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Guidelines for the implementation of effective e-learning courses based on collaboration

Report 2

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1 INTRODUCTION

1.1 Document Overview

This document is a result of the biennial Socrates-Minerva project ***"Social networks and knowledge construction promotion in e-learning contexts"*** (http://minerva.ing2.unibo.it).

It presents itself as a practical handbook for the implementation of effective e-learning courses based on collaboration, with particular focus on designing and implementing aspects. Although guidelines are presented in a pragmatic manner, this does not mean that we have neglected the theoretical principles at their basis. On the contrary, we will describe them in detail so that readers may clearly understand the origins of the good practices and the practices that we suggest.

This handbook is aimed at people, and particularly at teachers and tutors within and across cultural institutions who are contemplating, or are already executing, e-learning activities / projects. It reports the outcome of the work carried out by the project's team, coordinated by the University of Bologna, Department of Education (Italy), which includes the following partners:

- Ludwig-Maximilians-Universität, Department of Psychology, Institut für Pädagogische Psychologie, Munich (Germany);
- Department of Electronics, Informatics and Systems (DEIS), University of Bologna (Italy);
- University of Turku, Faculty of Education, Educational Technology Unit (Finland);
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- Coordination e-Learning. Université de Neuchatel (CH);
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In the next pages, readers will find a presentation of the project introduced by a brief description of the idea that has inspired our research (see paragraph 1.2 "Background").

Chapter 2 ("Computer-Supported Collaborative Learning"), then, will provide the necessary theoretical elements to introduce the notion of computer-supported collaborative learning (CSCL), and to explain the process of knowledge construction in e-learning contexts. Subsequently, we will describe the main results obtained from an exploratory study conducted on a sample of noteworthy e-learning experiences on the European scale. This will be followed by a detailed report of e-learning experiences and courses which were designed and developed within this project (see Chapter 3 "E-learning courses: example of good practices"). Our aim here is to provide readers with practical examples of e-learning courses, which illustrate some of the most important psychosocial aspects that come into play in learning contexts, and which indicate possible intervention strategies. In other words, we would like to offer examples of "good practices" and possible ideas and suggestions to be taken into consideration in the formulation of future e-learning courses, so that distance learning may be more effective both as far as the involved educational processes and the technological resources to make them possible are concerned.

Chapter 4 focuses on practical guidelines. These are presented as practical examples of activities and suggestions for the design and implementation of e-learning courses. They are meant to encourage a more effective development of those cognitive and social processes that characterize collaborative e-learning courses, which comprise activities related to knowledge or information exchange between collaborators (see paragraphs 4.2 and 4.3).

Technological aspects will be discussed in Chapter 5. We will offer a general overview of existing technological tools and instruments, together with some guidelines and a description of *ad hoc* designed collaboration tools conceived as *artefacts* that can be easily exploited altogether in a coherent and effective way. Furthermore, the conceived artefact provide components which can ease the monitoring of student social interactions by observing the artefact counterpart of collaboration tools**.**

Deeper insights on the issues of sustainability and learning transfer, and, specifically, of Social Networks Analysis (SNA), which is increasingly employed for monitoring and analysing individual and collaborative actions in e-learning environments, may be found in Chapter 4 (paragraphs 4.5).

The themes of digital divide and social inclusion, finally, will provide a sort of general framework for the results and instruments we presented as possible resource for the realization of e-learning courses. Since this topic plays a particularly important role within the European context, it may indeed be considered as the thematic framework of our project. As a matter of fact, e-learning would not be possible without overcoming digital divide. Moreover, distance learning may contribute to the achievement of one of the priority objectives of the European Union's policy, i.e., social inclusion. Fostering higher levels of education and long-life learning may in fact improve the life conditions of all European citizens (see Chapter 6).

1.2 Background

The present work is the result of a project that was co-funded by the European Commission within the Socrates programme, which consists of a range of "Actions" to be taken within the field of education. The main aims of Socrates - Minerva programme consist, firstly, in promoting a better understanding of the implications of ODL and ICT for education among teachers, learners, decision-makers and the public at large; secondly, in making sure that pedagogical considerations are given proper weight in the development of ICT and multimedia-based educational products and services; and, thirdly, in promoting access to improved methods and educational resources in this field. Minerva is an important instrument for following up the Council Resolution related to educational multimedia software, which was adopted on 6 May 1996. This Resolution emphasised that the use and evaluation of ICT in education must lead to an improved approach to the meeting of teaching and learning needs, and introduce new methods which take full account of the evolution of the role of the teacher, give pupils and students a more active and participatory role, personalise learning, encourage a cross-curricular approach, and foster collaboration and multidisciplinary learning activities (Further information may be found at: http://ec.europa.eu/education/programmes/socrates/minerva/index_en.html).

