The Conflict between Constructivist and Prescriptive Learning in a Virtual Learn-Work Environment

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Abstract

The endeavour of the Virtual Business learning concept of OTO developed at the Open University of the Netherlands, is the implementation of a new type of open learning arrangements, meeting the learning needs of today's bachelor students at the School of Informatics. OTO is the virtual learn-work environment for a course 'Design Project'. The constructivist and prescriptive learning elements in OTO lead to conflict situations, which in our opinion are fruitful for competence based education (CBE).

OTO is the acronym for "Ontwerp Transfer Open Universiteit Nederland" (www.ou.nl/open/otonet).

Keywords: collaborative learning, constructivism, critical transformative room, virtual business learning.

1 Introduction

The Open University of the Netherlands (OUNL) is an independent government-funded institution for higher distance education. Its primary objective is to develop open academic education accessible to anyone with necessary attitudes and interests, regardless of formal qualifications. The OUNL explicitly strives to encourage innovation in higher education. Innovation addresses all dimensions from instructional design to implementation: curricula, teaching methods, electronic mediation, etc. Distinctive for the OUNL's education is guided competency based self-study and teamwork, curricula with minimal pacing and time constraints, plus an orientation towards more cost effective forms of higher education.

At the School of Informatics 70% BA or MA students, already have other degrees and are in paid employment. They want to acquire additional know-how or retrain for a different occupation. Hence they appreciate the freedom of choice, time and place and the possibility to proceed at their own pace. A lot of courses at the School of Informatics are still based on distance self-study. The didactical means are mostly printed course material, CDs, books and readers, supplemented with tutor meetings in the study centres. The course testing is an automated assessment or an open-end assessment at the study centres. Each course is represented in the Study Net. Some courses have there an electronic course book, newsgroup and discussion group. Although, the web is mostly used as a source for study relevant information, the use of the potential of the web for interaction between students and staff is growing. The web is a good alternative for overcoming the geographical distances between students and tutors and creates an awareness of an interaction world of study. The OUNL has moved towards a more demand-oriented approach to education. Students ask for more personalisation;

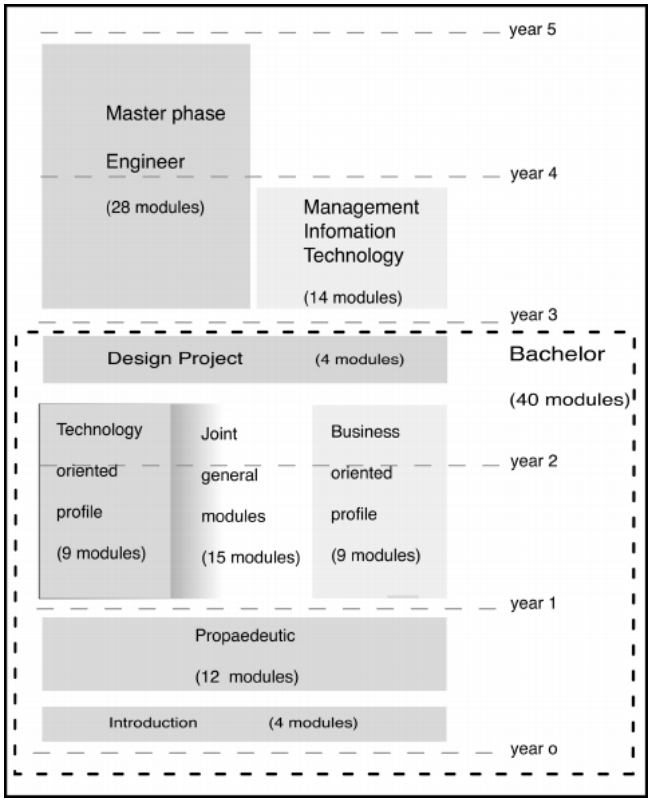

Figure 1: Curriculum of the School of Informatics

a request, which is expected to grow with the tendency towards life long learning and the resulting heterogeneity of future student population. On the other hand the ICT-industries and enterprises call for more team oriented competencies. The need for organizational competence will increase, too. They are looking for 'social-able' employees, with up-to-date domain expertise, proficient communicators, creative problem solvers and above all flexible team workers. Individuals working in teams, within or across companies will have to acquire versatile abilities, a combination of hard and soft skills to participate in a working life based on 'knowledge productivity'. A concept in which Kessels relates the required broad professional skills (competencies) of professionals, to generic learning abilities. Kessels defines knowledge productivity as the ability to signal relevant information, create new knowledge and apply this knowledge to step by step improvement and radical innovation of working processes, products and services (Kessels 1998, 2001). Knowledge construction in organizations is crucial for the continuous improvement of existing products and services and the development of new ones. Ongoing transformations in our society require from professionals to add value to their enterprise through creative use of available expertise. At the same time a pro-active learning attitude integrating new

