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D1.2: Towards an Environment Design Model for iCamp Space

(former: iCamp models for cross-cultural collaboration and learning incentives)

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Executive summary

As defined in previous documents of the iCamp project, such as the deliverable D1.1, we base our educational activities on the assumptions that today's adult learners in higher education shall be equipped with competencies and freedom to chose the most suitable learning environments and to manage and control these environments themselves. Thus, we are leaving the traditional approach of Instructional Design and move towards an **Environment Design Model for iCamp** that provides more autonomy to the learner, in terms of tools, activities and resources.

The iCamp Environment Design Model is greatly inspired by Activity Theory (Engström 1987, etc.), which we modify for iCamp analytical purposes. In the Distributed Activity System Model of iCamp we distinguish between conversational actions and productive actions, similar to the conversational learning model proposed by Laurillard (1993).

Additionally we introduce the concept of affordances to our analytical model since we understand our learning environments as a subjectivist concept. Unlike previous definitions of affordances (see e.g. Gibbson or Neisser) we do not consider affordances as being an objective or property of a specific tool, but we rather define affordances as a dynamic concept that is affected by situational change (such as tools, artefacts, actors, activities) and by previous experiences in any Distributed Activity System.

Following a Design Based Research approach the iCamp Environment Design Model is iteratively challenged by the advancement of our theoretical approach and its execution in the field trials. From the first iCamp field trials some implications have already been derived and these have influenced the Environmental Design Model for the second round of trials. One example is the importance of distinguishing between conversational action and productive action, which was not explicitly mentioned before the first trials.

In the next iteration we will be able to gain further insights from the trials for the iCamp Environment Design Model and will finally be able to derive a more general set of design guidelines for the type of educational challenges that iCamp promotes.

1. Educational design principles of iCamp Space: Instructional Design versus Environment Design

This deliverable outlines the educational design principles of iCamp project activities and our progressive work on an **Environment Design Model for iCamp Space**. This particular focus has been taken because it has become more and more evident that new learning environments and learning cultures, which iCamp project targets, may deviate from the traditional mainstream educational design principles of e-learning in institutional settings (e.g. the application of positivist models in closed institutional course- and learning management systems). Instructional functions are gradually shifting towards the idea that adult learners' responsibility and control of their educational processes should be increased in order to develop their competencies (see D1.1 for a description of our conceptualisation of competencies) of being motivated life-long learners in progressively changing technological environments.

This change of perspective suggests that learners should not only plan, monitor and suggest evaluation methods of their activities in institutionally offered learning environments, but for achieving their personal and group objectives, they must have competencies and freedom of choosing the most suitable environments for their activities to take place and control these. To meet these new needs, **computer-supported environments in institutions of higher education** must cease to be primarily tutor-defined and controlled, centralised entities. We need the integration of different landscapes of tools and services that can be assembled by individuals or groups. Such a programmatic change adds pressure on the traditional models of instructional design and development, and its underlying set of assumptions. It is not possible for the instructor to anticipate the participants' preferences for using particular tools and services for certain activities.

The educational activities in iCamp take place in iCamp Space**. iCamp Space** can be imagined as a Web-based activity space bridging adult learners, facilitators and support staff who establish and manage challenges for competency advancement in the areas of self-directing, collaborating and networking. In this context participants conduct joint learning projects and activities, and compose and share artefacts in a common landscape of tools and services. This landscape constitutes of interoperable institutional course- and learning management systems, learning object repositories and social software applications. The development of new educational design principles in iCamp Space is an iterative process that receives input from the different workpackages of the iCamp Project. The field trials, following the design-based research principles (see The Design-Based Research Collective, 2003) execute and evaluate self-directing, collaborating and networking challenges in authentic, cross-national settings in European higher education. This field research enables the validation of the theoretical assumptions underlying new educational design models, and the further development of intervention strategies. The technical support for realising these learning and teaching ideas is sustained by the gradual increase of interoperability of the institutional and social software in iCamp.

The **educational design model** developed by iCamp is not an Instructional Design model, but rather an Environment Design model. Instructional Design focuses mainly on planning teaching and learning sequences and activity patterns. Instructional Design models reduce the complexity level of learners' objectives and actions, presuming that facilitator can determine these instead of learners. The elements of traditional instructional design (see for example Leshin, Pollock, & Reigeluth, 1992; Dick & Carey, 1996; Kemp, Morrison & Ross, 1998) are mostly arranged sequentially

and rarely produce challenges that would be appropriate for **advancing competencies**, as we understand them in iCamp (please refer to D1.1 for a description of our conceptualisation of competence).

Under these circumstances participants have very few possibilities of making judgements and choices for their landscapes of tools and services and therefore often don't build up skills for information-navigation in the Two-Way-Web. The activities in many learning designs reflect the facilitators' working-style and apply his/her preferences for particular technological landscapes. All this potentially lessens the motivation and effectiveness of many adult learners, and brings forth an uneven distribution of competency development and advancement between educational specialists (designers, facilitators) and learners (Candy, 1991).

The iCamp project develops an Environment Design model. We do not see Environment Design as limited to the development of the technical medium for teaching and studying activities. **iCamp assumes that adult learners can be directed towards certain achievements and competency advancement by introducing them to new ways of self-directing, collaborating, and social-networking in technologically mediated settings, and by supporting a self-organised restructuring of their personal learning environments, which include landscapes of tools and services, activities, and human and material resources**.

Our Environment Design Model makes use of some core ideas of Activity theory (Engeström, 1987). Accordingly, each Learning Environment is an emergent Activity System, which arises when an actor or actors want to realise certain educational objectives. For fulfilling their personal or group objectives they need to construct, adopt and adjust their landscapes of tools and services for these purposes, adapt their activities to the co-actors' preferences, and jointly plan and coordinate their activities in these settings with learning-partners and facilitators. Different artefacts and objects mediate educational processes in this Activity System, and may serve as new inputs for other Activity Systems when they are finalised as the outcomes or by-products of learning.

This Activity System's based Learning Environment has the following characteristics:

- it is not centrally formed before the activity, but is dynamically built up in joint, conversationally grounded efforts of participating adult learners and facilitators;
- it integrates the elements of both institutional course- and learning management systems, learning object repositories, and distributed social software applications;
- it is constructed and run upon the dynamically grounded and monitored objectives, activities and evaluation means of the learners;
- it mediates a dynamically activated collection of activity patterns, which are constrained by the affordances that are perceived in respect to tool functionalities and their interoperability, properties of the artefacts and objects, and the learners' preferences in respect to objectives, working-styles, tools, co-workers and so forth.

2. The iterative process of developing an Environment Design Model in iCamp

For developing an effective Learning Environment Design model and for investigating its applicability in iCamp Space, the iCamp project team designs and executes field trials where open Web publishing tools and services are used together with synchronous and asynchronous communication tools to establish and manage educational challenges in area of self-directing, collaborating, and social-networking in cross-national, distributed settings. These trials are conducted by following a design-based research approach (Design-Based Research Collective, 2003). The Design-Based Research Collective (2003) has proposed that good design-based research exhibits the following five characteristics:

- The central goals of designing learning environments and developing theories or "proto-theories" of learning are intertwined;
- Development and research take place through continuous cycles of design, enactment, analysis, and redesign;
- Research on designs must lead to sharable theories that help communicate relevant implications to practitioners and other educational designers;
- Research must account for how designs function in authentic settings. It must not only document success or failure, but also focus on interactions that refine our understanding of the learning issues involved;
- The development of such accounts relies on methods that can document and connect processes of enactment to outcomes of interest.

iCamp field trials combine the 'conclusion- and decision-oriented' inquiry (Cronbach & Suppes, 1969) in order to develop a model for learning and teaching in cross national and technologically mediated settings that foster the advancement of competencies in self-directing, collaborating, and networking. **Conclusion-oriented inquiry** attempts to describe "reality", and guides the theorists who want to identify and give meaning to the cause-and-effect mechanisms or flows of events in the learning domain. **Decision-oriented inquiry** aims to change the reality and is common to practitioners, who need to develop applications that consider these theories and principles in various teaching situations.

