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Modeling spaces for self-directed learning at university courses

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ABSTRACT

This paper conceptualizes the theoretical framework of modeling learning spaces for self-directed learning at university courses. It binds together two ideas: a) self-directed learners' common learning spaces may be characterized as abstract niches, b) niche characteristics are collectively determined through individually perceived affordances. The implications of these ideas on the learning design are discussed. The empirical part demonstrates the learning niche formation at the master course „Self-directed learning with social media" at two consequent years. The results of the affordance determination were used to characterize and develop the learning spaces that support self-directed learning with social media. The realization of the learning niche at two following years demonstrated that students used different social media tools for putting a similar types of affordances of the learning niche in action. This finding suggested that affordance-based niche descriptions would allow flexibility and learner-centeredness but simultaneously might enable to identify a common emergent learning space and make it reusable for modeling environments for self-directed learning courses.

Keywords

Learning design; Learning niches; Affordances, Self-directed learning

Introduction

New developments in the Web provide individuals with various opportunities of personalizing the tools and services, and performing self-directed learning in an open and social context with their personal learning environments (Klamma, et al., 2007). Social software enables people to actively reflect, publish and share learning experiences; gain awareness and monitor other learners, communities and networks; publicly store and maintain the evidences of their learning; and personally retrieve socially gathered information (O'Reilly, 2005; Constantinides & Fountain, 2008). Learners can autonomously combine various tools, material- and human resources into personal learning environments and enter with their personal environments to various learning activities and courses (Pata & Väljataga, 2007; Fiedler & Pata, 2009).

However, the traditional e-learning design models that determine in advance the standardized learning environment components, instructions, and the expected outcomes for all learners (see Passerini & Granger, 2000) fall behind in promoting self-directed learning with personal learning environments at institutional settings (Attwell, 2007; Underwood & Banyard, 2008; Pata & Väljataga, 2007; Fiedler & Pata, 2009). Recently some learning design models for promoting self-directed learning (van Merriënboer & Sluijsmans, 2008) and considering the utilization of learner-defined spaces (Kirschner, Kreijns, Beers & Strijbos, 2004) have been proposed. Yet, these models lack to consider learners as agents who constantly monitor, shape and adapt their personal learning environments in respect to the community space, leaving feedback of their activity preferences to the space. Learners' active contribution that impacts the learning environment and -activities of the courses needs more attention while modeling e-learning designs for self-direction.

In this paper the aspects of an ecological learning design model are proposed. This framework considers mutual interaction between the bottom-up formation of course environments by learners, and the emergence of certain commonly perceived learning spaces and niches that constrain learners' selection of their personal learning environments. This paper provides some empirical evidence how learner-defined learning space descriptions could be used for determining the learning environment and activity design. It is discussed how common learning spaces for self-directed learners may be characterized, shaped and utilized at the targeted university courses as part of an ecological learning design framework. The empirical findings from the master level educational technology course with social software tools are used for demonstrating some aspects of this framework.

Self-direction with personal learning environments

In near future fundamental transformations are predicted in enterprises. New post-industrial organizations will be disaggregated (Snyder, 2006) and not based on monolithic industrial knowledge-management systems. Rapid developments in economy and social sphere will extensively rely on design-orientated, information-rich small creative companies that work in a new flexible mode of producing cultural goods and services, and drive the innovation (Fasche, 2006). The rapidly changing business and social environments require the development of constantly learning and creative, independent, responsible and autonomous people. With the increased use of social tools in learning and work processes, social shaping of these tools will become more democratic and dependent of people (Burns & Light, 2007). All this has implications on the e-learning systems used at universities, and to the learning design principles. Nordgren (2006) has listed important themes that must be solved in educational institutions in order to provide the future learning environment: students owning their learning; standards and curricula that guide rather than dictate; constructivist teaching strategies that empower students; trust and adult supervision; democracy and empowerment; and Global Workforce Competence: making schooling relevant to the work-place. Universities should provide experiences with shared power (democracy) and responsibility, developing learners‘ self-directing competences of learning and working (Fischer, 1999) in dynamically changing and globally intertwined industrial environments, workplaces and private lives outside the classroom, where institutionally offered monolithic software systems are not available. In this paper the self-directing comptenece is interpreted through the definition of Knowles (1975) and Brockett and Hiemstra (1991). Self-directing is diagnosing and formulating needs, identifying resources, choosing and implementing suitable strategies and evaluating outcomes (Knowles, 1975) in the learning activities that always take place in a certain social context inseparable from the social setting and other people (Brockett & Hiemstra, 1991).

New courses must specifically develop learners’ self-directing competences (Fiedler, Kieslinger, Pata & Ehms, 2009): i) the ability of diagnosing their learning needs in the light of given performance standards, ii) formulating meaningful goals for own learning (Kieslinger & Pata, 2008), iii) developing and using a wide range of learning strategies appropriate to different learning tasks, carrying out a learning plan systematically and sequentially (eg. Knowles, 1975; Pressley 1995), and iv) diagnosing, monitoring performance and identifying resources and tools for accomplishing various kinds of learning objectives (Fiedler & Pata, 2009). On-demand learning with personally owned tools (eg. portfolios, personal learning environments) can offer students the opportunity to plan their own learning trajectory by providing them a certain amount of freedom to choose what they want to learn (i.e., selecting a topic) and how they want to learn this (i.e., selecting particular learning tasks) (Kicken, Brand-Gruwel, van Merrienboer & Slot, 2008; Attwell, 2007; Underwood & Banyard, 2008; Fiedler et al., 2009). People need to obtain the competences of thinking new ways of their personal and social learning- and work-environments – forseeing the effective functionalities of social spaces, and managing and developing them as systems that support their personal and collective learning and work objectives.

Learning spaces and -niches

The main idea in supporting self-direction allows learners entering to the courses with their personally favored learning environments, which will be partially integrated for collaborative tasks (Fiedler & Pata, 2009; Fiedler et al., 2009; Pata & Väljataga, 2007; Tammets, Väljataga & Pata, 2008). Since each learner may have different personal goals and experiences, these environments differ. Consequence of this bottom up construction is that learning environment of the course is ambiguous and hardly describable by means of tools, functionalities and services. Therefore, in this paper the *learning space* term has been conceptualized as an alternative for describing learning environments in the courses that promote self-directed learning in collaborative settings. This learning space is not the collection of tools and resources in the environment but integrates people who interact with the entities from external space.

Recently, several largely tool-centered approaches of supporting self-directed learning with computer-based personal learning environments (Attwell, 2007; Wilson, 2008; Johnson & Liber, 2008), portfolios (Kicken, Brand-Gruwel, van Merrienboer & Slot, 2008) or distributed social software (Fiedler & Pata, 2009) have been described. However, some authors have suggested that self-directed learners develop more abstract individual cognitive learning spaces (Underwood & Banyard, 2008), which contain various material and human resources that they activate in their goal-directed action. Magnani (2008), and Magnani and Bardone (2008) use the term cognitive niche to mark the

distributed space that people create by interrelating individual cognition and the environment through the continuous interplay through abductive processes in which they alter and modify the environment.

Previously, the niche term in e-learning was used to emphasize individual's accommodation with its environment which was created for them by instructors or developers. Draper (1998) has explained that all successful computer aided learning technologies rely on the learners' fit to their ecological niche. He assumed that instructors' skilled administration for the teaching and learning using the technology enables the niche-based success. Draper interpreted niches as personally defined, rather than community defined spaces, and failed to recognize the niche influence on people through feedback loop. He assumed that: "If you want to be better adapted it is no good studying anybody else's niche, nor any other niche than the one you are in right now. It is also a long shot studying other people's solutions, although (as convergent evolution shows) just occasionally old solutions may be good for you too."