experiences for the person's knowledge productivity, is expected (Kessels 2001). Software systems have to satisfy the requirements of professional communities whose cultures of practices differ. Simultaneously integration with existing and future systems and components is required. 'Knowledge-ability', and versatile social-ability are crucial to today's competent professional behaviour. As an ICT-professional you need to learn focussing on users, consumers, clients as co-developers of an ICT-product: "(...) *Different relevant social groups have their specific kinds of expertise – we are all experts in specific ways. (...) more is involved in designing large projects (...) than is described in the engineers' handbooks. And for those other aspects, others are experts and need to be involved. (...) The interactions within and among relevant social groups can give different meanings to the same (technical artefacts*)." (Bijker 1996)

However students in distance education have the feeling that their wish to study with individual pace and the team oriented study approach are in conflict. They think that communication, coordination and cooperation tasks are just time consuming and not effective for the individual learning process. As 'knowledge-ability', the power to learn to create new solutions and situated competent behaviour become thriving forces in our economies, the educational debate intensifies on how to meet future professionals learning needs adequately (Drucker 1993, Castells 1998, Bolhuis 1999, Brown 2000). Issues as the transfer of students' learning experiences in academia to subsequent professional practice are crucial. The same holds for the debate regarding instructional guidance for competency growth on-the-job on multiple dimensions. Traditional training approaches strong in predefined transfer of domain expertise and skills in well-defined and prestructured instructional settings will not suffice.

How can distance education adequately prepare students for professional practice? How do we facilitate learning at work and a more team-oriented approach? (Tobias 2000). Education has to provide concurrent domain specific competency growth, supportive social competencies applicable to ill-defined problems in rapidly changing contexts. For professional life the facilitation of competency growth including today's key-competence: the learning ability will become predominant over the traditional learning processes embodied in traditional formal training structures. Responding to these demands a transformation of the content and the learning dimension of the Informatics curriculum is necessary. Therefore the School of Informatics is in the process of restructuring its education offers towards a competence based curriculum. A first innovation step was to position a course of 400 hours of study 'Design Project' at the end of the bachelor degree, imbedded in a Virtual Business learn-work environment OTO builds on notions of social constructivism, critical transformative interactions, situated and experienced based learning (Bolhuis 1999, Crutzen 2000a, Feltovich 1997, Kirschner 2001, Westera 2000). Within this context the web can facilitate 'interaction' and 'presence' between students and tutors. Since a major objective of the CBE curriculum is an ameliorated fit of academic education and the labour market: by preventing or reducing qualitative discrepancies. Hence learning by doing through immersion in the authentic setting of future professional practice might prove to be a successful answer.

2 Interaction, intertwining use and design

Interaction and competency

Interaction is an exchange of representations between actors; an ongoing process of mutual actions from several actors in series of situations. All acting of an actor is a representation of itself in a world of other actors and at the same time an interpretation of that world. Human actors are 'travellers' gathering many experiences, and connecting these to the ongoing interactions. Wherever there is interaction there is also continuity, a continuity of experiences, which function as representations of interactions in the past. Sloterdijk calls this travelling 'horizontal movements' and sees it orthogonal to the 'vertical movement' of thrownness[1]. Thrownness is the necessity of acting in situations without the time or ability to grasp the full consequences of actions or plans in advance (Mallery 1987, Heidegger's Ontological Hermeneutics). Designing[2] a future out of the actor's thrownness in the world of the actual interaction are fusions of experiences, expectations and fantasy. Through these fusions, actors give meaning to the actual exchange of representations. Making use of experiences is giving a situated and actual meaning to these representations in the current interaction. To develop the capacity to intertwine use and design in the actual situation is learning and growing in competency. It is the ability to operate effectively in ill-defined and ever changing environments where participants apply knowledge, skills and attitudes adequately to the task situation at hand.