These two aspects can clearly be distinguished in the aims of iCamp Trials. The decision-oriented aspects are related with reforming e-learning in higher-educational settings by facilitating the development of students' competencies for self-directing their own learning and change projects, and collaborating and networking with others in cross-cultural settings. The conclusion-oriented aspects are related with revealing the emerging activity patterns making use of the Two-Way-Web, which can then be better accommodated for realizing the decision-oriented aims of iCamp Project. Supposedly, better knowledge of these activity patterns could be used to re-conceptualise the technological support of teaching and learning in the Two-Way-Web. Knowledge and competencies are increasingly perceived not only as the property of individuals but also as distributed qualities between learners in a form of an inter-subjective awareness of the dispositions of others for operating in new landscapes of information and communication technologies.

Actors in the Two-Way-Web need to learn how to deal with this inter-subjectivity:

- How to use the public written or conversational knowledge artefacts as the common handles for transforming their individual knowledge;
- How to use conversational tools for grounding, monitoring and analysing, what and why they learn, and how they plan their activities, which tools they use for realizing their aims, and how they prefer to evaluate their learning outcomes;
- How to use knowledge on emerging Two-Way-Web practices as an inter-subjective source upon which they can rely when planning their own learning activities in this medium.

According to Reigeluth (1999), any instructional-design theory identifies methods of instruction and describes components to a level detail that provides educators with the means to effectively support and facilitate learning in certain situations. He claims that any Instructional-Design framework has to provide guidance for the following aspects:

- Identifying the **philosophical value** system under which learning takes place;
- Identifying the **desired outcomes** of learning for a particular target group;
- Identifying the **theoretical background** underlying the goals of instruction under certain circumstances;
- Identifying **appropriate tools** for applying certain Instructional-Design methods and scaffolding;
- Identifying the **best theory** driven Instructional-Design method for scaffolding the learning process to attain goals;

Edelson (2002) goes beyond this proposition and suggests that Design Research can develop and refine iteratively three different theoretical layers. **'Domain theories'** characterise the challenges and opportunities in a specific teaching and learning context, describe the models how people learn in this context, and the desired outcomes of learning. **'Design frameworks'** provide knowledge of the properties of successful design solutions. **'Design methodologies'** consist of concrete guidelines for successful design procedures. The first three aspects of Reigeluth's (1999) framework corresponds to Edelson's notion of 'domain theory'. The two last aspects rather fall under 'design framework', while the notion of 'design methodology' doesn't seem to be explicitly outlined by Reigeluth.

We find it useful to apply the differentiation proposed by Edelson to clarify why new educational design models are needed in our context, what must be considered in the development of a Learning Environment Design model, and how it can be applied in the naturalistic settings of iCamp Trials on designing educational challenges in the area of self-directing, collaborating and networking. However, instead of 'domain theory' we find it more appropriate to talk about a "domain framework".

Within the context of design based research, both 'conclusion- and decision-oriented' research questions need to be answered iteratively in order to develop an effective Learning Environment Design model for iCamp Space. Thus, for the first iCamp field trial that focused on creating an educational challenge for collaborating in a cross-cultural and technologically mediated setting, we sketched out a proto-theory of three challenges for competence advancement in higher education and outlined a first

Learning Environment Design model. This model was implemented in a naturalistic field trial, focusing on creating an educational challenge for collaborating via technological means in cross-cultural groups. The analysis of the results of this 'trial on collaborating' led towards the evaluation of both the initial Learning Environment Design model for realizing the iCamp collaborating challenge, and to the refinement of our theoretical understandings of learning and facilitating in **distributed Two-Way-Web landscapes**. It also informed the next cycle of planning for the upcoming field trial on fostering competency advancement in respect to self-directing.

3. Domain framework for iCamp Space

This section describes the delimitation of the "domain" that our Environment Design Model focuses on.

The rationale that guides the conceptual work in iCamp is based on the core assumption that adults increasingly benefit from the advancement and development of competencies in the area of collaborating with, self-directing intentional learning projects, and social-networking in cross-national, distributed, and technologically mediated settings. iCamp starts from an adult education perspective which entails that young adults who study in higher education always posses a basic level of competence in these areas.

We decidedly follow a conceptualisation of "competence" that goes beyond a mere focus on factual knowledge and procedural skills. Instead it emphasises the growing importance of additional and highly interrelated dispositions such as internalised attitudes, orientations, values and aspects of volition, which are essential to cope effectively in situations of uncertainty.

We agree with educational scholars who predict the growing importance of such competencies for coping with life in general (Rychen, 2003), and many challenging work contexts in particular (Erpenbeck & Heyse, 1999). In addition, we assume that formal educational systems for adults can and should be designed in ways that allow all participants to actually execute and advance their competencies in the specified areas under rather authentic conditions.

The educational work-package of iCamp tries to model how this can be achieved under the specific contextual constraints (distributed, cross-national, technologically mediated, and networked environments) that drive our project (see D1.1).

3.1 Applying core concepts of Activity Theory

The theoretical background underlying iCamp ideas is well grounded in Activity Theory (Leontjev, 1975/78; Engeström, 1987; Kuuti, 1995). According to Leontjev (1975/78) and Kuuti (1995), any activity that involves people can be defined through the individual or shared objectives that form the **object of the activity**. While some proponents of Activity Theory use the term **object to indicate the shared objectives** within an activity system, we consistently find that this use of the term invites confusion and evokes a set of inappropriate connotations (eg. objects as artefacts or learning objects). Thus, we will simply refer to objectives throughout this paper.

An activity is performed by certain subjects. Subjects in formal educational settings can be learners, facilitators, technical supporters etc. A more fine-grained description of subjects can also consider the roles that actors take in teams (eg. leadership). Individual actors who are self-directing their personal learning projects need to determine their objectives and ways how to realise these on their own initiative or with the help of the facilitator or learning partner. Actors who work in teams on shared objectives need to decide on the **distribution of labour** and their **roles** in teams. If they misinterpret or misconstrue each others' objectives, actions, role taking, and so forth, the achievable performance level and the materialization of

objectives is greatly constrained. Networked actors can take roles (eg. initiator, evaluator) or temporarily distribute labour in the frames of certain projects, but in general their activities and selection of tasks is based on self-determined objectives in accordance with the implicit or explicit community objectives they feel inclined to.

Activities consist of **goal-directed actions** which the subjects conduct. The goals of the actions are realised by performing **certain operations using instruments** (such as material tools and artefacts, immaterial tools like language and knowledge-artefacts, and so forth) as mediating devices. For Kuuti (1995) learning environments can serve at the same time as the mediating tools enabling the realization of the objectives and aiding knowledge construction and communication, and also as the objectives of the activity to make the implicit community knowledge externally observable and thus desirable by the collaborators. The latter is especially characteristic for the Two-Way-Web (e.g. social bookmarking, blogosphere etc.) where the social tools are not only the mediators of actions but also represent the new kind of knowledge and relationships explicitly. For defining the elements of activities in social-software supported educational environments, at least two levels of the activity should be considered: the operation level (Kuuti, 1995) and the Activity System level (Engeström, 1987).