The ecological framework, suitable for self-directed learning with social software-based personal learning environments, calls for revising these Draper's (1998) assumptions. Before elaborating the niche term for learners it is useful to explain in more detail, what the niche term means in natural science. Hutchinson (1957) defined a niche as a region (n-dimensional hypervolume) in a multi-dimensional space of environmental factors that affect the welfare of a species. Niche is an abstract space defined by the life activities of species. While each individual contributes to the formation of the niche and uses niche information in their activities, the niche as an abstract formation exists only through the activities of many individuals of this species.

Thus, the learning space term that is used in the ecological learning design model of this paper describes common abstract cognitive learning spaces of several learners at one course. The learning space term is not a description of the material system or a particular learning environment. Space is determined by users' activities and perceptions. The learning space term denotes an abstract composition of dynamically changing *learning niches*. Learners, who interact with the environment and respond to the expected interactions that they trust the environment would offer for them, constantly determine niches. Niches exist for certain populations and communities, who are involved in similar teaching and learning activities. Niches come into existence and may be identified when many individuals actualize personal or collaborative cognitive learning spaces for the same purpose with certain frequency at certain time period. This could be illustrated with the example of learners using social bookmarking or RSS aggregation services for maintaining their information flow. Through their personal learning environment they contribute and rely on certain culturally defined properties of the space - bookmarking and tagging information publicly, and constant updates in RSS flow. These activities are, therefore, characteristic to the information management niche of many learners. Within one abstract learning space for a certain group several learning niches may appear, which may be commonly actualized in different phases of the goal-directed learning activity. While conducting individual research, the new bookmarks may be tagged and filed or other persons' bookmarks and tags could be explored, and the community's contribution as one niche characteristic would be less crucial for the learner. However, while collaboratively collecting bookmarks for a project, and determining the meaning dimension of these bookmarked materials with tags for creating community's folksonomy as a common meaning-dimension, the contribution of the community is vital for successful usage of social bookmarking services. Therefore, the individuals and community members using a social bookmarking tool as one element in their personal learning environment, may perceive two different activity possibilities in their learning space. In one case using social bookmarking may support effectively individual information management, in another case it obtains a group information management possibility. Learners would perceive two different niches in their learning space, depending of their learning objectives.

The environmental factors that influence learners and define learning niches are not limited to external material resources (tools, artifacts, people), the type of their structural of organization (eg. networked, distributed, dynamically changing), or cultural context. The formation of learning niches is also dependent of internal learner-specific factors (goals, motivation, previous experiences, learning culture etc.). Specific learning niches (eg. for individual and collaborative activities) may exist within one learning space and the learners would switch from one niche to another in the course of action (Pata, in press).

One important aspect in the learning space formation is its ecological nature. Maturana and Varela (1992) coined the concept enaction that consolidates the divide through interdependence of the perceiver and the environment. They assumed that as we enact within a world, we are necessarily also embodied in it: knowledge involves creative cognition arising from the interconnections between our bodies, language, society, and the world. Thus, in the course of goal-directed action each learner perceives and actualizes only certain aspects of the environment. Presumably,

this actualization is two-directional. First, individual goals and previous experiences constrain the environmental aspects that are perceived beyond the others. Simultaneously, the environment as a complex system with other learners and resources actualizes certain goals and cultural behaviors for the learner. This individually directed perspective-taking process enables social selection of certain learning-related aspects of the environment beyond the others. The scope, how much certain aspects will be actualized by a larger group of learners, defines the learning space for them. Thus, niches and more large learning spaces, consisting several potential niches, are emergent and socially constructed as a result of ecological interrelations of individuals with their learning environment aspects.

Mathematically, niches are abstract multi-dimensional spaces. These spaces appear as environmental gradients, which indicate for the users these areas of the space, which are potentially more suitable for certain activities. In general, niche gradients have been described as peaks of the fitness landscape of one environmental characteristic (Wright, 1931) concentrated in space and time (Müller, 1998). Each gradient has certain ecological amplitude, where the ecological optimum marks the gradient peaks where the organisms are most abundant. Niche gradients can be visualized in two-dimensional space as graphs with certain skewness and width, determining the ecological amplitude. The shape of each fitness graph for certain learning-related characteristic could be plotted through considering the abundance of a group of learners actualizing and benefitting of this characteristic. In the learning niches each gradient is ecologically emergent of many learners' interaction with their environment. Each learner participates in the niche generation and gains from the niche individually by perceiving commonly preferred characteristics of the learning space for self-directed action.

The niches of the learning space may also facilitate and constrain each other. Hutchinson (1957) distinguished the 'fundamental' and the 'realized' niches – the former exist as the complex of all necessary environmental characteristics for certain species, the latter is formed under the pressure of all the currently available environmental characteristics in the competitive conditions with other species. Various actors and resources in learning situations have influence to each other, which would shape the niche. The 'fundamental learning and teaching niche' term applies for all possibly usable dimensions of software tools and services, artifacts and people that can aid for specific type of learning for certain learners, while the 'realized learning niches' will form under the constrained conditions of resource availability in the course of action of these learners. The paradox in using learning niche term in the learning design model is that for planning the fundamental niches the variety of realized niches for certain community must be identified in advance or in the course of action. Planning for the fundamental learning niches for a new course, the previous similar community niches from earlier courses may be used as the starting-points in the design. In this paper we use niche term to determine this part of the learning space that self-directed users perceived while working with social software.

Conceptualizing affordances as niche gradients

These niche gradients that make up learning and teaching spaces, may be considered as equivalents of learning affordances because they are defined mutually in interaction both by the learner and the surrounding system. Gibson (1979) originally defined affordances as opportunities for action for an observer, provided by an environment. He suggested that a niche is a set of affordances that constrains possible behavior with respect to what we are able to do in a certain niche.

The environment in affordance conceptualization does not merely involve material objects and tools in the environment. Referring to Albrechtsen, Andersen, Bodker, & Pejtersen (2001), in Gibson's view, it is the very mutuality between actor and environment that constitutes the basis for the actor's perception and action. Hence, the primary unit of analysis is not the actors nor the environment as distinct categories, but the total ecosystem of actors and environment. Chemero (2003), a follower of Gibson's ecological psychology, suggests that affordances are features of whole situations (meaning the actors are part of this situation). Michaels (2003) claims that perceiving affordances is more than perceiving relations, but it brings attention to the action-guiding information and sets up action systems to act. For example, Kreijns, Kirschner, and Jochems (2002) and Gaver (1996) describe affordances as the 'properties' of a collaborative learning environment that act as social-contextual facilitators relevant for the learner's social interaction. Barab and Roth (2006) have noted that connecting learners to ecological networks, where they can learn through engaged participation, activates the affordance networks. Affordance networks, in contrast to the perceptual affordances described by Gibson, are extended in both time and space and can include sets of perceptual and cognitive affordances that collectively come to form the network for particular goal sets. According to

Barab and Roth (2006) affordance networks are not entirely delimited by their material, social, or cultural structure, although one may have elements of all of these; instead, they are functionally bound in terms of the facts, concepts, tools, methods, practices, commitments, and even people that can be enlisted toward the satisfaction of a particular goal. In this way, affordance networks are dynamic socio-cultural configurations that take on particular shape as a result of material, social, political, economic, cultural, historical, and even personal factors but always in relation to particular functions. Barab and Roth (2006) assume that affordance networks are not read onto the world, but instead continually 'transact' (are coupled) with the world as part of a perception-action cycle in which each new action potentially expands or contracts one's affordance network. In the ecological learning framework, affordances are considered the relations between particular aspects of the situations and people planning or taking action – the perceived possibilities for both thinking and doing, what learners evoke and signify during their actual interaction with an artifact or tool and with each other. Learning affordance determination by users at individual level defines at community level niche gradients for learning-related activities.