Interaction worlds, habits and routines, change and doubt

Repeated presentations and interpretations of actions create interaction worlds, spheres of discourses. In such worlds of interaction the potential of all meaning constructing processes that may emerge, depends on the participating actors and the exchanged and ready-made representations. This potential will determine the learning possibilities of the individual actors. Through learning in interaction worlds actors develop habits and routines. In the way actors and the world encounter each other they reveal themselves. According to Dewey acquiring habits out of experiences is the power to develop dispositions, to cope with difficulties of a later situation to represent an acquaintance with the world of actors, materials and equipment to which action is applied. Routines however are repeated and established acting; frozen habits, which are executed without thinking. Most routine acting can be qualified as obvious and therefore invisible for all actors in their world of interaction: *"Routine habits (…) put an end to plasticity. They mark the close of power to vary."* In interaction worlds with only routine acting there is no room for learning. Dewey thinks that most people need to act out of a combination of routine and habits but *"(…) change is always with us as a part of our being and demands the constant remaking of old habits and old ways of thinking, desiring and acting (…) but the effective ratio between the old and the stabilizing is very different at different times*" (Dewey 1916, Chapter 4: Education as Growth, Ratner 1938 p.451). Although through the continuity of developing habits the potential of changed behaviour and sensitivity to situations will remain. For change of meaning and acting, according to Pierce and Dewey, doubting as critical thinking

is necessary[3]:*"But everything which is assumed without question, which is taken for granted in our intercourse with one another and nature is what, at the given time, is called knowledge. Thinking on the contrary, starts, (...), from doubt or uncertainty. It marks an inquiring, hunting, searching attitude, instead of one of mastery and possession. Through its critical process true knowledge is revised and extended, and our convictions as to the state of things reorganized." "Our beliefs guide our desires and shape our actions. (...) Belief does not make us act at once, but puts us into such a condition that we shall behave in some certain way, when the occasion arises. Doubt has not the least such active effect, but stimulates us to inquiry until it is destroyed."* (Dewey 1916, Chapter 22, The Individual and the World, Peirce 1877).

Doubt is always situated in the interaction and occurs not only by the visible in the interaction but also by the invisible. The activity of doubt is a method starting the process of dialog between differences, connecting and disconnecting experiences, it is a movement between construction and deconstruction between use and design: *"(...) embracing the skilful task of reconstructing the boundaries of daily life, in partial connection with others, in communication with all of our parts. (...) It means both building and destroying machines, identities, categories, relationships, space stories. Though both are bound in the spiral dance, (...)"* (Haraway 1991, p.181).

CBE and critical thinking

Competence based education (CBE) aims to provide enough possibilities for unfreezing routines, making them visible, testing and growing in experienced habits and acquire new habits. It demands from students and student teams an autonomous and critical attitude. In CBE the acts of doubting and questioning are crucial. They are bridges between obvious acting and a possible change of habitual acting. Without these habits change is a routine and does not create doubt. Every (inter)action causes changes but not all activities of actors are present in interaction worlds. If changes caused by interaction are comparable and compatible with previous changes then they will be perceived as obvious. They are taken for granted. This kind of interaction will not cause any doubt; they are not present. Actors and representations are only present if they are willing and have a potential of creating doubt and if they can create a disrupting moment in the interaction. According to Heidegger (re)presentations are 'ready-to-hand' and/or 'present-at-hand'. In an exclusive readiness-to-hand, actors are unaware of their presence and they are in a position of 'thrownness', being immersed in a situation. In present-at-hand situations actors are aware of the representation. (Heidegger1926, §15, §16). Acts of doubting and questioning create situations in which a ready-to-hand (re)presentation can be simultaneously present-to-hand; the (re)presentation can be encountered in an intertwined use-design relation. Learn-work environments for CBE are ready-made environments. The question is how they can be open enough so that the prescriptive elements for acting in this environment can be present and that prescriptivism can be experienced as useful and doubtful simultaneously. However in learn-work environments the act of doubt should not become a routine because a continuity of ongoing doubt will lead to despair and not to design; it will create a frozenness of not acting anymore. Creating and supporting such critical transformative learn-work environments is balancing in the actual interaction between the frozenness of the established acting and the frozenness which occur by to much insecurity. A room for such a mutual actability is based on a concept of work and study support of stimulus and impulses which provides that the process of use and design get out of balance. Such support is situated and cannot be planned completely in advance. On the contrary a generalisation of a planned support system makes the negotiation room for the learners very small, fenced in between forced and frozen routine and despair[4].