During the last 20 years, the development of new technological tools and the increasing need of life-long learning have led to a growing attention to online education, i.e., e-learning activities. In turn, the interest towards e-learning has given rise to a considerable amount of activities, experiences and research on the application of technology for supporting learning activities – which are especially applied to higher education. Thus, Open and Distance Learning (ODL) and Information and Communication Technology (ICT) in education have attracted the interest of both scholars and practitioners (i.e., of "providers" of education at different levels and in different contexts) involved in learning activities.

Globally, this phenomenon has encouraged a rapidly growing amount of research focusing on technology-supported learning from different theoretical perspectives (for a review: Larreamendy-Joerns & Leinhardt, 2006; Resta & Laferrière, 2007). Moreover, its multi-faceted character has made e-learning a trans-disciplinary field of inquiry, which includes psychology (educational, social and cognitive psychology), learning sciences (pedagogical and didactic sciences, educational technology), computer science (artificial intelligence, agent-based systems), and communication sciences.

Moreover, the increasing interest and use of online education has opened up a wide scenario of experiences, in which the use of technologies within learning activities is the common denominator. A teacher or tutor who aims at organising an e-learning course can

now wonder whether all learning experiences involving technologies are effective at the same level, and he/she may ask him/herself which ones, among the several strategies to adopt when designing and developing e-learning activities, are the most effective in order to foster knowledge acquisition in learners.

On the basis of this emerging interest and demand from the field, the European project **"Social networks and knowledge construction promotion in e-learning contexts"** (http://minerva.ing2.unibo.it) applies a sort of "knowledge transfer" approach, with the purpose of providing ICT-practitioners with good practices and guidelines drawn from empirical research in psychology of education. Such research is particularly focused on the idea of social nature of knowledge and abilities, which was especially developed in the Vygotskian tradition. Drawing on research evidence concerning the complex relationships between social interaction and cognitive activities, we basically aim at detecting, describing, and suggesting educational practices and technological artefacts, which may foster the beneficial effects of social interaction on knowledge construction.

The project was developed from October 2006 to the end of September 2008 according to the principles of action-research, and it involved the following four subsequent phases: 1) an exploratory study on a sample of noteworthy e-learning experiences (on the European scale); 2) the design and delivery of e-learning courses based on emerging "good practices"; 3) the process and outcome evaluation of e-learning experimental courses; 4) the identification of "guidelines" aimed at fostering good practices, which may facilitate the promotion of knowledge construction through social interaction; 4) and dissemination activities (international meetings, web-diffusion, etc.) that took place during the whole duration of the project.

This document covers all aspects and elements that we took into consideration in the course of the project. It is particularly focused on the most important practical lessons learnt, and on the information collected by the project team, so that readers are given a clear picture of the context in which this document was formulated and written.

2 COMPUTER-SUPPORTED COLLABORATIVE LEARNING (CSCL)

2.1 Background

There are at least two distinct phenomena that have led to the interest in computer-supported collaborative learning (CSCL), namely, the rise of information technology and networks from the 1970s and onwards that made new, innovate ways of collaboration possible (Stahl, Koschmann, Suthers, 2006), and perhaps even more importantly, the emerging of the socio-cultural learning paradigms and metaphors (e.g. Lehtinen, 2003). After mid-1990s computer-supported collaborative learning became a somewhat distinct field of study in educational technology (Koschmann, 1996), although nowadays most of the studies concerning information and communication technology in education focus more or less on the collaborative and interactive aspects of learning (Lehtinen, 2003).

In order to unweave the theoretical background of computer-supported collaborative learning, it is necessary to start from the paradigms (old, new and the shifts between these) of learning that have influenced the field, both the development of practical solutions as well as research interest. Usually, the distinction is made between three metaphors of learning: acquisition, participation and knowledge creation/building (Sfard, 1998; Lehtinen, 2003; Lipponen, Hakkarainen& Paavola, 2004). These three metaphors are based on different views on knowledge and learning. Acquisition metaphor is founded on theories of knowledge structures and describes knowledge as a property of an individual mind and learning as acquiring this knowledge, i.e. moving information from teacher and books into students' mind. Thus, using this metaphor, the focus of educational practice has been on the acquisition of domain-specific knowledge and collaboration or social interaction has been seen as a mere means of facilitating individual cognition (Sfard, 1998; Lipponen, Hakkarainen & Paavola, 2004; Lehtinen, 2003; Suthers, 2006). In contrast, the participation metaphor, with foundations in situated and distributed cognition as well as Vygotskyan tradition, depicts learning as becoming participant in cultural practices. This metaphor borrows heavily from traditional apprentice-master –model of learning: knowledge is located in the practice, discourse and activity of the group (Suthers, 2006), and collaboration also provides the

enculturation and scaffolding needed to internalize the abilities that first arose on a social level. (Sfard, 1998; Lehtinen, 2003; Lipponen, Hakkarainen& Paavola, 2004.)