The Activity System model of Engeström (1987) describes general information flows at the **community level** (comprised by all actors involved in an Activity System) within or between different communities. According to Engeström (1987), the objectives of a given community bring forth a division of labour and the alignment to certain rules that constrain the availability and the use of possible operations and tools. In any Activity System contradictions emerge between the conceptualization of the objectives, the division of labour, the alignment to the community rules, and the application of tools and artefacts. The connotation of the **community term** in Engeström's Activity System needs some in-depth elaboration. Memmi (2006) assumes that in the most usual sense, a community refers to a particular kind of social group, defined by strong personal links. Such a group will be fairly small, so that it is possible for each member to know personally everybody else in the group. Relations are supposed to be direct, face-to-face, frequent and stable.

However, German sociologists such as Tönnies (1963), Simmel (1989), and Weber (1956) have proposed a fundamental distinction between **traditional community** and **modern society** where links are much more impersonal, temporary and functional. Memmi (2006) suggests that flexible group membership is becoming more and more common. A typical modern behaviour has emerged, where group membership is constantly re-evaluated and renegotiated. The modern individual belongs to several groups (professional, cultural, political…) at the same time, but doesn't identify too closely with any of them. He or she views the association with any given group as potentially temporary. This type of person switches with ease between different social circles as his interests evolve or new opportunities arise, and doesn't allow an obsolete identity to become a burden.

Engeström, Engeström and Vähäaho (1999) distinguish Activity Systems **operating in teams**, and Activity Systems emerging in **work communities**. Teams are typically understood as relatively stable structures, sharing the same objectives and mediation tools over longer periods of time, in which the workflows dynamically develop and become stabilised to certain extent. **Networking** emerges in more loosely connected systems like work communities. Their workflows consist of combinations of people, tasks, and tools that are often orchestrated only for relatively short periods of time (eg. like in hospitals where each emergency patient would activate a different chain of temporary but coordinated workflow). Engeström et al. (1999) describe these

temporal trajectories of successive task-oriented combinations of people and artefacts that emerge within or between activity systems as **knot-working situations**. The notion of knot refers to a short time, distributed and partially improvised **orchestration of collaborative** performance between otherwise loosely connected actors and activity systems. Knot-working situations rely on the fast accomplishment of inter-subjective understanding, distributed control and coordinated action between actors. Engeström et al. (1999) assume that in **knot-working** the tying and dissolution of a knot of collaborative work is not reducible to any specific individual or fixed organisational entity as the centre of control. The locus of initiative changes from moment to moment - the centre does not hold. The learning situation in collaborating presumes the formation of teams who share common objectives, rather than networking of self-directed actors with different personal objectives. However, in collaborative teams the learners may define someone as their leader or try to work with shifted locus of initiative like in networking situations.

3.2 Distributed Activity Systems

Engeström‘s (1987) conceptualization of Activity Systems is mainly based on the analysis of face-to-face work settings, where people communicate directly and do not have to make use of technologically mediated communication and discussion to establish common objectives, roles and tools within a given work community. For modelling Activity Systems in distributed and technologically mediated settings it seems reasonable to modify Engeström‘s (1987) model. The Distributed Activity System model, developed for iCamp analytical purposes, distinguishes mediated **conversational actions**, in which people discuss and develop their ideas, and develop and negotiate common objectives, rules, roles, and so forth, from **productive actions** in which objectives are materialized, for example through the creation and publishing of elaborate digital artefacts. Actions in which people manipulate some artefacts that mediate their conversational actions, would also qualify as productive actions. Typically in this case the development of these artefacts is not the objective of the activity.

Similar types of actions have previously been elaborated in the conversational model of learning, proposed by Laurillard (1993). Laurillard‘s model distinguishes three types of actions between the facilitator and a participant: 1) dialogue acts on specific content (eg. ideas, theories), 2) productive actions (where ideas are formulised into artefacts and outcomes), and 3) dialogue acts about planning and giving feedback of content generation and productive actions (eg. regulation between ideas and outcomes). The aforementioned types of actions are also common between the participants. In the iCamp Distributed Activity System model we would refer to these actions, which do not normally result in the formation of crafted artefacts, as **conversational actions**. These conversational actions can be directly related to **subject-matter issues** (such as discussions on terminology, concepts, etc.), or they can be related to **regulative issues** (such as negotiating the distribution of work, roles, and so forth). In authentic work settings conversational actions switch rapidly and regularly between subject-matter and regulative issues.

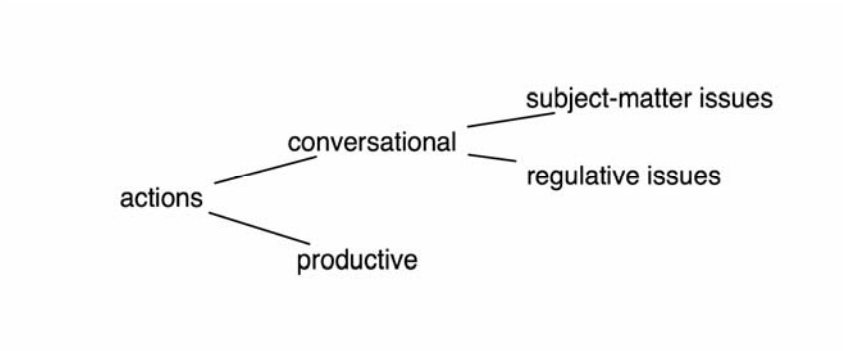

Figure 1: Actions in the Distributed Activity System model of iCamp

We would like to illustrate how the Distributed Activity System model describes the **activities in Two-Way-Web** and **enhances the analytical processes** about the learning in these. In technologically mediated environments conversational actions and productive actions are highly intertwined. Using synchronous chat or asynchronous Weblog applications, for example, people not only support their conversational actions, they also create potentially complex digital artefacts representing their discussions and exchanges. These discourse artefacts reflect the course of the knowledge-building and -regulation, but they are frequently too messy to be used directly as a knowledge artefact within other Activity Systems. Thus, the Distributed Activity System model classifies these as conversational actions related to subject-matter and conversational actions that are related to regulative issues.

When using audio/video chat applications (e.g. Skype), the communication is direct and not mediated by other manipulative actions like publishing. In many educational settings the ideas and the objectives of a shared activity are discussed and negotiated either directly in face-to-face situations or mediated by synchronous or asynchronous communication tools. However, the materialization of objectives as artefacts frequently takes place using a separate set of tools and services, e.g. Web-based text-processing services like google.docs.com, open-publishing platforms like Wikis, or shared digital whiteboards that do not support conversational actions too well. The Distributed Activity System model would enable to classify the former kind of actions as conversational (knowledge-building or regulatory) actions, and the latter as the productive actions.

In some cases, productive actions are performed making use of existing knowledge artefacts, like Web-based inquiry models for running certain processes, to support the meaning-making discourse in the conversational medium. These models themselves are only means for testing the ideas that are articulated via the communication tools. The separation of mediated knowledge-building and regulatory conversational actions and productive actions in our Distributed Activity System model reveals the conversational regulative dimension of the Activity System, in which groups have to establish common rules, distribute labour, and negotiate what tools and artefacts are needed to mediate their activities and realize shared objectives in the form of a materialised artefacts. In addition, in mediated action in distributed settings actors need to receive feedback on the relevance of their actions in relation to these objectives. Competencies of operating in this regulatory dimension – meta-cognition and comprehension at distributed group level – are crucial in effective learning in collaborative and networked mode.

4. Design framework for iCamp Space

We have initially tried to follow Reigeluth's (1999) outline of essential elements of Instructional Design Theories, which we see somewhat compatible with Edelson's (2002) notion of the different theoretical layers that design research can produce.