Affordances emerge and potentially become observable in actions what people undertake to realize individual or shared objectives. Any individual conceptualizes learning affordances personally, but the range of similar learning affordance conceptualizations may be clustered into more general affordance groups. Magnani and Bardone (2008) stress that human and non-human animals can "modify" or "create" affordances by manipulating their cognitive niches. In the Soviet school of thinking, Ilyenkov (1977) has coined the idea of 'ideality' that is of relevance if to describe the ideas how affordances are evolving and culture-defined. He noted that objects acquire an ideal content for certain activities not as the result of being accessed by an individual mind, but by the historically developing activities of communities of practice. The ideal exists in the collective not in the individual mind as a set of given rules, practices, tools and artifacts. Thus, relying on Ilyenkov we can say that communities interacting similarly within certain environmental surroundings for certain learning goals would define various ideal or fundamental niches. The creation of these niches is of ecological nature and they are not part of the material learning environment per se.

Since in the learning design models the choice of the software tools plays an important role, niches may be defined by the frequency each learning affordance is perceived useful for the community when making use of the certain tool among all other available or chosen tools. For example, when using aggregators and microblogging tools most learners might actualize and perceive the presence of 'filtering the social awareness' affordance. However, few individuals may actualize 'filtering the social awareness' affordance while using weblogs, social network or social bookmarking tools. Thus, the fitness peak for 'filtering the social awareness' would be situated among the aggregators and microblogging tools, and sloping in case of using weblogs, social network or social bookmarking tools.

Aspects of an ecological learning design model

The idea to use affordances in the learning design is not new. For example Kirschner et al. (2004) suggested an affordance based and learner-centered interaction design model. According to their interaction-design sequence model, the affordances must be derived from learners' behavior, translated to the affordances by developers, tested in activity through learner's perception and action, and then evaluated on the basis of effectiveness on learning. This model involves the following steps:

1. Collecting learner experience: What do the learners actually do and what they want to do?
2. Supporting affordances: How can we support what learners do and what affordances they need?
3. Considering constraints and conventions: What are the physical, logical and cultural limitations encountered?
4. Constructing the learning design and testing it in action: How do the learners perceive the support?
5. Controlling learners' experiences: How do the learners actually use the support?
6. Learning: What have the learners actually achieved?

Kirschner's and his associates (2004) model is centered to the learning environment development. Their application of affordances instead of functions and services in the environment design makes the design model ecological. However, they do not particularly emphasize learners' self-monitoring and -evaluation activities, and the task of monitoring for affordances is left for instructional designers. Thus, this model is only partially supporting self-directed learning principles and is not suitable for guiding the learning situations into which learners enter with various self-managed personal learning environments.

Alternatively, van Merriënboer and Sluijsmans (2008) have outlined an instructional design model that focuses on self-direction in the learning environment design by balancing certain learning environment properties and tasks externally of learners. Their basic claim is that all environments for complex learning can be described in terms of four interrelated components: (1) learning tasks, (2) supportive information, (3) procedural information, and (4) part-task practice. They assume that known principles to reduce individual learner's cognitive load and increase germane load while performing complex learning tasks (eg. simple-to-complex ordering and fading-guidance strategies, high variability and self-explanation prompts) are also useful to enable their self-directed learning skills (i.e. assessing own task performance and selecting future tasks). This model controls self-directed learning through pre-determined part-task practice in which self-direction and gradual taking control of the task choice is prompted. The new Web culture, however, relies more heavily on learners' initiative in choosing their own learning tasks, and appropriate learning environments, and instructors must face the emergent bottom-up learner-triggered task situations, which are complex and ambiguous from the very beginning (Fiedler & Pata, 2009; Fiedler et al., 2009). Thus, this design model too needs some elaboration.

Pata and Väljataga (2007), and Fiedler and Pata (2009) have suggested that learners' role in noticing and negotiating the affordances of their individual and joint learning space in self-planned, -monitored and -evaluated activities must be part of the learning design model. Their approach leaves more room for learners' self-direction but points out many critical aspects in prompting and supporting these learners' activities externally while facilitator is planning and maintaining the course environment and tasks.

For promoting self-direction with self-chosen tools at university courses the elaborated affordance-based learning design model should take one step further from the previously introduced models. The ecological learning environment formation in which the affordances have the binding role between individuals and niches, and activities of self-directing one's tool-choice in interaction with the environment are parts of the same integrated system, which provides new basis for the learning design framework. This ecological learning design framework introduces two ideas: a) self-directed learners' common cultural learning spaces may be characterized as abstract niches, and the facilitators may use these niche descriptions in learning design instead of learning environment properties and functions, b) niche characteristics are collectively determined through individually perceived affordances during the application of personal and collaborative learning environments for self-directed activities.

The basic steps of an ecological learning design framework for supporting self-directed learning in new social Web are:

1. Define the learning and teaching niches for your students by collecting their affordance perceptions of their learning spaces dynamically in the course of action.
2. To support the conscious self-managed development of learner-determined spaces, provide students with the tools of visualizing and monitoring their activity-patterns and learning landscapes, and enhancing public self-reflection and collaborative grounding of learning affordances.
3. To maintain coherence of the current niche, introduce cycles of re-evaluation of learning affordances of the learning space within your course.
4. Try to influence the niche re-emergence by embedding activity traces and ecological knowledge relevant to evoke affordances for certain niches or select activity systems where these traces are naturally present.
5. Use same social learning environments repeatedly to gain from feedback left as activity traces and embodied knowledge of earlier learners.

An ecological learning design framework can be explained as an iterative continuous cycle. In one phase one learning community will dynamically define their learning niche (or the niche of similar previous community /course/ could be used). The conditions for the re-appearance of this learning niche with different sets of learner-selected tools in the activities of another similar learning community must be supported. For this, the activity- and meaning traces created during the real activities of initial community in that niche must be preserved, and made available for the next communities. Therefore the new learning support systems at the university courses must contain community-based activity accumulation and visualization possibilities.

An ecological learning design framework involves cycles of grounding the learning affordances during the activities. Cook and Brown (1999) assume that affordances should be conceptualized as a dynamic concept. In an ongoing interaction with tools, artifacts, and other actors, we are not only affected by the dynamic situational changes but also by our previous experiences. Thus, our personal dispositions strongly influence what affordances we actually

perceive in a given situation at a certain point in time. The learning affordances are never fixed and stabile but ecologically emergent and may be influenced by many criteria (see Barab & Roth, 2006). The new learning design framework resides on the idea that niche construction in social software environments happens through the dynamic determination of learning affordances by many individually or collaboratively acting learners and teacher. Learners must develop a compatible understanding of the affordances of a given setting to make effective performance possible. This is true both for facilitator and learners who want to collaborate. The similar application of tools, functioning rule-system and distribution of labor that support the realization of certain objectives in the learning space are realized upon the commonly perceived affordances. To support dynamic niche shaping, the visualization, self-reflection and monitoring of personally perceived affordances in activities at certain tool- and service-landscapes must be enabled for students and facilitator.