The third metaphor proposed by Hakkarainen et al. (Hakkarainen, Palonen, Paavola, & Lehtinen, 2004), knowledge creation, is related to Bereiter's (2002) knowledge building and Engström's (1987) expansive learning models. [Suthers (2006) points out the distinction between Bereiter's knowledge building and knowledge construction; knowledge building refers to the deliberate effort of increasing cultural capital. Whether the knowledge or cultural capital created through collaboration is "new" is relative to the group's previous knowledge.] Knowledge creation refers to the phenomenon of creating, not acquiring, new knowledge and skills through cultural practices. It is evident that in this model the nature of knowledge is more dynamic, i.e. knowledge is something that is developed and worked on in collaborative practices. (Hakkarainen, Palonen, Paavola, & Lehtinen, 2004; Lipponen, Hakkarainen& Paavola, 2004.) This overcomes the problems, or exceeds the characterization, of learning as participating in the "community of practice":

> In modern educational situations, however, we deal with rapidly changing situations and it is difficult to see how traditional ideas about apprenticeship could be a sufficient basis for powerful learning environments in the future. (Lehtinen, 2003)

Shifting educational goals from the acquisition of knowledge or cultural practices to knowledge construction, it is more malleable to different and new learning situations, on any level of education. It should be noted that while the abovementioned metaphors are based on different assumptions and premises about the role of social interaction in learning, and locate and describe learning and knowledge accordingly, they are not mutually exclusive (Kaptelin & Cole, 2002). Lipponen, Hakkarainen and Paavola, (2004) note:

> As shown, each one of these frameworks poses theoretical, methodological, and practical implications for CSCL research. - - Even if the stress in CSCL research is on socially-oriented theories of learning, or theories of knowledge creation, one can conclude on the basis of our analysis, that there is still no unifying and established theoretical framework, no agreed objects of study, no methodological consensus, or agreement about the unit of analysis (this is of course, the challenge of many other disciplines as well), or no established way to classify the variety of tools that might be considered as CSCL tools.

2.2 Definition of Collaborative Learning

Koschmann (2002:1) describes the field of computer-supported collaborative learning as dealing with "meaning making in the context of joint activity and the ways in which these practices are mediated through designed artifacts". Although co-operative learning has played a role in the development of CSCL, it is useful, and common, to distinguish collaborative from co-operative learning (Stahl, Koschmann & Suthers, 2006; Dillenbourg, Baker, Blaye, & O'Malley, 1996; Roschelle & Teasley, 1995). Roschelle and Teasley (1995) define the distinction as follows: cooperative work is accomplished by the division of labor among participants, as an activity where each person is responsible for a portion of the problem solving, whereas collaboration involves the mutual engagement of participants in a coordinated effort to solve the problem together. This distinction also shifts the focus of research from the individual learner to the group process, from acquiring and participating metaphors towards knowledge creation and building metaphors (Stahl, Koschmann, Suthers, 2006). The chosen framework, co-operative or collaborative learning, typically has also implications on the desired achievements of the learning process. While co-operative perspective focuses more on the motivational and social rewards of the co-operation, collaborative perspective focuses more on the cognitive aspects (developmental and cognitive elaboration) of the learning environment. (Lehtinen, 2003; Slavin, 1995.)

Both the Vygostkyan and the Piagetian tradition have contributed to the definition of collaborative learning. Thus, the term is understood and valued differently among different researchers (Lipponen, Hakkarainen & Paavola, 2004). In Piagetian tradition, the value of collaboration is based on two possible outcomes of it; Socio-cognitive conflict causes a state of disequilibrium in the cognitive system, that results in new understanding and knowledge. Other outcome would be "*one's increasing ability to take account of other peoples' perspectives*", i.e. going "*from an undifferentiated and egocentric social perspective to in-depth and societal-symbolic perspective taking*" (Lipponen, Hakkarainen & Paavola, 2004:39, see also Lehtinen, 2003). Vygotsky's idea of development due to operating within one's proximal zone of development has been influential in understanding collaborative learning, as group members and peer-interaction offer behavioral models more elaborated than what one learner alone could perform (Lehtinen, 2003). While Piagetian traditions relies mostly on the acquisition metaphor, some of the Vygotsky's views on collaboration could be interpreted via the participation metaphor, as they stress the role of social interaction (Lipponen, Hakkarainen & Paavola, 2004).

2.3 Advantages of CSCL

Advantages of CSCL could be divided into two categories:

1. Advantages of collaborative learning in general:
    a. In addition to the learning, students engage in creative social interaction.
    b. It is possible to solve complex problems students could not solve independently by combining different skills and knowledge its members have.

2. Advantages of computer-supported collaborative learning:
    a. Computer-supported learning environments turn communication into substance, i.e. make thinking visible. This "forces" students to externalize their thoughts and gives themselves, as well as other students, the possibility to evaluate and elaborate them.
    b. Technological environments offer cognitive tools to structure, guide and support problem solving.