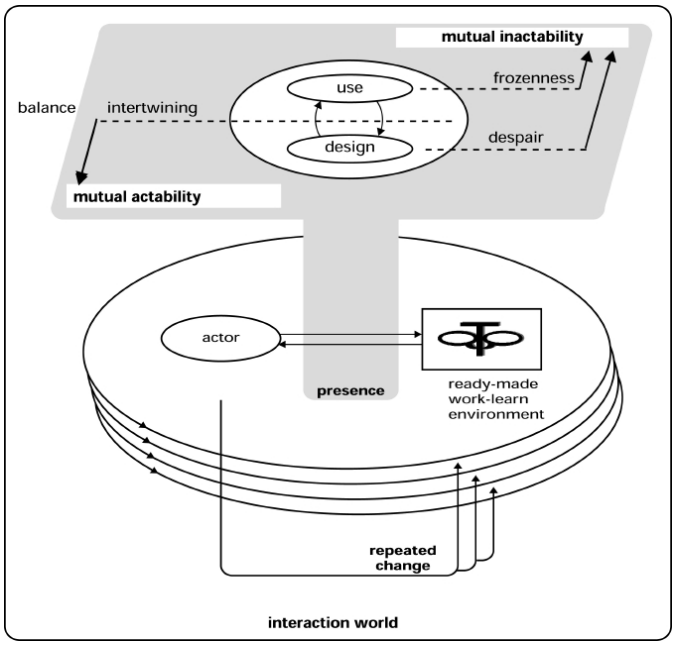

Figure 2: Use-design balance in interaction worlds

The world of Informatics

What actors know and understand is grounded in perceived experiences from their interaction in the worlds they live in (Jonassen 1991 p.10; 1994 p.34-35). The experiences of students at the School of Informatics are situated in the interaction world of their study and their professional job. In these worlds they have developed routines and habits. A learn-work environment should give students the opportunity for doubting their obvious acting, questioning the behaviour of others and transforming their habits developed through participating in the interaction worlds of Informatics. The 'preferred reading' of experiences from the past: representations in the form of hardware, software, methods and theories are negotiable if differences, different meaning construction processes, variety and ambiguity are respected. Differences from the dominant meaning and acting are not errors or failures. Actors questioning dominant discourse in Informatics are not dissidents. However changing 'routine-acting' is always very difficult. Routine does not have much presence in each world of interaction and a lot of people especially computer scientist whose focus is security and non-ambiguity, see doubt as a feeling of insecurity and creating doubt as an unpleasant activity and not as a necessary

prerequisite for change (Crutzen 2000a, b). In every interaction world, there are mutually accepted or enforced habits and routines: *"'Reality', or the way we see reality through the prism of our own culture's means of assigning meaning to the various elements of our world, (...) is a phenomenon which will inevitably be defined differently according to the dictates and needs of different cultures. (...) The meaning of 'reality', therefore, will depend very much on the way a particular society defines it. All elements of that society's history, the totality of its development, including its present economic, cultural, racial, class and political balance, will make it unlikely that any two societies, no matter how similar, will look at one issue in exactly the same way." (Dellinger 1995).* So it is likely that the culture of Informatics discipline differs from the culture of the worlds in which their products will be used. The invisibility of 'routine-acting' is precisely the problem of computer scientist designing ICT-representations for actors in other interaction worlds. The obvious acting in both worlds, the world of computer scientist and world of users, is hidden. They should experience that the meanings of ICT-products are always socially negotiated. Modifications in the culture of consumers cannot be imposed by ICT-products. Consumers should have the opportunity to develop their own use-design interactivity.

Learn-work environments: critical and transformative

In the course 'Design Project' the word 'design' has the meaning of projective acting into the future. So design implies the possibility of changing and changed acting in the Informatics domain and in the domain of learning and working. Learn-work environments can be characterized as critical transformative rooms (Crutzen 1999, 2000a, 2001) within the discipline Informatics if they are critical and transformative on several levels where use-design relations are at stake:

· **The study environment**

The constructivist learning process (Vygostky 1978, Brown 1989, Duffy 1993) of integrated learning and working in an virtual business setting, is a rich and authentic context in which the interactivity of use and design can be realised by confronting the student with an ill-structured domain in which alternative solutions for problems are possible because of the participation of and cooperation in a group of human actors coming from different worlds. The collaborative construction of knowledge happens in two ways: through internal negotiation and through social negotiation. The success of collaboration and therefore the success of collaborative knowledge construction and the sharing of constructed realities depend highly on successful social negotiation of meanings. With respect to this particular point Hiltz points out *that "The social process of developing shared understanding through interaction is the 'natural' way for people to learn"* (Hiltz, 1994, p. 22). However it is crucial that the social negotiation in the critical transformative room should not focus on coming to a shared equal understanding as soon as possible, but only to a mutual actability in which differences and multiple representations of reality are respected, and in a sense of change also appreciated. Learning in OTO is learning while performing in a team. It is active and self-regulated.

