collaboration is taking place. Individuals with different perspectives gather and negotiate upon the externalized concepts. Supportive services for this stage may range from social information filtering and retrieval in order to find appropriate learning resources. Specific activity monitoring and feedback generation services as well as human resource (e.g. mentor and learning co-workers) discovery mechanisms for collaborative group may ease the collaborative activities as well.

4. **Internalization of explicit knowledge**: self-reflection and internalization of the personal experiences gained via the interaction with others takes place in stage 4. Self-reflection can be technologically supported e.g. via portfolio-services. Such a system may support the personal planning of learning objectives as well as their monitoring and scaffolding via conversational activities. Additional features that are relevant for the internalization phase include technological support for creating and monitoring a learning path, feedback generation, and human resource discovery.

We would like to stress that we are not considering this knowledge conversion model expanded by the IntelLEO characteristics of an extended organization to be a purely linear process. The described stages shall help to understand the shift from tacit to external knowledge, which is a constant process that is taking place continuously in its various stages.

In IntelLEO we plan to provide means for learners to become aware of how the LKB process develops, who are involved actors and resources, how interaction takes place, which values and rules are involved, etc. The technological support shall make the whole process more convenient and more transparent.

IV. APPROACH

Based on andragogical and heutagogical principles combined with the extended knowledge conversion model IntelLEO aims to develop responsive services for cross-organizational learning and knowledge building activities. In order to create the feeling of ownership from the very

beginning we will involve the individual actors of our learning scenarios in the learning landscape design process of the IntelLEO project. Participatory design practices will be applied in three different business cases where we recently initiated the first phase of user involvement.

Our hypothesis is that by an active engagement of the workers from the very beginning the feeling of ownership may be positively influenced. Motivational aspects can be addressed right from the start. A co-design of all involved actors, namely users, educational designers, researchers, developers, managers, etc. implies that all actors are learners and may benefit from this close cooperation.

For the envisioned co-design we will apply participatory research methods as well as some more standardized ways of describing system requirements. The whole approach is summarized in Figure 3, the IntelLEO Design Conversion.
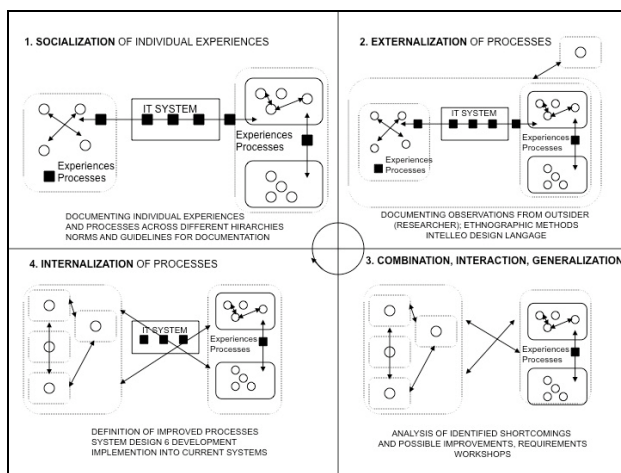

Figure 3.   IntelLEO Design Conversion

The participatory design approach is circulating around the following stages:

1. **Socialization of individual experiences**: in stage 1 the individual experience of the involved actors and their vision on the processes are documented. Individuals socialize with each other across organizational boundaries, they find stakeholders and identify issues that need harmonization as they might diverge on the organizational and individual level, etc. It is their very individualistic view that they try to socialize. This process should be applied on different hierarchical levels within the organizations and across the organizational boundaries in order to get a divers picture. At the same time, the researcher provides some external visions or norms to the design process that guides this socialization and later the externalization process. Thus this stage combines a very individualistic view of the involved actors with some guiding design norms that provide a more objective frame to socialize and externalize tacit knowledge.

2. **Externalization of processes**: In stage 2, independent researchers apply ethnographic methods in order to expand the subjective views gathered in stage 1. Following similar approaches [18] we apply some ethnographic methods without performing a full-scale ethnographic study that would be too time-intensive and costly. The aim of this stage is to gather a more neutral view on the processes and experiences

from an outsider. An immersion in the context is important for the researchers and developers in order to better understand the actors, the system, the processes, the context and its constraints. Apart from pure observations exploratory interviews will be performed as well. The externalization stage is important for defining a common design language amongst the different stakeholders, horizontally and vertically across organizations. The common externalization language constitutes the core of the IntelLEO design model as it is a co-product of the involved actors and will be related to UML (Unified Modeling Language) use cases, which provide a unified description for the developers.

3. **Combination, Interaction, Generalization**: Stage 3 combines both views – the individualistic from stage 1 and the collective from stage 2, analyses the identified interaction patterns and deduces requirements. Current shortcomings and potentials for improvements in terms of process optimization as well as technological support will be defined. The tacit knowledge should be transferred into the system design knowledge. Again, researchers and users should be involved in this process, e.g. via workshops. The usage of UML case descriptions across the different organizations will enable a generalization of the IntelLEO model requirements. During this stage discursive co-development and formative evaluation to validate these externalized constructs are part of the participatory design model.

4. **Internalization**: Finally, in stage 4 the interaction, design and development process shall take place. Similar to the previous stages, all actors shall be involved in this stage. Users shall be involved e.g. via workshops where mock-up demos can be presented and discussed. Since we create a temporary IntelLEO context during this design process that is presumably more supportive to collaborative learning and knowledge-building activities then the previous working context users across the organizations need to internalize this situation. Continuing the cyclic approach they should then be able to socialize their individual experience in the enhanced environment.