Reigeluth (1999) has assumed that the identification of two aspects, the theory driven scaffolding of learning processes, and the appropriate learning tools for mediating learning would enable the designers to convey their theoretical ideas into practice. In more traditional Instructional Design models the instructor is expected to plan the appropriate support strategies and tools before the actual activity. These models suggest instructors (or designers) can predict the outcomes of learning, define the way how to reach these outcomes, and determine which tools are appropriate for mediating these processes.

This approach mostly reduces learning environment design to the selection of a set of tools, which offers objective functionalities for doing something. The instructor's task is to make use of these tool functionalities in pedagogically sound ways, creating instructional intervention strategies for using these tools in the activities. In addition, instructors are supposed to make learners aware of these tool functionalities in order to guarantee their success.

In our **Learning Environment Design model**, however, we understand Learning Environment **as a broad and subjectivist concept**. It entails all the instruments and material and human resources that an individual is aware of and has access to in the context of an educational project at a given point in time. An individual's Learning Environment that entails other actors inevitably involves different components of the Activity System, which we have outlined earlier.

The systemic nature of such Learning Environments suggest that scaffolding issues and tool use must be considered as highly intervened parts of the whole system. In order to describe the Design Framework of iCamp trials in accordance with our broad conception of the Learning Environment, we consider the scaffolding and tool aspects together. We aim to demonstrate how such a broadened view on what makes up a Learning Environment alters the facilitators' control over the work and communication processes and the actual outcomes and their evaluation in a given educational setting.

4.1 Integrating the notion of Affordances

To analyze how learners in a given Activity System perceive themselves, the artefacts and tools, and other learners, we find it useful to integrate the **notion of affordances** into our Learning Environment Design model.

Gibson (1979) originally defined affordances as opportunities for action for an observer, provided by an environment. Gaver (1996) emphasized that affordances emerge in human action and interaction and, thus, go beyond mere perception. This contrasts with the common interpretation that affordances simply refer to situations in which one can easily see what to do (Gibson, 1979).

Neisser (1994) elaborated Gibson‘s concept of affordance and distinguished three perceptual modes:

- **Direct perception/action**, which enables us to perceive and act effectively on the local environment;
- **Interpersonal perception/reactivity**, which underlies our immediate social interactions with other human beings, and;
- **Representation/recognition**, by which we identify and respond appropriately to familiar objects and situations.

Besides the affordances related to the environment, Neisser’s interpretation introduces the interpersonal perception of subjects in action as an additional source of affordances in the social and regulative domain. Another type of affordances relates with learners‘ familiarity of perceiving certain aspects of the environment certain ways, which is culture- dependent and idiosynchratic.

The mainstream view on affordances in educational technology settings considers them as objective properties of the tools, which are perceivable in the context of certain activities. Thus, it is commonly suggested that tools have concrete technological affordances for certain performances that can be brought into a learner’s perception with specific instructions (Norman, 1988; Gaver, 1996). This use of the concept tends to ignore its relativistic nature and observer-dependence, and seems to imply that affordances should be located in the environment or specific artefacts or tools.

Kirschner (2002), for example, defines pedagogical affordances as those **characteristics of an artefact that determine** if and how a particular learning behaviour could possibly be enacted within a given context. Kreijns, Kirschner, and Jochems (2002) have defined social affordances as the **“properties” of a collaborative learning environment** that act as social-contextual facilitators relevant for the learner’s social interaction.

However, the iCamp project does not follow this positivist, deterministic understanding of affordances as part of learning environment. From an interaction-centred view (Vyas et al., 2007) affordances are the perceived possibilities for both thinking and doing, what learners perceive and signify during their actual interaction with an artefact or tool. While interacting with an artefact or tool, learners continuously interpret the situation, and (re-)construct meanings. Thus, instead of relating affordances objectively with software applications or other complex tools and artefacts, they should rather be related to the Activity System, where learners must realize how they perform joint actions with artefacts and tools in order to accomplish their shared and personal objectives.

Affordances emerge and potentially become observable in actions what people undertake to realize shared objectives. Grounding on objectives and tools for particular actions brings along the development of certain implicit or explicit rules for effective action in particular settings. These rules frame how tools could be used in specific actions. In educational settings, constraints in using the tools in a particular way also arise from the perception of predetermined tasks, objectives and artefacts that are meant to guide and contextualise the learning process. Within an Activity System, activities are also framed by the technical functionalities of tools and services and the artefacts in a specific domain context.

Actors must develop a personally and socially viable understanding of the affordances of a given setting to make effective performance possible within an Activity System. This is true both for the facilitator and learners who want to collaborate. The similar application of the tools, functioning rule-system and distribution of labour that support the realisation of certain objectives in the Learning Environment are realised upon the commonly perceived affordances. In the iCamp Learning Environment Design Model this means that facilitator cannot predefine but only anticipate the affordances of Learning Environment. The Learning Environment cannot be ready when learning starts but has to evolve in the process.

Cook and Brown (1999) and Vyas et al. (2007) assume that affordances should be conceptualized as a dynamic concept. In an ongoing interaction with tools, artefacts, 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. This dynamic understanding of the affordance concept appears to be entirely compatible with the ideas of Engeström et al. (1999), who described the dynamic nature of interactions between the components of the Activity Systems. **The dynamic changes in the perception of Learning Environment must be considered as part of the Learning Environment Design model**: iterative cycles of grounding and regulation with conversational actions among the learners and the facilitator about the state of art of the Learning Environment as the Distributed Activity System, and the development of these competences would become increasingly important.

When facilitators or instructors cannot pre-determine the Learning Environment and its possible affordances for the participants, the production and communication processes still need some structuring and orientation. The iCamp approach of viewing the affordances as part of the Learning Environment enables the restructuring of these processes around activity patterns. These activity patterns involve participants and facilitators, their objectives, mediators of their activity (tools and artefacts) and the list of anticipated affordances of this Learning Environment in relation to predetermined actions.

Instead of entering into a pre-defined landscape of tools and services where all objectives, actions and evaluation means are listed by and instructor, actors in our Learning Environment Design model would be offered the general activity patterns that enables them to carry out certain challenges. The realization of each activity pattern in certain institutional settings requires a conversational grounding process for establishing and maintaining a Learning Environment, or rather **Learning Environments that can interoperate and interrelate on various levels**. In this process the anticipated affordances serve as the landmarks for selecting particular tools and services that can support the productive and conversational actions of participants and facilitators.

Our Learning Environment Design model presupposes that users‘ perception of affordances in concrete activity settings should be considered. In the context of a collaborating challenge, for example, a facilitator has to observe and evaluate the dynamic emergence of affordances in Learning Environments and provide feedback if learners face problems in establishing a compatible set of affordances within their environments.

Several aspects must be addressed in the implementation of such Learning Environment designs:

- How to observe the different **students' perception of the affordances** of the Learning Environment in different learning activities dynamically during the activity?
- How can the **facilitator measure the effectiveness** of the perceived affordances from an objectives realization perspective and give feedback to the learners to enhance their perception of affordances of their Learning Environment?
- How to **support participants in establishing consensus** on the affordances of their Learning Environments during the activity?

5. Design methodology for iCamp Space

Following a Design-based Research approach, one needs to raise and solve research questions iteratively during the process of design. Results need to be fed back into the **domain framework** and the **design framework** respectively, which would in turn suggest how to adapt the existing design methodology. The first field Trial of iCamp focused on investigating how an educational collaborating challenge for competence advancement can be arranged within the contextual constraints specified for iCamp settings (see D1.1 for more details).