The first educational uses of computers, e.g. computer-aided instruction (CAI) were based on the idea of individualizing teaching according to needs of student at that moment. Many educators were uneasy with this solo-learner model that seemed to exclude the user from the social interaction of traditional classroom work (Lehtinen, 2003). This fear was probably reinforced by the stereotypical view of computer-users as anti-social "geeks" (Stahl, Koschmann & Suthers, 2006). The situation has changed dramatically. Today, largely due to the rise of Internet, the most prominent applications as well as the most important fields of educational technology research concerns the possibility of social interaction via (but also around) computers. Computer-supported collaborative learning arose partly in reaction to the solo-learner software, because it is "*based on precisely the opposite vision: it proposes the development of new software and applications that bring learners together and that can offer creative activities of intellectual exploration and social interaction*." (Stahl, Koschmann & Suthers, 2006:1.)

In addition to alleviating teacher's fears of anti-social learning environments, the characteristic social aspect of CSCL has been seen as one of the advantages promoting learning, based on both cognitive theory and current philosophy of science that stress the socially distributed nature of human intelligent activity (Lehtinen, 2003; cf. Hakkarainen, Palonen, Paavola & Lehtinen, 2004; Hutchins, 1995; Pea, 1993; Perkins, 1993; Resnick, Säljö, Pontecorvo & Burge 1997). This is especially true in subject areas where computer supported collaborative learning has been seen as most promising, that is where, instead of completing isolated and organized sub-tasks or exercises, students have to solve complex, ill-

defined problems. By collaborating with their peers in a computer-supported learning environment, it is possible, through social interaction, to combine the partial resources (such as information and skills) of participants and deepen the understanding of the problem. The cognitive load (load on working memory) is shared between participants and cognitive tools of the learning environment thus enabling solving of more complex problems than would have been possible by an individual agent. (Lehtinen, 2002; Pea, 1993; Salomon, Perkins, & Globerson, 1991; Resnick, Säljö, Pontecorvo & Burge, 1997; Miyake, 1986.)

While much of the abovementioned is also true in case of face-to-face collaboration, there are advantages that are characteristic to the computer-mediated collaboration, or CSCL. Dillenbourg (2005:260) summarizes: "these environments turn communication into substance". CSCL environments transform the internal processes of participants into a shared group working memory that acts as a joint representation of the problem, which can be further examined, re-interpreted and refined. (Lehtinen, 2003; Suthers, 2006; Stahl, Koschmann & Suthers, 2006; Dillenbourg, 2005; Paavola & Hakkarainen, 2005.) Also, the externalization process in itself fosters learning and cognitive achievements. In order to explain the concept, problem or solution to other learners, one has to organize the knowledge in a comprehensible and coherent way. The power of externalization is also evident in the Reciprocal Teaching model (Palincsar & Brown, 1984; Järvelä, 1996), in which learner develops meta-cognitive skills by focusing on the essential elements of the problem. In addition to this, before one is able to teach the content to other learners, one has to combine and formulate the essential elements of the problem in a meaningful way (e.g. Lehtinen, 2003).

The benefits of computer-supported externalization of individuals' mental models are not limited to the traditional view of learning as something that happens and is measured individually. As Stahl (2006) notes, this view of learning is problematic in the CSCL framework for two reasons. Firstly, learning happens everywhere and all the time, and thus, it is impossible to pinpoint the actual cause of it and the moment it took place. Secondly, learning cannot be observed, only the consequences of it. Therefore, Stahl (2006) suggests a shift of focus in CSCL research from learning outcomes to the knowledge building process of CSCL, because it "*refers to specific, identifiable occurrences*" and "*one can directly and empirically observe the knowledge being built, because it necessarily takes place in observable media, like talking. Moreover, it produces knowledge objects or artifacts, which provide lasting evidence and a basis for evaluating the knowledge building.*" (Stahl, 2002:63.) Furthermore, although convenient, it is not necessarily appropriate to use face-to-face communication (or collaboration) as a starting point when evaluating the affordances of computer-mediated communication (CMC). Dillenbourg (2005:246) questions "*the intuitive trend to consider face-to-face settings as the ideal model for CMC design. Instead, I*

encourage designers to explore CMC functionalities that do not exist in face-to-face interactions."

CSCL environments do offer affordances for collaboration that are unique and (almost) impossible in face-to-face learning environments. Using computer-mediated communication, it is not only possible to "*make thinking visible*", but also trace the history of discussions, i.e. the evolution of joint problem solving tasks, argumentation structures, trajectories of participation (e.g. Lehtinen, 2003; Suthers, 2006; Hewitt, 2002; Scardamalia & Bereiter, 1994; Lehtinen & Rui, 1996; Suthers, Erdosne Toth, & Weiner, 1997). These traces of collaboration can be used as a group mirror to foster groups' self-regulation, or, technology can be harnessed to structure and guide collaboration. This reduces the socio-cognitive load of collaboration and makes it possible to implement a learning agenda (Dillenbourg, 2005; Suthers, 2006; see also Lipponen, Hakkarainen, Paavola, 2004). Furthermore, digital artifacts are reconfigurable, dynamic, easy to manipulate and replicate, making it possible to elaborate ideas and refine artifacts not possible in many traditional media (Suthers, 2006; Stahl, Koschmann, Suthers, 2006) and thus, the ideal collaboration tool.