· **The methods, theory and practices of Informatics**

By deconstructing the 'use-design' opposition in the Informatics discipline and domain the vanishing of the critical 'subject-position' and the vanishing of design as a changing activity focused on an openness of the future can be 'disclosed'. Doubting and questioning is necessary in working and learning interaction for changing the concept of 'interaction' itself in the Informatics domain; a concept that usually is conceptualised as a transmission between a dominant sender and adaptive receiver in which feedback is seen as necessity for convergence to the intention of the sender. (Crutzen 1997) Interaction is based on the planned cooperation between software and hardware. Necessary is a displacement of the binary opposition 'use–design' and a change in the Informatics discipline to a view that the relations of use and design are basically interactive. Design in Informatics is seen as making a product for a remote world, whose interaction can be modelled from a distance and without being experienced. In the process of making ICT-representations those models of interaction are frozen into the behaviour of computer scientist and into the ICT-representations, which they them self use and which they apply and force back onto the informatics domain. ICT-professionals are mostly not designing but using established methods and theories. They focus on security, non-ambiguity and are afraid of the complex and the unpredictable (Crutzen 2000a, b, 2001). As Hirschheim a. o. claims "*The research literature by and large continues to promote one paradigm: functionalism in ISD (comment: information systems development) and objectivism in data modeling. (…) the textbooks on data modeling and IS development which form the basis of university teaching, they are virtually entirely functionalist in orientation (...) So the academic community perpetuates, consciously or unconsciously, functionalism. We teach it to our students (…) The students (…) apply it in practice. However in applying it to practice, it is likely that the shortcomings of functionalist approaches surface.*" (Hirschheim 1995 p.237). A learn-work environment in which the working process is based on practices of Participatory Design in a real business setting can discover that ambiguity and doubt creates a changed vision on design.

· **The relation of consumers with ICT products and their involvement in the development of an ICT product**.

The usage practices of professionals are reflected in the ICT-products ready-made for consumers. Users are not given enough opportunities to intertwine use and design. Meaning construction processes have disappeared in processes of doubtless syntactical translation. The dominance of ICT ready-made products closes off and mostly prevents the act of discovery of the users by the designer and acts of discovery on the part of the users. Design is focused on generalised and classified users. Users are turned into resources, which can be used by designers in the process of making ICT-products. Users do not have room any more for starting their own designing processes. Those who do not fit in pregiven classes are seen as dissidents. Use and design cannot be treated as activities in different worlds; a world of senders (informatics professionals) and a world of receivers (consumers), while the IT-products are seen as the exclusive links between these worlds. A reconstructed meaning of 'use' is: Using ICT-representations means always designing and redesigning a

flexible world of interactions between human and non-human actors. For human actors involved in these worlds it should be possible connecting and disconnecting the interaction between themselves and the non-human actors (Crutzen 2000a)[5]. ICT-representations should always have a presence of leavability; a user should be allowed to use the ICT-representations as a routine but also give the users the opportunity of learning in which situations the ICT-representations are adequate and in which situations they should be abandoned (Crutzen2001).[6] A closed readiness is an ideal, which is not feasible because in an interaction situation the acting itself is ad-hoc and, therefore unpredictable. The ready-made behaviour and the content of ICT-representations should be differentiated and changeable to enable users to make ICT-representations ready and reliable for their own use. The means of interaction with ICT-representations should be as diverse as possible and the presentation of the ICT-representations' behaviour must not determine the acting of users. Translations and replacements of ICT-representations must not fit smoothly without conflict into the world they are made ready for but the range between desperation and obvious acting should be leavable, useful and reliable.
This use and design concept is realised in the implementation of OTO since as students they are consumers of a ready-made implementation, too.

3 The implementation of OTO

The Company OTO
For the 'Design Project' course a virtual company OTO is started by the School of Informatics based on and developed out of a generic learning concept: the Virtual Company developed by the OUNL as an organization-for-learning and a learning organization (Westera 2000). The demands of the professional workplace for communicative employees able to deal with non-routine working processes operating in teams embedded in a turbulent business environment lie at the basis of OTO. Students are temporary employees in OTO during the project and work collaboratively in teams of 5 to 10 members. The staff roles in the company are director, human resource manager (hrm), coach, knowledge coordinator, help desk and expert. The parts are taken by employees of the OUNL. If necessary students can consult experts from outside the OUNL. The director in cooperation with the hrm is responsible for the contacts with external organisations. They make the initial contacts and acquire project proposals from which the student teams can choose. The external business goal of the company OTO is to offer to other organisations a cooperative and participative redesign process (analysing, modelling, implementing, evaluating) of the relation between their business processes and their information system. OTO offers its clients a participatory design process. OTO-employees (the students) intentionally and continuously involve employees of the external organization in the interaction redesign process of the external domain. External organizations must make a commitment that they are willing to give participation time in the project. The team refines the chosen initial proposal together with the representatives of the external organization to a project draft and first product idea and later on to an external project planning script. This script contains the basic agreements of the formal contract that the external organization and OTO sign. This contract symbolises the end of the A(cquisition)-phase of the working process and the beginning of the P(roject)-phase. The internal business goal of OTO is competence development of each employee, of each team and OTO itself by means of knowledge and human resource management and by evaluation of the business processes of OTO strengthening the changing potential of OTO; all employees, staff and project teams, to design the process of learning together.