Social software based learning environments already integrate a feature of tag-clouds to get overview of the meanings of certain communities, using the bottom-up method. The possibility of bottom up collecting of information of activities, that the social software based learning spaces are most commonly used for, is still missing. Therefore, it is difficult to visualize how a community behaves in its niche. Affordances, which interrelate the goal-directed activities and various components of the learning environment, serve as suitable candidates for defining spaces socially in a bottom up manner. Using visual schemas and narrative descriptions of activity patterns and learning landscapes together with public self-reflection as tools for self-directed planning, is one, but labor-consuming possibility how to make affordances explicit for individuals and negotiate the affordances of common spaces. The application of this method in the courses enables learners and facilitators to define the dynamic changes in the niche for achieving better coherence as a community with certain learning aims. This type of learning involves design-oriented thinking and promotes the competence development that is expected from learners in future workspaces as Fasche (2006) has suggested. For grounding affordances of the niche, various self-reflection tools (blog, aggregator, shared whiteboard etc.) can be suggested, which help the community to monitor the niche formation. However, it is expected, that in future, the missing possibility of bottom-up collecting and viewing user-defined affordance information in social Web would be technologically solved.

Table 1. Basic differences between the traditional and ecological learning designs

Traditional learning design	**Ecological learning design**
Learning environment consists of tools, people and resources.	Learning space is an abstract niche emerging in the course of evoking affordances, while learners interact.
Software tools and services make up learning environments independent of learners and facilitators being present.	Learning spaces and their user communities have interdependence and cannot exist without each other outside the activity setting.
The functionalities of software tools and services for learning and teaching are an objective part of the systems and appear similar to all learners and the facilitator.	In action each learner and facilitator evokes subjectively different learning affordances, depending of the environment, and the learning culture.
Certain learning and teaching paradigms can be embedded and fixed as conceptual designs within the learning systems.	Learners and facilitator participate ecologically in the niche construction, changing the learning spaces and causing the evolution of learning and teaching paradigms.
Relevant learning environment properties can be identified before conducting the learning activity and the learning environment can be prepared for students.	Learning space affordances emerge among learners and facilitator during the activity in the course of interaction.
Instructions in narrative and visual form can be embedded to the environment to transfer useful learning environment properties and activity tasks to students.	Instructions should be left as activity traces and ecological knowledge that learners and facilitator can actualize as part of their action plans.

Certain instructions can be used to lessen the difference of learners‘ and facilitators‘ perception and expected affordances in the learning space. Instructional texts may contain anticipated affordances for different kinds of action-potentialities, but the emphasis of an instruction must be on triggering learner’s action plan so that they might start using the elements in the learning space similarly as the instructor and a larger learning community believes is efficient. This could be realized by leaving relevant activity traces to the learning space or choosing the learning space in which such activity traces were provided by the larger community of learners. New social Web environments provide such an opportunity without too much effort of preparing activity traces by the instructor.

Vicente's (2002) Ecological Interface Design offers an example of using this principle in learning design. His approach suggests that an important design rationale in is the notion that actors would directly perceive the state of affairs in the environment. In order to aid this, the interface of a system must be transparent in the sense that the deep structure of the work was accessible to direct perception as an affordance space in a Gibson's sense.

The theoretical framework of using learning niches as part of the design assumes that they are defined ecologically and may start guiding learning processes when learners and facilitator would dynamically actualize learning and teaching affordances in action, make them explicitly observable, monitor and negotiate about them. The same set of learning affordances as a functional niche can be put into action with different sets of social software tools chosen by the learners and facilitator in the course of action. For example learners can use the affordance-based decision-tools to select tools in their personal learning environments (Väljataga, Pata, Laanpere, & Kaipainen, 2007). The main aspects, how ecological learning design differs from traditional learning designs (see Passerini & Granger, 2000), are presented in Table 1.

The ecological learning design framework application at the self-directed learning course

In the following chapters the niche formation and the application of an ecological learning design framework principles are illustrated based on the master level course for self-directed learning. The iterated design-based research was conducted, considering the ecological learning design elements. The tasks for students involved composing descriptions of individual and collaborative social Web landscapes and activities for self-directed learning while using these landscapes. Public self-reflection of affordances of these learning environments was prompted. The facilitators used affordance data collected from students for planning the learning activities for the following course.

1. The study sought answers to the following research questions:
1. What characterizes the learning niche for self-directed learners who use social software?
2. How the course niches differ at consequent years, and are niches replicable with different toolsets?
3. How could the learning niche descriptions be applied in developing the course design?

Firstly, it was expected that the niche description from the self-directed learning course would reveal affordances for self-direction in individual and collaborative settings while using social software. Knowing these affordances of the learning niche would help to keep some structure in the learning design of the course. Secondly, it was predicted that it would be possible to define the fundamental learning and teaching niche for self-directed learning purposes, and re-create the similar learning niche at the consequent years of the course, while giving the students certain freedom of planning their activities and personal and collaborative learning environments from social software tools. This would demonstrate that niche characteristics might be described and reused effectively, meaning that in the learning design model, the learning space can be conceptualized as a niche with n-dimension of affordances, rather than the fixed set of tools similar for all learners. It was assumed that to replicate the niche, students would be granted the freedom to use different toolsets and resources for constructing their personal and group learning environments. Third assumption was that using the bottom-up method to define the learning niche could be used to diagnose if the learners had actualized the learning and teaching potential of social software tools similarly like the facilitators presupposed, relying on their own experience with social software. This diagnosis could enable them to change the course tasks towards better supporting self-directed learning.

Methods

Sample

The participants of the study were master students of Tallinn University, mainly from Institute of Informatics who participated in the course „Self-directed learning with social media". The two groups of students were involved in two consequent studies. In the first study, held in spring 2007, 25 second-year master students participated at the course. In the fall 2007, 28 first year master students participated at the course. They were organized into groups at some learning assignments. The master students of the Tallinn University, Institute of Informatics originated from heterogeneous backgrounds – there were practicing teachers of different subjects or informatics, educational technologists of different governmental and military institutions and private enterprisers. Thus, they all had needs for

different competences, and their contact with social media had been quite minimal so far. Due to the authentic settings of the study, convenient sampling was used. Therefore, the conclusions from this research must be regarded in the particular contextual setting. Two facilitators of the course were involved in research.

Course settings

At the first year (Case I) the course was run aiming to develop primarily the learners' competencies of using social software environments for planning learning landscapes and activity patterns, both for personal and collaborative use (see Väljataga, Pata, Tammets, in press). After the course learners' perception of their learning niche was studied to make corrections in the teaching emphasis of the course. At the second year (Case II) the focus of the course was concretized, emphasizing more the development of self-directed learning competences through individual and collaborative activities with social software (see Tammets, Väljataga & Pata, 2008). This meant mainly that the self-reflection on personal learning contracts in weblog was integrated as one of the learning tasks in addition to the previous tasks that were used at the first year of the course.

The course consisted of three face-to-face contact days, meantime learners were asked to do independent work, either individually or in groups. At contact days, facilitators gave theoretical lectures and modeled practical competences of using different social media tools and services for educational purposes. The evaluation data from Case I was used to elaborate some aspects of learning with social media tools for teaching in Case II. Learners were expected to get practical experiences with different social media tools in order to plan their individual and collaborative learning environments and activities with those tools.

The same course environment was reused at both cases without removing the contents of the previous course. The general planning of the course' learning environment was the following. The distributed web-based learning environment of the course was conducted dynamically under learners' eyes with their active participation. Every student individually developed his or her personal distributed learning environment and described and tested it in action. In order to perform collaborative learning tasks, learners had to combine their learning environments, to conduct collaborative activities. Creating such joint learning environment together with learners, improved the learners' competencies of conceptualizing the affordances of the learning space similarly as the facilitator and other learners, and enabled the facilitator to make corrections in the learning environment in accordance with the learners' perception of affordances. Students could see, that their role was equal to the facilitator, and monitor, how each member was contributing to the development of the distributed learning environment of the course.