2.4 Prerequisites for and implementation of CSCL

Stahl et al. (2006) point out that e-learning in general is quite often, erroneously, conflated with computer-supported collaborative learning. Yet, in CSCL, the emphasis is on the collaborative efforts of the learners, whereas e-learning covers everything from digitized, static self-learning material to learning games to CSCL. So, although CSCL is e-learning, not all e-learning is CSCL. On the other hand, this is more a question of how, not what kind of, technology is used (Lipponen, Hakkarainen & Paavola, 2004; Lehtinen, Hakkarainen, Lipponen, Rahikainen, Muukkonen, 1999).

When implementing CSCL, it is useful to think in terms of input-process-output-model (see Guzzo & Shea, 1992; Hackman, 1983). *Input* includes the characteristics of individuals taking part in the CSCL course, group structure and size as well as environmental factors such as reward structure etc. Stahl (2007) has collected an extensive, though tentative, list of preconditions for CSCL, which can be divided roughly into three partly overlapping categories:

1. Group participants

   Must have means and willingness to interact with each other. It is necessary for the collaboration that participants have, to some extent, shared cultural background and interpretive horizon, including language, tacit knowledge of artifacts, concepts and meanings. This does not mean homogeneity of the group, because the power of CSCL lies in the ability to bring different people with different skills, knowledge and perspectives together. But some common ground is needed to initiate collaboration.

2. Technological environment

   Perhaps the most important feature of CSCL environments is the shared space for interaction, where participants are able to discuss, create and elaborate objects of knowledge and "construct and maintain a shared conception of a problem".

3. Pedagogical arrangement

   This is also related to the pedagogical arrangement of collaboration. For participants to engage in a meaningful collaboration there has to be "object of activity", a common reason, topic and a goal for interaction. Often, this is at least partly defined by the group itself. (Stahl, 2007.)

Process refers to group interaction variables, that could be subdivided into cognitive and social variables.

- *Cognitive* process variables are for example:
  grounding problem space, epistemic activities, argumentation, dissemination of information, problem solving and conflict-orientation.

- *Social* process variables are:
  group cohesion, interpersonal memory, social/motivational/emotional conflicts and scaffolding.

Output refers to the desired outcomes of the CSCL learning task (see chapter 5 for more detailed description of input-process-output–model). Whereas the *input* variables are somewhat more given (apart from group size etc.) and restricting (or enabling) the desired cognitive and social/motivational outcomes (*output*) shape the process and implementing of CSCL. The desired cognitive outcomes are intertwined with the learning metaphor considered appropriate: should the participants acquire or apply knowledge/information as individuals, should they participate in the shared activities to e.g. solve a problem, or should they even create new knowledge as part of the process. Also, socio-emotional and

motivational aspects play a role in designing CSCL courses, because the learning task and environment should be chosen accordingly. What activities are expected and encouraged during the course depends also on the desired outcomes of the CSCL; as discussed above, the group interaction process can get many forms from individuals co-operating to collaborative knowledge creation, and this has also implications for the assessment of individuals and group work.

3 E-learning courses: example of good practices ("lessons to learn!")

In the previous chapter we could note that although CSCL is e-learning, not all e-learning is CSCL. As a result, we asked ourselves how we may activate this process of knowledge acquisition, in which knowledge is something that is developed and worked on in collaborative practices. If knowledge creation refers to the phenomenon of creating, and not of acquiring new knowledge and skills through cultural practices in the context of joint and collaborative activity, how may we design "powerful learning environments"? How may we apply and employ the recent findings on the beneficial effects of social interaction on learning, and incorporate them into e-learning contexts in order to facilitate effective and factual computer-supported collaborative learning?

To answer such questions, we attempted, first of all, to identify and illustrate examples of actions and strategies ("practices") that are implemented within a collection of European e-learning courses based on collaborative activities. Subsequently, we designed and delivered e-learning courses – within academic domains – with the purpose of applying examples of "good practices". Finally, we formulated "guidelines" and practical tips for encouraging practices and activities aimed at promoting knowledge construction through social interaction. The following section will describe the main aspects we investigated, and the most relevant results we obtained from the exploratory study we conducted within the project. Subsequently, we will present the e-learning courses we designed, and which allowed us to formulate guidelines and good practices.

3.1 An exploratory study on European scale

With the purpose of identifying which pedagogical and technological tools, activities or strategies may be useful to enhance the effectiveness of social interaction in e-learning contexts, we conducted an exploratory study on a sample of noteworthy e-learning experiences on the European scale.