The learn-work environment OTO
Conventional instructional scripts do not fit the learn-work community in OTO. The main processes in OTO, working and learning cannot be completely planned in advance. Therefore they are only minimally prescribed. However OTO is not supposed to be a work environment in which learning results depend on learning occurring by chance. On the contrary OTO is purposefully designed to facilitate critical transformative learning. OTO offers the students a set of well defined competencies they can develop. The broad range of professional skills defined in the 'Workplace Big Five' (Pi Media) and Kessels' professional core competencies[7] are regarded as key objectives for learning on the job, and are essential for preparation of students for professional practice. The basic OTO competencies are cooperation, integrity, client orientation, result orientation and self development. Students

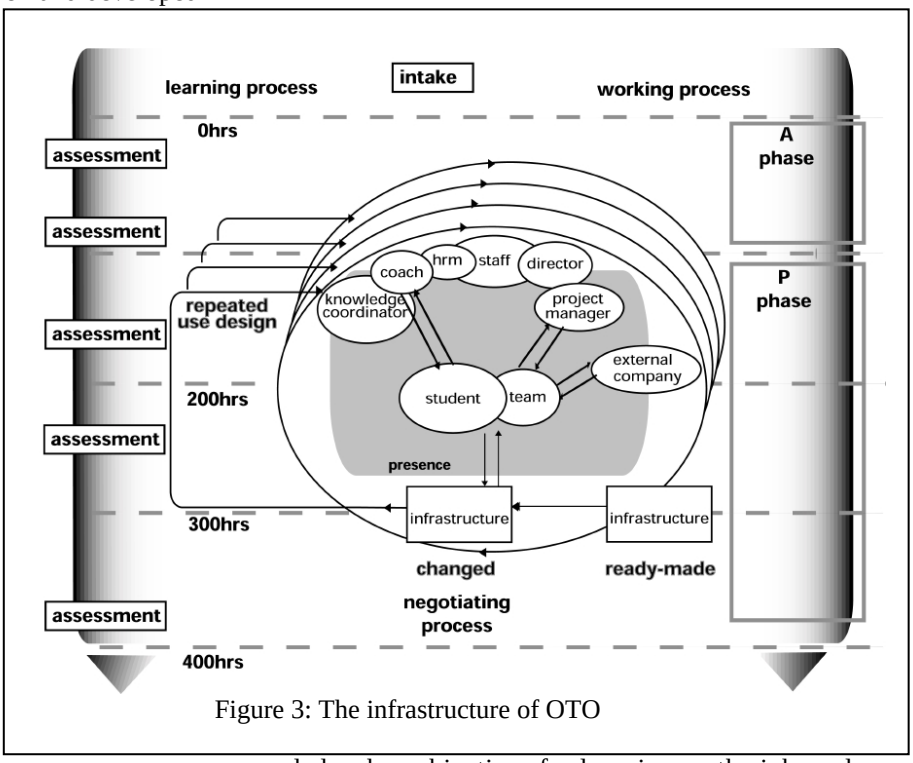

Figure 3: The infrastructure of OTO

can couple these with an individual choice of competencies, related to the tasks and roles they can take in the team, such as flexible behaviour, initiative, problem analysis, power of reasoning and judgement, organisation sensitivity, quality oriented, adaptivity. Beside to the competency definitions there are descriptions of ICT jobs and tasks in which specific competencies are needed. The definitions are accompanied with coaching and performance tips.
The personal growth objectives for each OTO professional are laid down in a personal development contract in the intake. The contract will be renewed constantly through peer-, coach- and self-assessment. In OTO there are a lot of instruments available for assessment. Each assessment is followed by a coach-student consultation. Together with the external planning script each team composes at the end of the A-phase an internal planning script in which the tasks and the roles of each team member are mentioned. These tasks and roles should be linked to the competencies they want to explore. It is the responsibility of the student team to combine the working and learning process in the internal planning script. The internal and external planning scripts are the starting documents for the P-phase. During the P-phase these planning scripts are continuously adjusted to the circumstances in the project interaction.
A project manager from the OTO staff supports the working process in each team. This role is a supporting role for the working process. In the role description of the project manager there is a set of impulses available. Besides that a personal coach supports the learning process of each student employee. Project manager and coaches are not leading in the A- en P-phase of project. The project manager and coach give impulses only in situations when a student or a whole team is blocked, and processes are frozen, and the balance between use and design is lost.
A very useful instrument is the personal reflection template in the electronic student portfolio in which coach, project manager and student comment the ongoing activities in relation to the chosen competencies. By commenting the ongoing learning and working processes the student can reflect on her/his performance and relate activities in the working process to the objectives of the learning process. Besides the support by staff members and the competence structure, OTO provides in its infrastructure a variety of tools, templates, skeleton contracts and a library with relevant articles on methods and theories.
OTO has a lot of tools to support the communication, coordination and planning processes needed for collaborative work in a networked environment, for assessment and coaching, for (knowledge) management and especially for the working process and the interaction with the external organizations. In the electronic study material a global description of the working and learning processes and of the competencies student employees can acquire, are provided.