In this chapter we outline the concrete design procedures that were used for **Trial 1 (collaborating challenge)** and some issues that were highlighted and analysed to inform the further development of our Environment Design Model. At the end of the chapter we discuss the implications of our data analysis and analytical review for planning **Trial 2 (self-directing challenge)**.

5.1 Setting up an environment for Trial 1 (collaborating challenge)

At the beginning of Trial 1 the interoperable set of tools and services that is envisioned for the iCamp portfolio was not fully functioning. Thus, the trial was planned making use of a limited set of open-source and available open-access (social) software tools and services. In **Trial 1 (collaborating challenge)** the project team pre-selected certain parts of the landscape of tools and services. Initially, the iCamp project team selected and recommended a reference set of tools and services. However, participants could still decide adding additional tools and services or replacing the ones that were recommended.

The preparations for the iCamp Trial 1 included the establishment of a technical support Weblog that aimed to support the learners' use of collaboration and communication tools recommended for the active trial phase (see D4.1 for a more detailed description of the trial set up). All the participants of the Trial were asked to create accounts for the **Del.icio.us social bookmarking** service and to use a common tag „iCamp1" for all the links published on this service that were related to the trial. This mechanism was also used to indicate one's own Weblog to other participants and to support the selection of partners to form cross-national learning groups.

In addition, a **Web-based support group** (groups-beta.google.com/group/icamp1) and a **Skype** (skype.com) technical hotline were initiated to provide participants with technical support and enable them to trace the problems other participants had faced already. For contacting peers and technical supporters, participants were suggested to create Web-based group and Skype accounts. Two aggregated pages – one connecting the RSS-based Webfeeds of all the trial Weblogs, and another one providing all the comments from most Weblogs – were to support the trial organisers and facilitators.

Participants could voluntarily choose the iCamp collaborating challenge as an additional option for competence advancement beyond their traditional course offers.

The general task of the cross-national groups that were formed within the Trial was the **development of a joint artifact** (questionnaire) for investigating phenomena related to e-learning. Participating students started their activities within closed Learning Management Systems belonging to their local universities. Consequently, the groups augmented their learning environments with (social) software tools and services to be able to communicate and work on a joint artefact across the borders of institutionalised systems.

During the first week the activity took place in distributed, individual publishing spaces. Learners at each participating site were instructed to **create individual Webblog account**s, either on a local Wordpress installation at their site or on some other platform (like the free-host Wordpress.com) they had access too, to present themselves to their international peers.

They tagged their Weblogs with Del.icio.us, thus creating a **common information-"space"** where participants from institutions within four different countries could get in touch with each other. Skype accounts and email addresses were published with tagging. Students were encouraged to visit and comment Weblogs of their peers and to establish cross-national groups of four. This was realised as a participant-managed initiative. By the end of the first week several groups were formed and announced in individual Webblogs. From this point on, the activity was shifted from the individual to a **collaborative Weblog** that was set up by a group member.

Analysis on the group level indicated that these **group weblogs** gradually became the **core medium**, from where the students could start building an Activity System, integrating other (social) software tools and services for their operations.

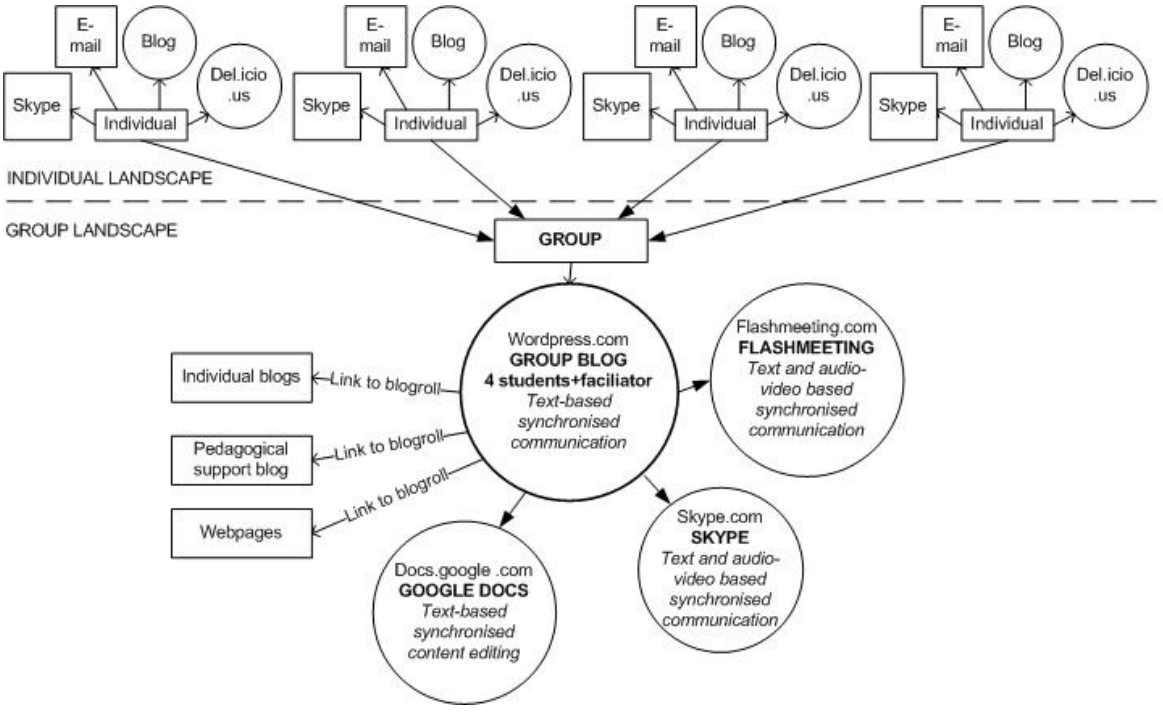

Figure 2: General overview of landscapes

The **various types of tools and services for communicating** (Flashmeeting, Skype, MSN, e-mail), generating and sharing content (Weblogs, Google.docs) played different roles within the groups.

The activity pattern diagram of iCamp's first field trial (Trial 1) depicts different activity flows that were suggested for establishing an educational collaborating challenge under the contextual constraints specified for iCamp settings (see D1.1 for a detailed description of these constraints). The activity pattern diagram connects participants and facilitators, their action objectives and actions in each activity, the artifacts, which are used or created in each activity, and the proposed affordances that relate the activities with the selection of different software tools and service

The subject-paths in each activity are outlined separately, thus indicating which of the activities were conducted both by participants and facilitators, and which only by participants. This activity pattern diagram generalises the optional activities as a workflow but leaves freedom for participants to select different tools and services to form their particular landscapes.