The central feedback and learning material service of the course was a blog at *Wordpress.com* provider, which was maintained by two facilitators (http://kaugkoolitus.wordpress.com). The primary function of the blog was organizing learning materials and assignments, it also served as the feedback channel between learners and facilitators. Students' and facilitators' comments at the blog were visible for the students in Cases I and II.

The second part of web-based distributed learning course environment was the social bookmarking service *Delicious.com* (http://delicious.com/mii7008), where facilitators collected bookmarks of the materials related to the course. The *Slideshare.net* tool and *Splashcast* were used to present slideshows, which were also embedded to learning materials at the course blog. The third central tool of the course was a shared aggregator in *Pageflakes.com* provider (http://www.pageflakes.com/kpata/12983138). This aggregator enabled to integrate different distributed course tools, using feed and mashup technologies. The course aggregator collected into the shared place the feeds from course weblog and learners' weblogs, enabling the monitoring between learners themselves and between facilitators and learners (Väljataga, Pata & Tammets, in press). The tagcloud feed from the course bookmarks, and the mashed feed from social bookmarks accounts were pulled to the aggregator. Students in Case 2 could also view the aggregated page of the course in Case 1.

The students' distributed learning environments consisted of blog, social bookmarking service and slideshare accounts, web-based office software, wiki, instant messaging services, and aggregators. Individual blog was a compulsory tool for each student. Secondly, using *Delicious.com* for bookmarking information with shared tag was required. The rest of the tools were not optional. Some students used very actively wiki, some web-based office service, and social repositories of *Flickr.com* and *Youtube.com*. This kind of usage of tools and services supported the personalized mediation of self-directed learning and constructing the personal learning environments that were

useful for their owners. Every learner could make the choice of the most suitable tools for her/him. Learners had a chance to decide what is useful for them, and they could use only those tools, and not merely the services, that teacher had proposed as the most suitable. The shared learning environments of the groups were developed as part of one of the course assignment. In general individual blogs, collaborative writing/drawing environments like wiki, *google.docs, Vyew.com* or *Bubble.us*, and instant messaging services like *Gabbly.com*, *MSN.com* and *Skype.com* were used for constructing group environments, but the final settings of groups differed from each other. The learners formed groups, then selected tools what they needed in order to complete assignments, they planned the group work, selected the tools suitable to everyone in the group, decided how to organize the communication between the group members, and how to divide the responsibility. In other words, the assignment developed their competencies, which would be required in their professional and academic life. Most of the learners could not meet face-to-face between the contact days, which facilitated online interaction with assignments.

For the tasks, learners were expected to draw visual schemas of individual and collaborative learning environments and activity diagrams, describe these schemas in self-reflections, explaining the main learning affordances related to the schemas, and write in blog an essay about their personal development in the end of the course. Learners had freedom to choose relevant objectives and setting for their activities and learning environment. For example, some learners visualized learning environments for their work settings (eg. the model of information management in radio-station, the model of communication for multi-national kindergarten groups and parents, self-directed learning environment for a master student to communicate with supervisor etc.). Drawing the schemas of activities, and distributed individual and collaborative learning environments, and reflecting about them in blog were considered important activities for giving learners the tools to plan and monitor the realization of their tasks.

Data collection and analysis

Schemas of personal and shared distributed learning environments and activity diagrams were collected from learners‘ blogs. Each figure was accompanied by narrative descriptions mentioning several learning affordances in relation with the tools the student(s) used for activities and for constructing distributed learning landscapes. Essays and schemas from learners‘ blogs were used as research instruments in the design-based research process. In that kind of authentic settings it was important to use such data gathering instruments that enabled to collect the learners‘ perceptions of learning affordances without intervention. Thus, the same data-collection instruments could serve simultaneously as a natural part of learners‘ assignments, supporting their competence development.

The analysis of 53 individual and 10 collaborative activity- and learning landscape descriptions was conducted. For the study two researchers analyzed from schemata and narratives, investigating, what kind of tools were part of the learners‘ distributed learning environments and what kind of tools they used for planning activities. It was categorized, which learning affordances the students perceived in relation to every tool in their learning environment in two Cases. The relationship of the learning affordance with the tool(s) was categorized using binary system. The categorization scheme separated each affordance according to its belonging to Case 1 or 2. Each affordance was listed only once in relation to mentioning it with the certain tool. The main tool categories were: blog, wiki, chat tools (MSN, Skype, Gabbly), email, search engines, RSS aggregator, social bookmarking tools, forums, co-writing tools (eg. zoho or google documents), co-drawing tools (eg. Vyew, Gliffy), and social repositories of Flickr and Youtube. These were selected because these tools were mostly in use during the course and they also appeared at students’ schemas frequently. These data reflected specifically the learning affordance perception of students in this course (beginner users of social software), and cannot be broadened to the perception of learning affordances of the active social Web users in various settings.

The learning affordances were consequently categorized into specific types of similar affordances: assembling, managing, creating, reading, presenting, changing and adding, collaborating and communicating, sharing, exchanging, searching, filtering and mashing, collecting, storing, tagging, reflecting and argumentations, monitoring, giving tasks and supporting, asking and giving-getting feedback, and evaluating (see Appendix 1). These types were deduced from the main verbs the students tended to use in their learning affordance descriptions. The differences between the two researchers’ categorization were resolved after comparison and discussions.

SPSS 16.0 was used for statistical analysis. To show the preferred interrelations between software and affordance types, the Principal Component Factor analysis was performed with the frequency table of software and affordance

types. To compare the two cases on the basis of software and affordance-types, the ANOVA analyses with affordance distribution between the affordance-types and software-types were calculated. The Chi square analysis was performed with same data. To visualize learning niches the Cross-tabulation of affordance types and tool-types was used. The frequency of learning affordance types was found for each software type. Each learning affordance type eg. 'searching' was considered as a variable defining the niche. Niches were conceptualized as the collections of environmental gradients with certain ecological amplitude, where the ecological optimum marks the gradient peaks where the organisms are most abundant. Over all activity/landscape descriptions the optimum for certain learning affordance type was calculated, dividing the frequency of this affordance type per certain software type to the total frequency of certain learning affordance type for all the software types. The results were plotted as the niche maps with wireframe contour figures of MS Excel.

Results

Self-directed learners' learning niche affordances with social software

For characterizing the functional learning niche components for self-directed learners who use social software, two approaches were taken: qualitative text analysis of affordances, and quantitative factor analysis of affordance types and software. Initially all the learner-defined affordances from Cases 1 and 2 were categorized under certain affordance types that could be distinguished from each other. The affordance types were named by the most common activity verbs represented in this category. The affordance types with examples provided evidence, that learners perceived various indicators of self-directed learning when working with social software. The affordance types with distinguishable examples are presented at Appendix 1.