The infrastructure is offered to students mainly as an open structure with only minimal prescriptive elements. For instance in OTO there are some strict rules regarding privacy and responsibilities for the learning process of oneself and the colleague team members. The teams can decide autonomously which tools, methods and theories they want to use for making the product, only with the constraint of the client's close involvement. Using this structure, students and the student teams can negotiate a tailored, personal growth in the team. By the critical use of the infrastructure through student teams and staff, OTO is growing into a virtual environment of differences in acting. It is the task of the human resource manager and the knowledge coordinator to keep the balance between an overwhelming offer of differences in coaching approaches. In the role of examiner of the Design Project it is the task of the OTO director, in spite of all these necessary differences, to guarantee a fair and just final assessment.

4 Learning in OTO: first student experiences

The design and availability of the educational facilities provided in OTO enable the student employees to acquire as many competencies as possible, acquire domain-expertise as well as self-propelling learning attitude for sustained life-long learning in work practice. How do students experience learning in OTO designed on such different foundations as the more prescriptive learning arrangement they encountered earlier in their study? Since OTO has become operational we can present the impressions of the first student teams, the 'OTOWEG' and 'Omega' teams. In both teams the students live geographically distributed in the Netherlands and in Belgium.
First of all students highly valuated the possibility to be able to focus on their own competency growth while working in a real work setting. Even when they were already working in an ICT job the possibility to explore their own potential in a safe setting, where doubt and insecurity are allowed, were of great importance to them. However in the future the competency definitions including the performance and coaching tips needed a more appropriate formulation according to the teleworking situation.
Since the work takes place in a virtual setting: distributed, computer mediated and predominantly a-synchronous, the students noticed that the process of getting acquainted to each other is differed from their earlier experiences: working face-to-face in teams with people one already knew somehow. Communication and coordination processes in a virtual e-room differ especially in the beginning, when you are not yet familiar with your team member's contexts and qualities. The processes of getting acquainted with the abilities and ambitions of each other takes time. Decision-making in the first phase therefore is a somewhat difficult and a more time-consuming process since it intermingles with the complex processes of becoming a team. In a virtual room team oriented interactions such as communication, coordination and planning lose their routine status. The technology of a virtual room reveals the richness of human behaviour not mediated by technology and it discovers that technology supports especially structured communication, planning and coordination. In the beginning of the A-phase some necessary impulses of the project manager prevented the new employees from a too high level of frustration. However the students' discovery that some of the work was done twice or superfluous lead to their conclusion that a team leader was no luxury. On the other hand in both teams the experience of their own autonomy was fruitful for becoming acquainted with the freedom of a non-restrictive way of use and design.
The OTO environment was experienced as an environment in which students see themselves confronted with a multitude of new elements: a task different to earlier assignments, a new work environment, new expectations and new learning

possibilities in a variety of dimensions. For most students working so intense in a team was new, too. The richness of the OTO learn environment however offered each student the possibility to choose for learning objectives matching her or his ambition.

The asynchrony of the OTO learn environment fits very well to incorporate the OTO work into the student's daily (job and private) obligations. Most of the students work in OTO during evenings and weekends. However the asynchronism places a burden on the rapidity with which processes take place: it takes some time before you receive feedback on a message or proposal to your coach, project manager or teammates. In this sense it burdens a smooth and rapid workflow and decision-making. In a future experiment with synchronous electronic work facilities we want to experience how and when synchrony can support coordination and cooperation. At the moment the students do a lot of telephone conferencing and net meeting. Incidentally they meet face to face, especially for client contacts.