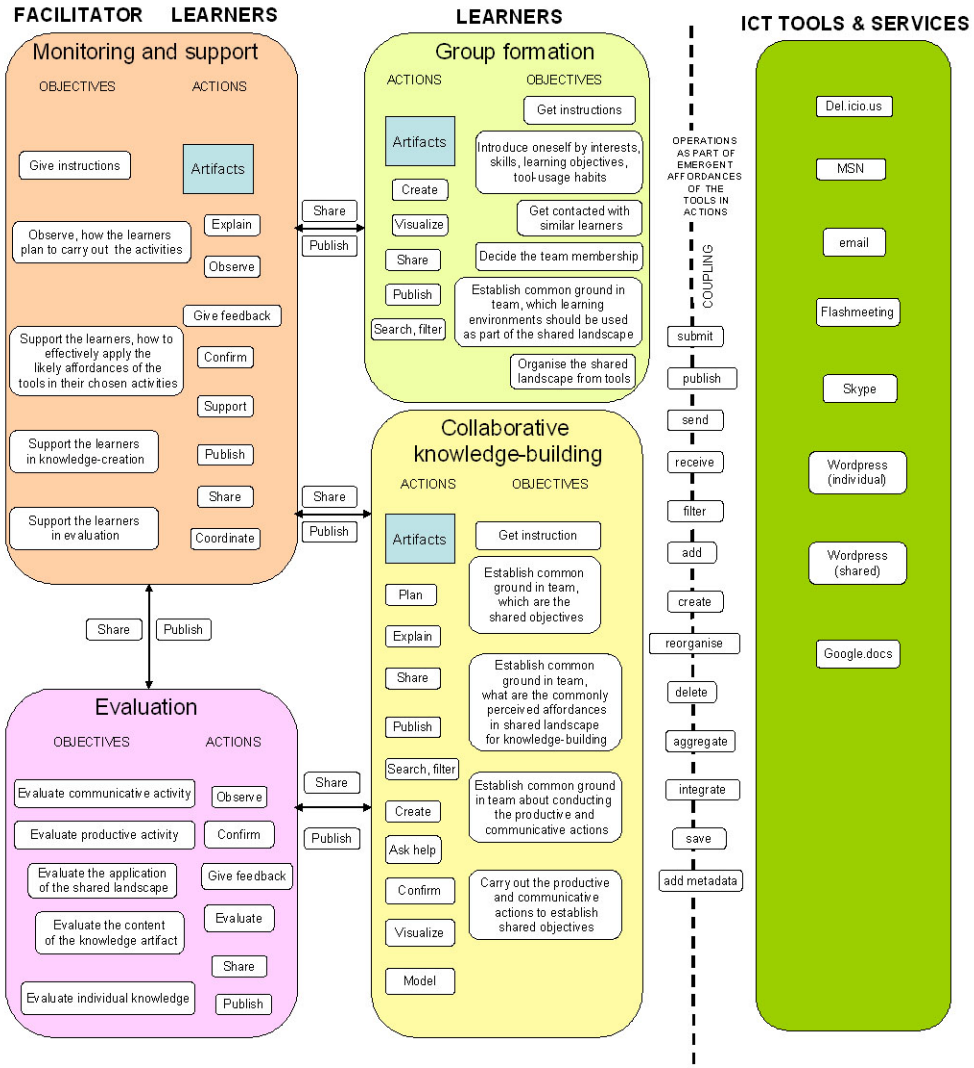

Figure 3: Activity pattern diagram of Trial on collaborating

5.2 The analytical approach for investigating Trial 1 (collaborating challenge)

Reigeluth and Frick (1999) suggest formative rather than summative research methods for creating and improving Instructional-Design theories. They assume that specific circumstances should be considered when evaluating the effectiveness of Instructional-Design methods. The analytical approach we aim to introduce in the development of our Environment Design model was based on the combined qualitative content analysis of learner's contribution in different distributed publishing spaces and the plotting of these results on the learning landscapes of groups by using the types of activities we have previously described as part of a functioning Distributed Activity System.

In the initial phase of the data analysis for Trial 1, the main issue of interest for the work in WP1 was how the collaborating challenge was implemented within the constraints of cross-cultural, distributed and technologically mediated setting.

Initially, investigators reviewed the whole data-set what would be particular aspects that could influence the emergent activity systems in iCamp Space. This data-set consisted of the traces and records of students' and facilitators' communicating and (inter-)acting via different tools and services.

Gradually, we started to ask more particular questions such as the following:

- How was the **initial facilitators' outline** of iCamp Space realised by different teams?
- What were the **constraints for running a shared learning environment** in each group?
- How **effective, efficient and appealing** was **Trial 1** for competence advancement from the perspective of the participants and facilitators?

First, it was important to clarify how the participants actually created distributed learning environments from a variety of social software and services and to examine whether the affordances they perceived differed considerably from the ones initially anticipated by the facilitators.

Second, iCamp researchers intended to carry out an in-depth review of the formation of Distributed Activity Systems among collaborating participants and the dynamic changing affordances they perceive and evoke in relation to selected tools and services.

Our third research question aimed at clarifying to what extent the educational collaborating challenge in Trial 1 was perceived and experienced as an effective, efficient, and appealing setup for competence advancement by participants and facilitators alike.

The first two issues were important for clarifying some potential scaffolding aspects in our **Environment Design Model** and for planning for the **self-directing challenge** for the next field trial.

The third issue was mainly of interest from the perspective of **future dissemination** of similar educational challenges in higher education.

The data analysis process for the first question involved the qualitative analysis of data on how participants used different tools and services mediating their conversational actions in relation to regulative or subject-matter aspects and their productive actions directed to artefact production.

Productive actions were the following:

- Assembling distributed participants and their landscapes of tools and services in groups, using shared communication spaces;
- Materializing the objectives via the application of tools and services; and
- Creating the questionnaire and its content.

Regulative conversational actions were:

- Grounding who will do what actions in teams with tools;
- Grounding leadership;
- Grounding how to work; planning the meetings;
- Grounding where to work and what activities to do in each medium; Evaluating team-members, with whom you work together; and
- Grounding how the subjects‘ performance was meaningful for realising their shared purpose.

Subject-matter related conversational actions were:

- Grounding the content to be created, and the content of materials to be used, and their relationship; and
- Grounding the content discussed, and its realisation in a material artefact.

The **second analytical procedure** focused on the examination of two selected cases, mapping how the groups developed their **learning landscapes** and **Distributed Activity Systems** along the timeline. The results of previously identified activities were generalised and plotted on the diagrams of the landscapes of tools and services that were used during the collaborating challenge. This revealed areas of constraint, such as missing types of activities in groups, difficulties in establishing the shared activity space, and so forth.

Reigeluth (1999) has assumed that research that aims to create generalized design knowledge should be evaluated according to the criteria of effectiveness, efficiency, and appeal for the users. In the settings of Trial 1 effectiveness was to be evaluated according to the increased competencies of learners in collaborating in cross-national teams in distributed Two-Way-Web settings. This entails their dispositions (factual knowledge, procedural skills, internalised attitudes and orientations, and volition) for successfully grounding their objectives in teams, establishing shared landscapes of tools and services, and exploiting those with commonly accepted rules, and realizing their objectives by productive actions.

However, it was not possible to decide whether some of the group landscapes of tools and services and Activity Systems dynamics were more desirable than the others. Rather, the emergence of the variety of different landscapes was considered as a proof that a participant directed Environment Design was taking place in Trial 1, instead of a facilitator-directed Instructional-Design approach.

The efficiency measurement of the results of Trial 1 would mean of evaluation how different institutions invested of the human-, technical-, time- and material resources to the successful conduction of the trial on collaborating. The students‘ appeal towards Trial 1 learning-designs was collected with the questionnaires (Nguyen-Ngoc & Law, 2007).

Reigeluth (1999) points out that it is important to remember that the probabilistic nature of Instructional-Design theories in general implies that an application of these theories increases the chances of attaining the goals rather than ensuring the attainment of goals. Accordingly, the iCamp field trials can only provide a variety of case-descriptions, which can be generalised to increase our understanding of new facilitation and work patterns to create educational challenges for cross-national, distributed and technologically mediated settings. However, any time participants start work on one of the educational challenges in iCamp Space, their personal choices have a strong influence on how they perceive and activate the tools and services for realizing their objectives.

5.3 Main implications of the results from Trial 1 (collaborating challenge)

The table on the following page demonstrates the affordances of the distributed tools and services as perceived and applied by the Trial organisers (iCamp team members and facilitators) and different Trial groups.