The important innovation in this approach, which can be interpreted as a spiral process, is the fact that the employees/users are involved in all stages and are thus designers of their learning activities, the involved processes and the technological support system. The researchers and developers play an important role in this interaction as they provide some norms and guidelines to the different stakeholders. They are mediators of a conversational translation from tacit knowledge to explicit context knowledge to some more formalized use case descriptions, requirements definition and system design. The cyclic movement between an individualistic view and a collective view during the design, development and evaluation phase shapes the IntelLEO framework as well as the design process itself.

V.   Conclusions

The IntelLEO project itself and the presented participatory design process started only recently. Thus, there are currently no decisive conclusions that we can draw from. In this paper we wanted to outline our innovative ap-

proach in involving users in all stages of the design process of an advanced technological environments for cross-organizational knowledge sharing and collaborative learning and raise the feeling ownership amongst the future users of the IntelLEO services. The empirical work only started very recently and will hopefully contribute to a more elaborate model of co-design.

What has already become clear during this first phase is that this approach requires a strong commitment from all involved actors and is a rather time-consuming process. In addition, the fact that IntelLEO is dealing with three very distinct business cases adds an additional challenge to the methodological approach. The different organizational and cultural contexts require certain adaptations of the specific methods. However, the presented approach will hopefully conduct to better results and an increased motivation on the learner's side.

ACKNOWLEDGMENT

We would like to express our thanks to all our project partners in the IntelLEO project.

REFERENCES

[1] Knowles, M. S., et al., "Andragogy in action: Applying modern principles of adult education". San Francisco: Jossey-Bass, 1984.

[2] Hase, S., & Kenyon, C. "From Andragogy to Heutagogy", Peer Reviewed. Original ultiBASE publication. 2000. http://ultibase.rmit.edu.au/Articles/dec00/ hase2.htm

[3] Senge, P.M. (1990) The leader's new work: building learning organizations. Sloan management review, 32(1), 7-23.

[4] Osterloch, M. "Human resources management and knowledge creation". In K. Ichijo & I. Nonaka (Eds.) Knowledge creation and management. New challenges for managers. (pp. 158-175). Oxford University Press. 2007.

[5] F.W. Rudmin & J.W. Berry. Semantics of Ownership: A Free-Recall Study on Property. The Psychological Record, 37, 257-268 (1987).

[6] Palette (pedagogically sustained adaptive learning tthrough the exploitation of tacit and explicit knowledge) project: http://palette.ercim.org/

[7] Mature project: http://mature-ip.eu/de/start

[8] ROLE (Responsive Open Learning Environments) project: http://www.role-project.eu/

[9] Fiedler, S., & Kieslinger, B. (2006). iCamp Pedagogical Approach and Theoretical Background. iCamp project deliverable 1.1. Accessed online 2.April.2009 at: http://www.icamp.eu/wp-content/uploads/2007/05/d11___icamp___pedagogical-approach.pdf

[10] Braun, V., Czech, D., Fletschinger, B., Kohler, S., & Lüber, V.: Motivation und Anreize in informellen Lernprozessen beim The-ma Wissensmanagement. Project thesis, Pforzheim University of Applied Sciences, 2009. Accessed online 2.April.2009 at: http://mature-ip.eu/files/2008OESeminar_Motivation-und-Anreize-in-informellen-Lernprozessen.pdf

[11] Mayer, H., Haas, W., Thallinger, G., Lindstaedt, S., & Tochtermann, K. (2005). APOSDLE - Advanced Process-oriented Self-directed Learning Environment. Poster Presented on the 2nd European Workshop on the Integration of Knowledge, Semamtic and Digital Media Technologies, 30 November - 01 December 2005, London.

[12] Candy, P. (1991). Self-direction for lifelong learning. San Francisco: Josey-Bass Inc.

[13] Brockett, R., & Hiemstra, R. (1991). Self-direction in adult learning: Perspectives on theory, research, and practice. London and New York: Routledge.

[14] Brookfield, S. (1986). Understanding and facilitating adult learning. A comprehensive analysi s of principles and effective practice. Milton Keynes: Open University Press.

[15] Nonaka, I., & Toyama, R. (2007). Why do firms differ. The theory of the knowledge-creating firm. In K. Ichijo & I. Nonaka (Eds.) Knowledge creation and management. New challenges for managers. (pp.13-31). Oxford University Press.

[16] Nonaka, I., & Takeuchi, H. (1995). The knowledge-creating company: How Japanese companies create the dynamics of innovation. Oxford: Oxford University Press.

[17] K. Pata, M. Laanpere, Supporting cross-institutional knowledge-building with Web 2.0 enhanced digital portfolios. In P. Diaz, Kinshuk, I. Aedo, E. Mora (Eds.) The 8th IEEE International Conference on Advanced Learning Technologies (ICALT 2008), July 1st – July 5th, 2008, Santander, Spain. (798 – 800). Washington, IEEE Computer Society Press.

[18] Maier, R.,& Thalmann, S. Informal learner styles: Individuation, interaction, in-form-ation. In: Andreas Schmidt and Graham Attwell and Simone Braun and Stefanie Lindstaedt and Ronald Maier and Eric Ras (eds.): 1st International Workshop on Learning in Enterprise 2.0 and Beyond, CEUR Workshop Proceedings vol. 383, 2008

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