Students experienced that it was difficult to concurrently cope with the ongoing performance in learning- and group-processes. Problems and postponing decisions led to stress in order to meet deadlines with the client. So the reflection template was introduced as an instrument for the second team and it proved to be adequate for connecting the working and learning processes. What worked very well was the attention to the chosen competencies. As a student expressed: "It enlarged your awareness on your attitude, behaviour and it forced you to explore tasks which in other circumstances you would ignore out of escapism." Another student observed that in the P-phase the attention to competency development was overlooked by the stress getting the project done. The student experienced that as something what is typical for an ICT job.

Virtual communication and asynchronous working requires a lot of time. Especially participation of persons of external organizations was time consuming. Students have discovered that "you need to start this process as early as possible" (one of the many guidelines the first team advised to the second team).

As staff we have learned that giving only the necessary impulses does not mean not giving stimulating and positive feedback.

Making OTO a more realistic company, we plan to make the staff team's work more visible for the student teams and we have to do efforts to support the knowledge management of the students more, because students are not experienced enough to do this all by themselves. We need to develop stimulations to encourage students to read articles from the OTO library to enhance their knowledge, especially on Participatory Design. We also have to enhance the means of transporting knowledge and expertise between teams.

We believe the OTO concept fulfils the requirements of a constructivistic learn environment. In line with the claim stated by the constructivists that knowledge and skills are best acquired in the context of a real life experience our design of 'employee teams' uses a 'natural' setting, thereby preserving the complexities and uncertainties of real life. Task and role performance within the teams connects knowledge and skill construction to the real life working problems of the business context of a real company.

We have seen that the application of an electronic telecommunication network enables group members to be connected and allow having interpersonal conversations in which meanings and individual and team behaviour are socially negotiated, using the ready-made infrastructure intensively and differentiated. There is good balance between the prescriptive elements and the variety of free choices. It stimulates students to discover the qualities of their team members and becoming good colleges.

Is there a conflict between the demand of students for prescriptive learning instructions and the situated self-directive learning of the students in authentic collaborative action of participatory design? There are conflicts because we have chosen for an approach in which the 'travelling' of the student teams is not smoothly. Roundabout ways enable unexpected experiences. We only give impulses if they loose their orientation towards the product: to design their own competency growth, and towards the client's needs for the product. However we have learned that travellers should receive a 'warm bath' regularly to refresh their use-design energy.

Acknowledgements

The development of OTO, its concepts, design and implementation is teamwork. We are indebted to the contributions of the other staff members of the OTO team: Erik van der Hout, Herman Koppelman, Paul Oord, Peter Putter, Marjo Rutjens, Howard Spoelstra, Peter Szumski, and the first two OTO teams: OTOWEG and Omega.

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Notes

[1] Sloterdijk 2001, Absturz und Kehre, Rede über Heideggers Denken in der Bewegung, p.41-45

[2] (Heidegger 1926, §31, p.145-148) Heidegger uses the word 'Entwurf' (project-in-draft): "*The German terminology shows us clearly the opposition that there is in Heidegger's thought between dereliction and the project-in-draft – between Geworfenheit (comment: thrownness) and Entwurf. (comment: Design) (…) 'Entwurf': "does not mean, …, to contemplate this beyond as an object, to choose between possibilities as we choose between two paths that intersect at a crossroads. This would be to deprive possibility of its character of possibility by transforming it into a plan established beforehand. Possibility must be seized in its very possibility – as such it is inaccessible to contemplation but positively characterizes the way of the being of Dasein. This way of being thrown forward toward one's own possibilities, of adumbrating them throughout one's very existence, is a crucial moment of understanding."* (Levinas 1996).

[3] Dewey gives several meanings to the function of doubt in a variety of modes of thinking; the thinking necessary for change (Ratner 1939, p.837-850) (Dewey 1917, p.183-216).

[4] Despair in the meaning of continuous doubting. Dewey calls this kind of doubt an intruder, a not welcome guest (Ratner 1939, p.838) (Dewey 1917).

[5] Dourish calls this use-design relation to ICT-technology 'coupling': *"(…) coupling is (…) how to assemble the range of computati-onal components available to me into a grouping through which I can achieve whatever effect I need."* (Dourish 2001, p.140-142).

[6] Heidegger calls this "Verläßlichkeit". He used it in two meanings: leavable and trustworthy (reliable) (Heidegger 1936, p.28-29).

[7] Kessels seven key competencies for the professional: technical-occupational competence; methodological; organisational; social-cooperative; cultural-normative; strategic; learning competence.
The assessment instruments and competency definitions of OTO were developed in cooperation with PiMedia (Big Five competencies see: www.pimedia.nl).