Several conclusions could be drawn from the table:

- the facilitator’s perception of the affordances within an initial educational settings may be limited and rather different from what the participants might perceive during the activities;
- the groups of learners would perceive and apply the affordances of the tools and services of their personalised landscapes differently from each other;
- different tools may evoke learning affordances during the performance of the activities.

Table 1: The activity types performed with the distributed tools as perceived and applied by Trial organisers (T) and Trial groups (G1-G8 – Group 1 – Group 8, WP – Wordpress, G – Google docs., F – Flashmeeting, S – Skype)

Activities	Activity description	T	G1	G2	G3	G4	G5	G6	G7	G8
Productive activities	Assembling distributed learners and their learning spaces in groups, using shared communication spaces	Del.icio.us, individual WP, email , S, shared WP								
	Materializing the objectives with tools; Creating the questionnaire and its content;	G	G	G	G shared WP	G shared WP	webpages G	G shared WP	G	G shared WP
Regulative conversational activities	Grounding, who will do what actions in teams with tools; Grounding leadership etc.	shared WP	?	MSN	shared WP G, S, F	shared WP	shared WP G, S, F	shared WP	shared WP	shared WP
	Grounding, how to work; planning the meetings etc.	Shared WP	?	MSN	Shared WP G, S, F	Shared WP F	Shared WP G, S, F	Shared WP, F, S	Shared WP	Shared WP
	Grounding, where to work and what activities to do in each medium	shared WP	?	MSN	shared WP G, S, F	shared WP	shared WP G, S, F	shared WP	shared WP	shared WP
	Evaluating team-members, with whom you work socially	individual WP, del.icio.us	?	shared WP	shared WP G, S, F	shared WP	shared WP G, S, F	shared WP S	shared WP S, F	?
	Grounding, how the subjects' performance was meaningful for realising their shared purpose	Shared WP, S, F	?	MSN	shared WP G, S, F	shared WP F	shared WP G, S	shared WP F	S, F	?
Subject-specific conversational activities	Grounding the content to be created, and the content of learning materials to be used, and their relationships.	S, F	?	MSN shared WP	shared WP G, S, F	shared WP F	shared WP G, S, F	shared WP F, S	shared WP G	shared WP
	Grounding discussed learning content, and its realisation in material artefact.	S, F	?	shared WP MSN	shared WP G, S, F	shared WP F	shared WP G, S, F	shared WP F	shared WP S, F	shared W

We are demonstrating in two examples how the plotting of students Activity Systems within their distributed landscapes of tools and services reveals some critical limitations. We introduce the Learning Environments of Group 6 and 4 in a short narrative format, and visualise their landscapes of tools and services in a diagram. Both examples are taken from the collaborative artefact-creation stage of the activity flow, which followed the group-formation. We have used the country-names to refer to different participants in this cross-national group.

5.3.1 Case 1: Establishing the common learning environment

This case demonstrates various problems in establishing a shared environment.

The participants of Group 6 – Lithuania, Turkey and Estonia – centred around Poland who initiated the joint Weblog. Poland took leadership in this group from the very beginning of joint actions, stating that it was time to start discussions about the project. Poland published in the group Weblog the links to the Webpages. The learners started to use the Weblog as the area for conversations on social and process regulation. Poland and Turkey took responsibility for technical arrangements of the Weblog, but Lithuania and Estonia were having difficulties in this new publishing space. The group members maintained a social atmosphere by publishing positive comments on each other's suggestions. All team members did not acknowledge the attempted leadership of Poland, and Lithuania tried to establish a Skype meeting. However, this initiative was not recognised. The next day Turkey made the suggestion to arrange a meeting in Flashmeeting (flashmeeting.com). Poland supported this proposal. This meeting did not take place because the trial support team had not prepared the technical facility for Flashmeeting yet. The iCamp facilitator added subject-related comments to the group Weblog to initiate the execution of the planned tasks within the groups. On the same day Lithuania suggested again to meet via Skype. Poland and Turkey supported the proposal, and the meeting was held with Poland's and Lithuania's participation. They discussed subject-matter related issues, also referring to Web-based artefacts on questionnaire development. Poland and Lithuania prepared a short feedback report on subject-matter related issues and published it on the Weblog. They also linked to Web-based documents related to this subject-matter area. This contribution also got positive feedback from the facilitator.

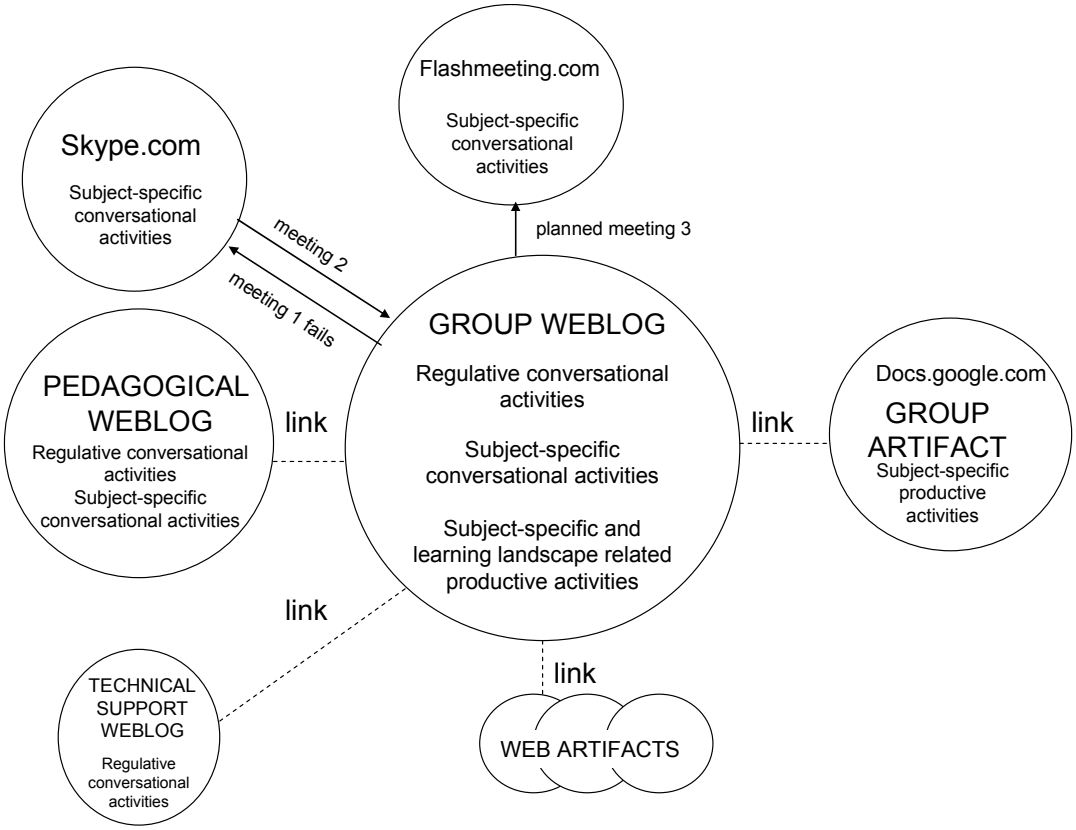

Figure 4: Learning environment example in group 6

On the next day, Estonia suggest on the Weblog to use docs.google.com for preparing the joint artefact. The facilitator added subject-matter related prompts to the shared Weblog, and later this day he launched a Pedagogical Weblog for the trial containing regulations and subject-matter related prompts. The same day Turkey attempted to initiate the next meeting via Skype, but this proposal remained unanswered by Estonia and Lithuania. Anxious about the arrangement, he asked for possible meeting times over and over again. Meanwhile the subject-matter related discourse was abandoned, which triggered Poland to take the lead and shift the subject-matter related production directly to the shared Weblog. Poland proposed some contributions to create shared meanings and asked for feedback. Turkey commented this work and they jointly elaborated the topic in the group Weblog. The active members made efforts to prompt them participate and started to plan the joint Flashmeeting. Poland reminded that the group also owned the shared artefact on docs.google.com. Lithuania reconnected, reporting of continuous technical problems of viewing the blogroll and giving positive feedback about the shared meanings developed in the Weblog. Finally, Poland proposed to meet on Flashmeeting while looking at the artefact on google.docs and arranged the meeting time.