We collected 78 experiences in several European countries. 74.4% of them occurred within University courses or within lifelong learning experiences.

We examined a number of elements involved in the design of e-learning courses, so that we could identify and illustrate various examples of activities that teachers/tutors may implement in order to encourage social dynamics that may stimulate participants to engage in the deep scrutiny of information and divergent thinking and thus advance their knowledge.

In particular, we explored several aspects, which are considered fundamental to the development of successful e-learning courses based on effective online collaboration (further details may be found in Matteucci, 2007).

3.1.1 E-learning courses: structural aspects

The first elements we investigated were the structural aspects of the e-learning courses considered (e.g., duration, compulsory or voluntary attendance, etc.). Information on the e-tutor/teacher's previous experience, on pedagogical/didactical concepts, on the courses' objectives, on participants' characteristics (in terms of previous experience), and on the nature of their interaction (presence of groups and/or of subgroups, members per group), was collected as well.

Interestingly, what emerged was that most respondents (i.e., teachers and tutors) had accumulated experience in the design and development of collaborative online courses, whereas learners were not familiar with e-learning. This suggests that collaborative online courses are not so widespread in higher education, and confirms the picture of a higher education system, in which collaborative knowledge construction plays a marginal role, i.e., that of an additional dimension that supports more traditional learning and e-learning models. As far as the course objectives and pedagogical and didactical concepts are concerned, *knowledge acquisition* and *knowledge application* are indicated as the main goals of most courses, whereas *cooperative/collaborative learning*, *learning by doing*, and *problem/case-based learning* are among the most common pedagogical/didactical frameworks.

With reference to the countries, in which these experiences took place, it may be suggested that e-learning seems to encourage border crossing, since many courses were simultaneously delivered in more than one country.

3.1.2 Technological aspects of collaboration

We prepared a questionnaire that contained several items concerning the courses' technical aspects, with the aim of investigating the role of technological tools in the implementation of online collaboration. In particular, we explored the platform's technical potential in terms of possibility to collaborate, and the tools employed in this sense. Moreover, we proceeded in order to identify the most effective tools for collaboration, the extent to which different tools for communication and for supporting collaboration may be used, the added value of computer-mediated collaboration, and the possibility to use statistical data related to learners' online activities.

The number of platforms employed was considerable. What is remarkable is that most e-tutors indicated the *ease of use* as most important criterion or feature for choosing a specific platform. Didactical and/or pedagogical concerns, on the contrary, were evoked only in a few cases. As far as *tools* are concerned, we could notice that those related to the asynchronous approach, which mainly involves *forum* and *e-mail,* are by far the most used. Interestingly, other communication tools – e.g., Skype, MSN, SMS, personal e-mail - were reported as well, thus demonstrating the growing use of popular tools, developed outside e-learning contexts, which are not part of e-learning platforms.

3.1.3 Online collaboration and knowledge acquisition

Drawing on the assumption that cognitive processes occur in social interaction (Doise & Mugny, 1984), we explored the design of the learning environment. Our main focus was the importance that e-tutors assigned to several cognitive and social processes involved in learning processes, as well as to didactical practices implemented to foster these processes. As a matter of fact, several studies suggest that advanced cognitive outcomes are more likely to appear when participants are engaged in specific interaction situations. Therefore, practices promoting effective interactions among learners are likely to represent an important dimension that e-tutors/teachers may take into consideration.

With the purpose of discovering practices that e-tutors/teachers adopt in order to foster collaboration activities, we explored some ***cognitive*** and ***social processes***. As for the cognitive aspects of collaboration, our questionnaire included items concerning the learners' online discussion, argumentation and different perspectives of observation, collaborative problem solving and knowledge exchange. As for the social aspects of collaboration, our questionnaire asked whether dysfunctional phenomena of group work happened during the course (i.e., group conflicts, superficial discussions, dysfunctional competition, ignoring

minorities, diffusion/lack of responsibility, and pursuit of personal goal) and what actions were taken to solve these problems.

As for the ***cognitive processes***, it became evident that tutors value collaboration as a very important element. It should be noticed that e-tutors rate the cognitive aspects of collaboration processes as much more worthy of attention than the social dynamics beyond collaborative interactions. Most of the interventions that took place in e-learning courses, therefore, were oriented towards the promotion of individuals' cognitive functioning, rather than the support of effective social interactions.

In particular, *online discussion* and *exchange of knowledge* seem to be the most important processes (M=5.19 and M=5.23 respectively). The former is also the aspect according to which e-tutors intervened most (80.8%), probably because of its more general character. *Collaborative problem or case solving* is, on the contrary, the least important aspect (M=4.70), although the high variance of the score indicates that a number of e-tutors rate this aspect as much above (or much below) this average score. A possible explanation is that e-tutors who adopted problem-based learning are likely to consider this aspect as very important, while the other respondents consider it as less important.