Secondly, Principal Component Factor Analysis (Table 2) was used to demonstrate that learners relate certain affordances types with certain software. 13 factors were identified, which explained 60 % of the system. Certain software types (eg. blog, co-writing and -drawing tools) were represented in several components of the factor analysis, indicating that students perceived various affordance dimensions when working with them. Others (search engines, social repositories, social bookmarking systems) were represented only in one component, presuming that learners perceived narrower action potentialities with them. Since these results were collected from the course of beginner users of social software, different factor structure may emerge with the more experienced users of social Web environments. Following factors were found:

I. Searching with search engine (Google)
II. Collecting and sharing in social repositories (Flickr, Youtube)
III. Exchanging with email and chat (Skype, Gabble, MSN)
IV. Storing and tagging with social bookmarking tools (Delicious)
V. Filtering, mashing and monitoring (but not reflecting) with aggregator (Pageflakes, Netvibes)
VI. Collaborating and communicating with collaborative publishing tools (Pbwiki, Zoho and Google documents, Vyew and forums)
VII. Presenting, giving tasks and supporting (but not monitoring) with co-drawing tools (Vyew, Gliffy)
VIII. Giving tasks, supporting, asking, giving and getting feedback (but not sharing, reflecting and arguing) with blog (Wordpress)
IX. Changing and adding and storing (but not collaborating and communicating, and sharing) with co-drawing tools (View, Gliffy)
X. Creating and reflecting (but not assembling) with co-drawing tools (View, Gliffy)
XI. Monitoring (but not collecting, managing, collaborating and communicating) with blogs (Wordpress)
XII. Evaluating (but not assembling and monitoring) with blogs (Wordpress)
XIII. Reading and reflecting (but not monitoring) with forums and blogs (Wordpress)

The comparison of two courses: software types and affordance types

To clarify if the two courses differed by the use of software and by the use of affordances, two ANOVA analyses were performed. The comparison of used software types at Cases 1 and 2 (Table 3) demonstrated, that if the course design allows flexibility and freedom of using personal tools, different groups of self-directed learners would bring

to the course significantly different learning environment components for performing same tasks. This complicates planning the learning environment in advance as part of the learning design.

Table 2. Rotated Component Matrix Components for affordance types with social software (Note. the factor names are presented in the text above)

	Rotated Component Matrix Components												
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Variance %	5.79	5.55	5.50	5.46	5.37	5.05	4.26	4.14	4.04	4.0	3.74	3.63	3.59
Eigenvalue	2.34	1.85	1.75	1.60	1.57	1.48	1.32	1.21	1.18	1.13	1.09	1.06	1.03
Search	.865												
Google	.856												
Flickr		.839											
Youtube		.809											
Email			.774										
Chat			.753										
Exchange			.510										
Bookmarks				.746									
Tagg				.740									
Store				.520					-.327				
Aggregator					.813								
Filter/mash					.732								
Co-writing						.710							
Wiki						.703							
Co-drawing						.381	-.356		-.279	.234			
Present							-.730						
Feedback								.713					
Tasks/support							-.464	.549					
Blog								.347			.176	-.224	.334
Change/add									-.720				
Collaborate						.428			.436		-.238		
Share		.243						-.316	.374				
Create										.737			
Assemble										-.541		.336	
Reflect					-.353			-.241		.432			.230
Manage											-.614		
Collect		.210									-.520		
Monitor					.310		.311				.448	.226	-.224
Evaluate												-.837	
Read													.714
Forum						.307							.443

Note. Software types are presented in Italic

Table 3 presents which software types were perceived useful when affordances were described at two cases – Spring 2007 (Case I) and Fall 2007 (Case II). It was found that the main difference in Case II compared with Case I was students' higher preference on focusing at the these software types that enable constructing jointly distributed learning spaces for collaborative activities.

Table 3. ANOVA of the distribution of learning affordances between software types in Case I (N=381) and Case II (N=285) descriptions

Software types	Case	N	Mean	StdDev	df	Mean square	F	Sig
blog	I	121	0.32	0.46	1	13.658	60.236	0.001**
	II	173	0.61	0.48		0.227		
wiki	I	19	0.05	0.22	1	0.155	2.626	0.10
	II	23	0.08	0.27		0.059		
chat	I	23	0.06	0.24	1	1.336	15.258	0.001**
	II	43	0.15	0.35		0.088		
social bookmarks	I	42	0.11	0.31	1	0.935	7.711	0.006*
	II	53	0.19	0.39		0.121		
aggregator	I	87	0.23	0.42	1	1.069	6.896	0.009*
	II	42	0.15	0.35		0.155		
email	I	21	0.06	0.23	1	0.107	1.729	0.18
	II	23	0.08	0.27		0.062		
search engine	I	30	0.08	0.27	1	0.042	0.532	0.46
	II	27	0.09	0.29		0.078		
co-writing	I	15	0.04	0.27	1	1.440	20.190	0.001**
	II	38	0.09	0.29		0.071		
forum	I	6	0.02	0.13	1	0.113	4.322	0.038*
	II	12	0.04	0.20		0.026		
co-drawing	I	3	0.01	0.09	1	0.865	23.805	0.001**
	II	23	0.08	0.27		0.036		
flickr	I	14	0.04	0.19	1	0.001	0.015	0.90
	II	11	0.04	0.19		0.036		
youtube	I	12	0.03	0.18	1	0.805	14.186	0.001**
	II	29	0.1	0.30		0.057		

**p<0.001 *p<0.05 I – Case I (Spring 2007) II – Case II (Fall 2007)

The in depth Chi square analysis indicated that in Case I the aggregator-related affordances were mentioned significantly more frequently that expected (χ^2=6.846, df=1, p<0.01). However, in Case II the affordances related with blog (χ^2=5.539, df=1, p<0.001), chat (χ^2=1.496, df=1, p<0.001), forum (χ^2=4.307, df=1, p=0.038), social bookmarks (χ^2=7.645, df=1, p=0.006), co-writing (χ^2=1.965; df=1, p<0.001) and co-drawing tools (χ^2=2.306, df=1, p<0.001) and Youtube social repository (χ^2=1.393, df=1, p>0.001) were mentioned significantly more often than expected. This indicated, that in Case II, students perceived more learning affordances that were related with social software for collaboration. Difference in the higher perception of certain affordances related with collaborative tools in Case II compared with Case I might have been caused by various reasons. In their final postings about their progress at the course students expressed that they had previously had very little possibilities of working collaboratively in technologically aided environment, collaborative task was interesting and challenging for them, and they were satisfied with the new experience. Since at for them this learning course was also the first course where they initially met with other students, they presumably also tried to establish some community relationships using these collaboration tools.

The distribution of affordances between affordance types at two cases was compared as well. The comparison of different types of affordances used in Cases I and II is presented in Table 4. It appeared, that the significant differencies in the perception of main learning affordance types in two cases occurred only with few affordance types. In comparison with the significant differencies (p<0.001) that were found in the distribution of affordances between tools in two Cases (see Table 3), all detected differencies appeared between affordance types appeared at lower significance level (p<0.05).

The Chi square analysis indicated that differencies between cases occurred in the affordance types of 'managing the learning environment' (χ^2=6.506, df=1, p<0.01), 'assembling the learning environment' (χ^2=5.44, df=1, p=0.020) and 'reflecting' (χ^2=4.718, df=1, p=0.030), which occurred significantly higher than expected in Case I. This might be explainable with the fact that the course was run first time, and also the facilitators learned during the course how

to manage such social software based course. Apparently, this novel self-managing aspect caught students' increased attention. The 'presenting' affordance type was found more frequent than expected (χ^2=4.912, df=1, p=0.027) in Case II.