This example demonstrates that Group 6 had problems to decide, which medium would serve as the place for grounding subject-matter related issues and where to realize the joint artefact. Figure above illustrates that the group did hardy engage in productive actions for developing the joint artefact (questionnaire), but dealt mainly with regulative aspects.

The following conclusions were inferred from this analytical approach and need to be considered in our Environment Design model for the Two-Way-Web:

- The learners might lack awareness of their different interpretations of the tools and services within their landscapes;

- The application of different tools and services within certain activities should be conversationally grounded among the group members before a consensus can be established and a common learning environments could be established and start functioning effectively for the group.

5.3.2 Case 2: The evolvement of a common learning environment

This case demonstrates how Group 4 was constantly using and polishing certain activity patterns in their established learning environment.

The shared activities of Group 4 started with the initiation of a group Weblog by Poland. After its creation, individual Weblogs of group members remained neglected except the Weblog of Poland who kept adding some content (schedule, group documents) from the Group Weblog to the individual Weblog. This was an example of self-directed learning practices using an individual Weblog. After starting the group Weblog, Poland also published regulations for his group-mates and started to organise the Weblog into sub-sections and linking it with individual and technical Weblogs. Estonia and Turkey evaluated Poland's activities positively. Estonia also took the initiative and reorganised the group Weblog. Poland and Estonia continued regulating their attempts to re-organise and elaborate the Weblog in the group Weblog itself. The Weblog of Group 4 finally consisted of a shared blogroll, links to the individual Weblogs, and links to the Weblog of artefacts.

The next efforts of Group 4 were directed to the initiation of subject-matter related conversations. Poland suggested holding a meeting via Skype and Estonia introduced shared artefact generation on docs.google.com where she also added her ideas about the questionnaire since she had not been present on Skype. Turkey and Estonia discussed in the group Weblog about possible times for a Skype meeting and on the next day the meeting took place. The facilitator of Group 4 added subject-matter related ideas and links to resources to the Groups' Weblog.

The team planned to meet via Skype the next day. This meeting actually took place and the learners developed a strategy how to distribute tasks and use simultaneously collaborative discussion, shared document generation, and their group Weblog. The group-members discussed the subject-matters, regulative issues, next meetings, and the schedule of work via Skype.

During the meeting one member of the team was responsible for keeping track of the conversation and for publishing a report on docs.google.com that the team used as the external representation of the state of art of their discourse and decisions. After the meeting was over, another member of the group was responsible for preparing the report of the meeting for their group Weblog. This report also consisted of subject-related and regulative decisions. No additional comments were added to the report in the Weblog. This rotating scheme was added to the group Weblog, too.

Besides the group Weblog, the shared document served as the secondary source of the group's regulation. The group followed the same strategy for work both on Skype and Flashmeeting.

It was quite remarking that the tasks of reporting within the shared document and of reporting in the group Weblog were circulated among the group-members. The next few times the report in the Weblog was commented by several team-members after the meeting.

Finally the group decided that the members would work individually on versions of the shared artefacts in docs.google.com. The next meeting was planned on Flashmeeting for comparing and evaluating the output of the individual work on documents.

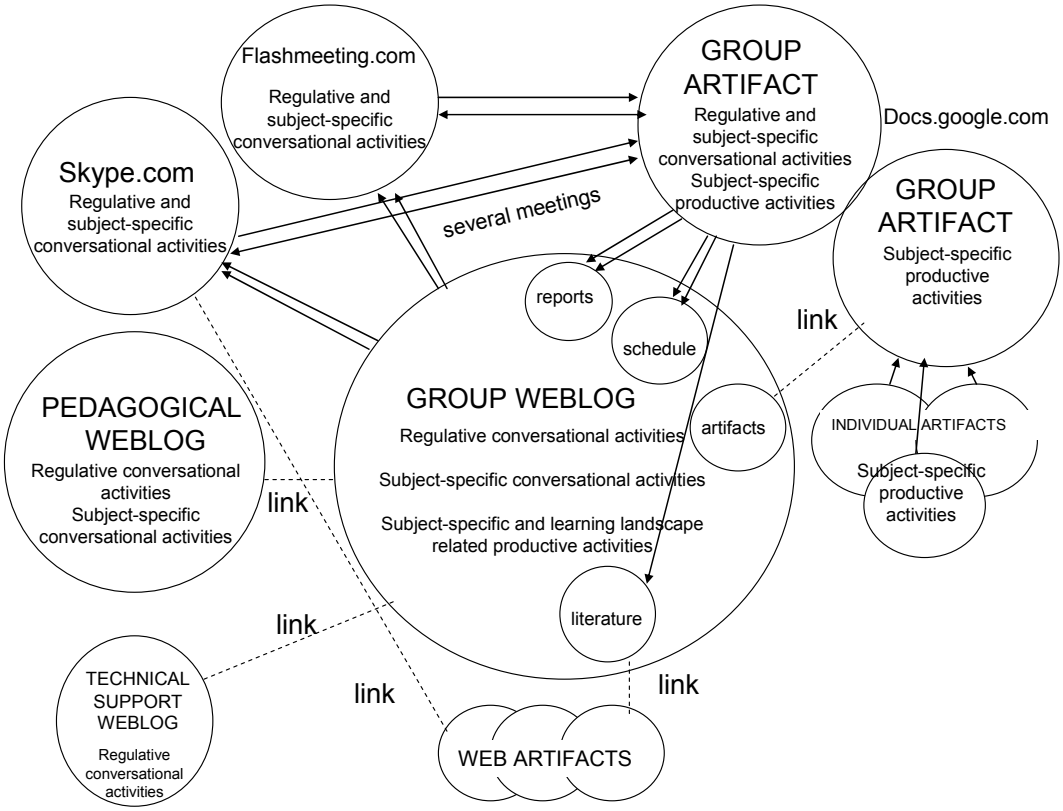

Figure 5: Learning environment example in Group 4

Group 4 managed to establish a shared learning environment and certain workflows making an initial use of three separate tools and services. During subsequent meetings the same practice was repeated and the team-members took ownership of it by circulating responsibilities and contributing comments to the reports. However, while regulating the distribution of work and managing to work in two simultaneous places with the help of external artefacts, the team did not distribute the types of actions between the tools.

The same activities (subject-matter related and regulation related conversational actions, and productive actions) were repeated and refined in three different spaces producing an additional workload for all participants.

The following conclusions were inferred from this analytical approach:

- Teams gradually develop the in-depth common understanding of the affordances of the learning environment;
- Teams may not use the affordances of the learning environment effectively;
- Teams need some feedback during their activities to perceive whether they use their learning environment effectively.

The overall conclusions that we were able to draw from our fieldwork in Trial 1 and the analytical review of the work- and communication patterns that emerged within the various groups, directly inform our attempt to create an improved set of concrete guidelines for setting up Trial 2. After the completion and analysis of Trial 2, we intend to abstract and condense our experiences and derive a more general set of design guidelines for the type of educational challenges that iCamp promotes.

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