As for the ***social aspects*** of the collaboration process, the majority of e-tutors did not intervene, and the main motivation was that intervention was not necessary. Two principal interpretations can be formulated: 1) dysfunctional phenomena in collaboration were either not present or not noticed in several experiences; 2) in other experiences, these social phenomena - if present - were not considered as a significant problem for e-tutors. The only aspect that saw the majority of interventions by e-tutors was actually the learners' tendency to turn to the e-tutor, in order to ask for content-related information, and to wait for answers, instead of posing questions to their peers. This may be explained with the fact that in these situations, e-tutors are directly involved in the phenomenon, since they have to do something in order to reply to learners' request/wait.

The most interesting and recurrent methods of intervention adopted by e-tutors to promote various cognitive and social processes of collaboration were similar, as far as practices are concerned. They consisted in the creation of groups, roles/responsibilities assignation, use of rules/scripts, different forms of feedback (also of provocative nature) and various types of activities for learners (e.g., collaborative construction of documents, discussions on peers' problem solution, ePortfolio, etc.).

3.1.4 Organization of group work

Drawing on the assumption that planning and organizing online activities may enhance collaborative learning, we explored whether e-tutors/teachers considered the autonomy of participants as an important factor in the organization of their group activities and the long-term planning of their group-work. As theoretical literature shows, learning

success and enhanced motivation are in fact predicated upon learners who take responsibility for their own learning, which is a characteristic of learner autonomy (e.g. Dickinson, 1995; Little, 1991; Deci & Ryan, 2000).

E-tutors considered both of the investigated dimensions as important (M=5.05 and M=4.44 respectively), even though the *autonomy in organization of group activities* seems to be more important and the majority of e-tutors intervened to foster it (57.7%), probably because this dimension is more general. As for the second aspect (*planning group activities)* 48.7% of e-tutors intervened to encourage it. Key findings related to methods of intervention are similar to those presented for collaboration aspects, and mainly concern the use of rules and/or scripts.

3.1.5 Feedback and evaluation

We investigated the direct intervention of e-tutors in terms of feedback on a content-specific level, collaboration activities and evaluation. This phase started from the evidence that tutors who give feedback on social interaction as well as on content-specific questions are an important element of e-learning, because learners in e-learning environments get the impression of being totally alone and unguided if the contact person is inadequate (Schweizer, Pächter, & Weidenmann, 2001).

Findings reveal that only *content-specific feedback* is judged as very important, whereas *on-going group work feedback* and *evaluation* are considered only fairly important (M=4.55 and M=4.25 respectively). Moreover, only 47.4% of e-tutors intervened to rate the on-going activities of collaborative work. However, except for *content-specific feedback*, the variability of e-tutors' answers is fairly high. This probably means that part of e-tutors considered various feedback and evaluation aspects as very important and acted accordingly, whereas others considered these aspects as less important and did not make any use of them.

The use of grades is not widespread within the *evaluation methods* of the outcomes of group work. In some cases e-tutors preferred an evaluation based on comments/feedback. *Knowledge application* and *understanding of the content* are the most common criteria for both outcome and process evaluation. Finally, what may be observed on the level of *procedure*, is that *essays* are widely employed, whereas *tests* are the least common assignments.

3.2 E-learning Courses

Following our exploratory study, seven e-learning courses involving more than 440 students in total were developed (see Table 3-1). They took place in university contexts. The courses intended to promote student construction of knowledge by means of different strategies. Such courses were obviously inscribed within the didactic responsibility of our project's partners. Thus, they were designed and developed according to the rules and necessities of each of the Universities and Faculties involved (in terms of, e.g., timetables, frequency of lessons, number of participants, etc.).

Each e-learning course focused on one particular aspect of online collaboration through an experimental approach to "good practices" within the phases of design and development of e-learning courses. The following tables will illustrate the seven experiences realized, and the main characteristics of each course. Besides describing our work within the project, such tables are also aimed at providing ideas and suggestions to e-tutors for the formulation and development of e-learning courses based on practices aimed at promoting knowledge construction through effective social interactions:

Table 3-1

	Institution	Title	Target group (N)
1	University of Bologna Faculty of Psychology (I)	"GOAL ORIENTATION IN E-LEARNING COURSES"	Adult Students (240)
2	University of Bologna Faculty of Psychology (I)	"NEW TECHNOLOGIES AND TRAINING"	Adult Students (30)
3	University of Bologna Faculty of Psychology (I)	"PROMOTING THE QUALITY OF ARGUMENTATION IN FORUM DISCUSSIONS: AN EXPERIENCE IN A FULL DISTANCE STATISTICS LAB"	Adult Students (35)
4	University of Bologna Depart. Electronics (I)	"PROMOTING STUDENT COLLABORATIVE WORK IN A SOFTWARE ENGINEERING COURSE"	Adult Students (80)
5	University of Neuchâtel Faculty of Humanities (CH)	"REASONING ON DATA ANALYSIS FOR PSYCHOLOGY AND EDUCATIONAL SCIENCE"	Adult Students (20)
6	University of Neuchâtel Faculty of Humanities (CH)	ACADEMIC COMPETENCIES ON PSYCHOLOGY AND EDUCATION (A COURSE TO FOSTER STUDYING COMPETENCES)	Adult Students (87)
7	Ludwig Maximilian University Faculty of Psychology and Pedagogy (DE)	"COGNITIVE AND SOCIAL ACTIVITIES AS WELL AS TUTORIAL SUPPORT IN A VIRTUAL SEMINAR"	Adult Students (15)