Table 4. ANOVA of the distribution of learning affordances between affordance types in Case I (N=381) and Case II (N=285)

Affordance types	Case	N	Mean	StdDev	df	Mean square	F	Sig
assembling	I	66	0.17	0.37	1	0.677	5.472	0.02*
	II	31	0.11	0.31		0.124		
managing	I	17	0.04	0.20	1	0.190	6.550	0.01*
	II	3	0.01	0.10		0.029		
creating	I	36	0.09	0.29	1	0.100	1.065	0.30
	II	34	0.12	0.32		0.094		
reading	I	14	0.04	0.18	1	0.004	0.130	0.71
	II	9	0.03	0.17		0.033		
presenting	I	35	0.09	0.28	1	0.502	4.934	0.03*
	II	42	0.15	0.35		0.102		
changing and adding	I	17	0.04	0.20	1	0.212	3.770	0.053
	II	23	0.08	0.27		0.056		
collaborating and	I	68	0.18	0.38	1	0.283	2.096	0.15
communicating	II	39	0.14	0.34		0.135		
sharing	I	24	0.06	0.24	1	0.071	1.390	0.23
	II	12	0.04	0.20		0.051		
exchanging	I	6	0.02	0.12	1	0.013	0.660	0.41
	II	7	0.02	0.15		0.019		
searching	I	31	0.08	0.27	1	0.001	0.017	0.89
	II	24	0.08	0.27		0.076		
filtering and mashing	I	48	0.13	0.33	1	0.285	2.955	0.08
	II	24	0.08	0.27		0.096		
collecting	I	14	0.04	0.18	1	0.001	0.013	0.91
	II	10	0.04	0.18		0.035		
storing	I	15	0.04	0.19	1	0.155	3.113	0.08
	II	20	0.07	0.25		0.050		
tagging	I	16	0.04	0.20	1	0.032	0.909	0.34
	II	8	0.03	0.16		0.035		
argumentation and	I	41	0.11	0.31	1	0.375	4.737	0.03*
reflecting	II	17	0.06	0.23		0.079		
monitoring	I	19	0.05	0.21	1	0.003	0.064	0.80
	II	13	0.05	0.20		0.046		
give tasks supporting	I	36	0.09	0.29	1	0.033	0.367	0.54
	II	31	0.11	0.31		0.091		
asking giving and	I	29	0.08	0.26	1	0.139	1.715	0.19
getting feedback	II	30	0.11	0.30		0.081		
evaluating	I	15	0.04	0.19	1	0.029	0.665	0.41
	II	15	0.05	0.22		0.043		

**p<0.001 *p<0.05 I – Case I (Spring 2007) II – Case II (Fall 2007)

In general it can be assumed that learners' perception of the most learning affordance types differed very little in Cases I and II. Mainly similar distribution of specific affordance types in Cases I and II indicated that the same kind and amount of affordances were perceived necessary in both cases for self-directed learning (Table 4). However, the same niche was actualized significantly differently with tools at Cases I and II (Table 3). This finding is in accordance with the theoretical proposition that learning spaces may emerge like repeated sets of affordances, which describe the learning niche for certain learning and teaching community. This means that in the learning design model the learning space needs to be conceptualized as a niche, composed of certain learning affordances, rather than

the fixed set of tools, similar for all learners. If following this principle, learners will be provided with the freedom of choosing personal tools for realizing the learning niche.

Using learning niche descriptions for cyclical development of course design

The niche descriptions can potentially serve as useful means for cyclical development of the courses. In biology, niches have been visualized by different means, for example the amplitude of using certain kind of niche gradients might be visualized. Learning niches can be defined by the frequency each learning affordance is perceived useful for the community when making use of the certain software among all other available or chosen tools. Thus, user-collected frequency data about each affordance type can be used to calculate to which extent each available tool in this community would be perceived useful for activating this affordance. The optimums for certain learning affordance types were calculated dividing the frequency of this affordance per certain software type to the total frequency of certain learning affordance type for all the software types. The results were plotted as the niche maps with wireframe contour figures of MS Excel (see Figure 1).

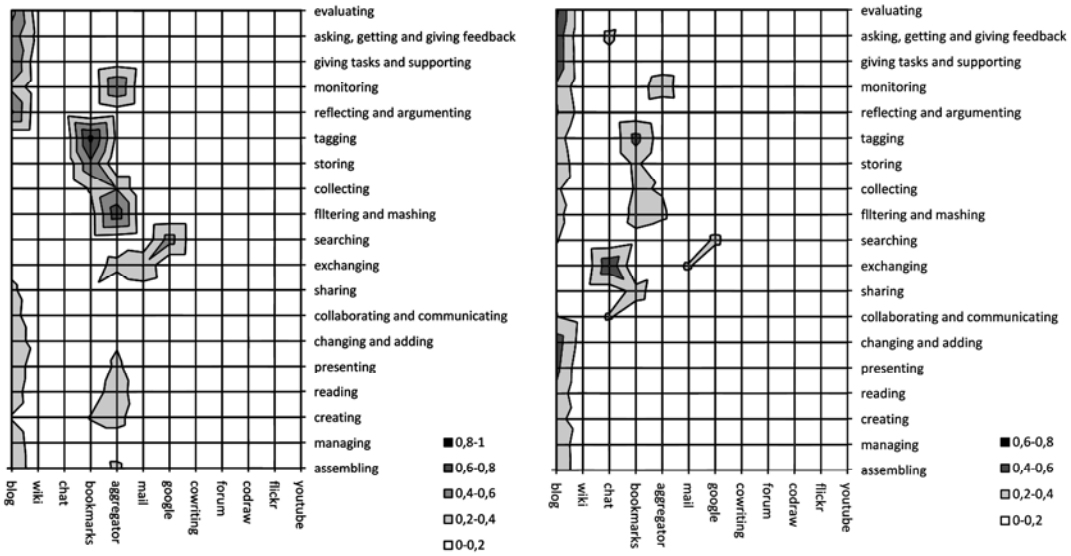

Figure 1. Realized niche landscapes of Case I (left), and Case II (right) presented with the contour lines representing gradient directions from 0-1

Figure 1 demonstrates the realized course niches with the use of certain type of tools in Cases I and II. The niche is plotted as the landscape where contour lines represent the niche gradients in respect to certain tools. The comparison of figures indicated that in Case II certain progress occurred and learners managed to perceive more affordances that are particular to social Web. This might have been caused by the increasing experience of course facilitators in presenting the software possibilities.

Certain differences between two cases served as a valuable feedback for the course developers to grasp the realized niches of the students. It appeared that in Case II students perceived blogs not only as their reflection places that are monitored, scaffolded and evaluated by facilitator and other students, but also noticed the sharing, tagging, filtering and mashing affordances. Thus, it may be assumed that in Case II facilitators were better able to draw students' attention to the new features, common specifically to social software, that blogs offer.

While the affordances of exchanging and sharing were perceived in relation to email in Case I, indicating to the habit of using email as the main tool in the course communication, in Case II chat and social bookmarking tools took over this role. This change in Case II towards using social software that enables new type of activities with information was seen as positive, indicating that students really started to carry out activities with social software tools.

In students' perception an aggregator had a more important role in Case I than in Case II. Students perceived that aggregator supported monitoring, presenting, reading, creating and assembling affordances in Case I, while in Case II only monitoring affordance prevailed. The decreasing significance of aggregator-related affordances was surprising, and pointed to the need to draw students' attention towards self-managing and assembling aspects of social bookmarking and aggregation tools in the next runs of the course.

Discussion

This article pointed to the need for the new learning design frameworks for self-directed learning with social software that were ecological. This learning design emphasizes the following aspects, which were developed and tested empirically.

Theoretically, in the self-directed learning process students should be promoted to use their own personal learning environments. Thus, the learning environment as a system of tools and resources cannot be ready when learning starts but has to evolve as part of learners' self-directed individual and collaborative action process in which facilitator has a guiding role. The applicability of emergent course design was tested at two cases. The dense methodological description introduces specific details of this approach, however, it presents only one possible way how social software could be used in the learner-centered manner. Therefore, in this paper it was attempted to give a general framework how to plan and control various emergent course designs.

To run emergent bottom-up courses, facilitators would need to establish some constraints and guidelines for planning the learning process. Rather than composing a list of optional course tools, resources and activities, an abstract learning space might be determined for the course design and made explicit to the learners. This article proposes that learners' perception of action potentialities of their personal and collaborative learning environments – learning affordances - could be dynamically collected in a bottom up manner during learners' public planning of their goals, visualization, and self-reflection of their learning activities and learning environments. Knowing these learning affordances and making the abstract learning space explicit for the learners and for the facilitator would permit: i) the individualized learner-specific integration of their goal-directed activities with other perceived components, resources and community activities in the environment; and ii) the reuse of the commonly perceived affordances for environmentally adaptive self-direction.

In this study the course for self-directed learning with social software and the ideas of an ecological learning design framework were simultaneously developed. Ideally the emergence of the course's learning space would consist of cycles of developing and monitoring the learning niches. Such dynamical monitoring and grounding of the mutually used learning affordances was possible and practiced during both courses. For this learners' schemes and reflective postings in their weblogs were used. However, the whole learning niche was not clearly visible for students in the course of action. The learning niche analyses of Case I and II were created after each course was over, and used mainly for evaluative purposes for planning the changes of the course. However, it is assumed that if some tools were available for learners and facilitator to visualize the niche with less analytical effort during the course of action, this might increase the use of affordances as niche gradients in adaptive shaping of self-directed learning.

Knowing the fundamental learning niche characteristics enables to develop particular list of suggested activities and plan appropriate instructions during the course. In this study it was found that students perceived many affordances that are related with planning, reflecting and evaluating personal learning in collaborative social software settings. In this paper only the list of these affordances was presented, however, potentially these affordances could be further used for activity design.

When planning participation at the courses and for choosing tools and resources for personal learning environments, self-directed students might need information of the affordances that a particular course community perceives in relation to certain tools. In this paper the factor analysis brought out that some types of social software might offer a unitary affordance perception possibility while others would evoke different types of affordances. In is assumed that, during the learning activity the latter software would serve as multifunctional for switching from one learning niche to another. We have not analyzed in this paper the particular differences between learning niches (eg. for individual or collaborative activities) that form the learning space, but there is evidence (Pata, in press) that such distinguishable niches appear within the general learning space.

One of the expectations of investigating the course learning space at consequent years was to see if the fundamental learning space for self-directed learning with social software was stabile and potentially replicable while students had a big freedom of using various tools. The ANOVA analyses demonstrated that while the use of affordances clustered by different types of social software differed significantly at Cases I and II, the affordances clustered by affordance types were used with similar frequency at both cases. This permits to conclude that the affordance-type based learning space description might be re-used in the course design as a guideline for students and the facilitator, for deciding which affordance types should be evoked at the course. Coupling this affordance-based learning space description with the descriptions of the affordances that certain community has activated with certain types of tools, and considering individual perception of affordances of the personal learning environment, enables learners to participate at joint course activities with their own tools.

Conclusions

This paper outlines the main principles of an ecological learning design model, which is suitable for supporting self-directed learning in social software-based Web systems. It demonstrates how to consider learners' actions and learning environment perception ecologically in the evolving learning design framework. It is envisioned that when applying such learning design frameworks, the recording and visualizing of the emerging affordances while coupling the activity patterns and learning environment resources in the communities must be under special attention. Affordances as connectors of goals, actions and environmental resources constitute a powerful carrier of an ecological knowledge in new Web systems – a driving force for dynamical changes in Web cultures and learning paradigms, and the guide to the optimal activities in learning spaces.

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APPENDIX 1. Affordances types of the self-directed learning niche with social software

Assembling: Assembling information, connecting information/data/artifacts, pulling feeds to the aggregator, community-wide assembling and monitoring of aggregated information, adding bookmarks to social repository, assembling a joint communication environment, creating connection points for group-work, relating weblogs with other mediating environments;

Managing: Self-managing the systems, student/facilitator can restrict/provide access, adding important information, creating time-tables and action plans, sending reminding notes into shared calendar, coordinating actions;

Creating: Co-writing, collaborative creation with other students; simultaneous creation with group members, teacher can look the created work, student develops the goal of the task, teacher evaluates the created work, creating learning materials, giving opinions to peer-students' creations, student chooses the tools to solve the task, learning from joint writing, using jointly created artifacts;

Reading: reading peer's weblogs, an interest-based reading of weblogs, searching images/videos/books while using information collected from blogs, tagging information found in weblogs, quick view to publicly published notes, teacher/other student can read and comment students' published work, reading tasks at weblog;

Presenting: Hanging works in internet, presenting information to the students, publishing artifacts/homework/ideas in blog, offering personal RSS feed, presenting artifacts community-wise, initiating topics in blog, publishing news into shared aggregator, posting personally interesting information, changing the color of notes to make them distinguishable, making information feeds to demonstrate results;

Changing and adding: student can change and add data, student/facilitator can change texts and make corrections, student can make corrections after feedback, student can add his own sub-topic, student have access to editing, students/facilitator can adding figures, images, sounds, slides and RSS feeds to the community resources;

Collaborating and communicating: Working jointly, communication with team members, viewing bookmarks collaboratively for learning in group; coordinating the information among the group of students, community-based viewing/listening of artifacts, learning from shared results, trusting each other, synchronizing and harmonizing work, individual communication with the community-members, calling new members to collaboration, co-writing simultaneously complementing texts and images;

Sharing: Sharing data/information/materials with interested counterparts/community, taking into use the artifacts of shared learning activity, sharing personal feeds, using shared resources, sharing with the use of tag-clouds;

Exchanging: exchanging materials/experiences/knowledge with other learners, quick and inexpensive exchange of information, exchanging information privately;

Searching: learners are searching ideas, searching information for learning from different sources, searching without leaving personal learning environment, searching by keywords;

Filtering and mashing: filtrating information, pulling RSS feeds, RSS feeds go automatically from various places to aggregator, filtrating information by interest/by tag, mashing RSS feeds, analyzing RSS feeds, connecting information and artifacts, community members can individually add feeds to shared resources;

Collecting: facilitator/learner collects data, collecting data from peer students, collecting a personal information store, collecting the results from the group activity, community members can collect individually artifacts/links for the community;

Storing: storing/saving data, information/artifacts/results/homework, social bookmarking, storing in social repository, storing and providing tags;

Tagging: Choosing bookmarks by searching tags, marking important information, adding tags to texts/important information/posts/books, saving bookmarks with tags, social aggregation of information with tags, finding similar people by their tag-clouds, remembering important information with tags, sharing with the use of tag-clouds, initiating new tags, access to information by tags, social retrieval of information by tags;

Reflecting and arguments: reflecting on artifacts in the weblog, self-reflection; self-analysis, relating community reflection with facilitator-reflection, argumentation, analyzing information feeds, making homework/problem-based work, discussing tasks and making decisions, keeping personal learning contracts;

Monitoring: the facilitator/students can monitor the process of solving the tasks, facilitator/students can monitor different teams, community-wide monitoring of aggregated information, collaborative monitoring the feeds/co-students, community can monitor teachers' RSS feed, monitoring comment-feeds from feedback, monitoring collection of community resources (eg. bookmarks, slides);

Giving tasks and supporting: Facilitator/student is giving tasks/posting homework and supporting students; giving enthusiasm, supporting collaboration, promoting team-formation;

Asking and giving-getting feedback: coordinating understandings/information with students, asking from the community/peer student/facilitator, commenting/giving feedback to peer's work, getting feedback, getting information from the users;

Evaluating: self-evaluation, evaluation of students' new knowledge, recognizing students, evaluating feeds, evaluating managing the learning environment and the use of resources, evaluating the affordances of the environment, peer- and facilitator-assessment, providing evaluation criteria.