3.2.1 Course 1: GOAL ORIENTATION IN E-LEARNING COURSES

Rationale

Goal orientation refers to the students' motivation for completing a task. Researchers have contrasted ability-development goals with ability-demonstration goals (Dweck, 1986; Nicholls, 1984), and approach goals with avoidance goals (Carver & Scheier, 1998; Elliot & Church, 1997; Higgins, 1996), and they have suggested that the different types of goals have different behavioral and affective consequences (for a review: Kaplan & Martin, 2008). This means that, when task involved, some people work in order to improve their mastery and competence (the so-called "mastery goal"), whereas other people aim at gaining positive, or at avoiding negative judgments about their abilities, (the so-called "performance goal") and not at improving their abilities and competencies. In actual fact, the educational goals that students may pursue can be of different types: they may either consist in the development/improvement of abilities and task learning (mastery goal), in the demonstration of ability and competence (performance–approach goal), or in the concealment of the lack of ability (performance-avoidance goal).
Goal orientation may have positive *versus* negative effects in learning contexts: there is evidence that performance goal orientation might be problematic, whilst mastery goal orientation may provide the basis for enhanced achievement and students' well-being. In other words, when mastery goals are perceived as being emphasized within an achievement context, and when students endorse them as an orientation, the quality of student engagement in tasks is higher: students are likely to invest in the task, seek challenge, persist longer, feel more positively about it, and be more productive.

Research questions

The purpose of this project is to understand whether students' achievement goals are likely to influence collaborative networking, individual work, group work and also their final performance.

Materials and method

A case study should be defined as a research strategy, i.e., as an empirical inquiry that investigates a phenomenon within its real-life context. Case studies usually involve an in-depth, longitudinal examination of a single instance or event: a case. The case to be considered here is a blended-learning course developed at the Faculty of Psychology at the University of Bologna.
Participants were 240 (200 female: 83.3%; 40 male: 16.7%). They were all psychology students at the University of Bologna that had attended the module "Introduction to literature and scientific language". Ages ranged from 19 to 56 years (*M* =: 24.1, *SD*= 7.9).
Participants were asked to anonymously fill out a questionnaire during the first lesson, so that their learning goals could be evaluated. Such a questionnaire included the Achievement Goal Questionnaire (Elliot & Mc Gregor, 2001) and other items aimed at investigating the students' perception of their own web competence, the importance assigned to the course, and the relevant expectations as far as the course's degree of difficulty was concerned.

The factorial analysis of the Achievement Goal Questionnaire has led to the identification of 2 factors (explained variance 64.1%), on the basis of which subjects have been grouped into two main categories, i.e., "mastery" (N= 69) and "performance" (N=45). Not all participants fit completely into one or the other category, because they agreed with both or none of them.

Course Description

INPUT

Main objective of the course	The course "Introduction to literature and scientific language" is intended to provide students with specific knowledge of the typical features that characterize scientific literature and language and scientific writing (review procedure). Students are supposed to develop competencies in scientific text reading and comprehension, and in the identification of specific characteristics of different scientific texts. Besides focusing on these specific competencies, the course is also aimed at encouraging the following transversal competencies: ability to work in a team; ability to work online and to manage e-learning platforms; critical analysis and evaluation of written texts.
Target group	Adults or university students.
Duration	The course ran from March 3rd to May 19th (1st lesson: March 3rd; 2nd lesson: April 16th; 3rd lesson May 19th).

Learning resources (web-based materials)	The platform offered the following web-based learning resources: scientific papers; power point presentations; special fill-in forms to support individual and group activities; and several platform tools including wiki (for collaborative construction of products), web- forum and chat for group discussion aimed at organizing and developing activities.
General course organization	The course involved 3 face-to-face lessons of 2 hours each and developed according to the following schedule: introductory lesson; mid-course lesson; and final lesson. Students were supposed to complete their individual and group online activities in the time span between the first and the last lesson.
Didactic structure	The first lesson offered a general introduction to the course and a presentation of the key theoretical principles to be dealt with in the subsequent individual distance learning activity. In the course of the following 6 weeks students were supposed to download 4 papers from the platform, analyze them, and produce an individual written report. The second lesson provided initial feedback on the first activity together with further theoretical insights, which were aimed at facilitating the development of the second activity. The second distance activity consisted in an individual work, which had to be completed and delivered. After this delivery, students were then divided into subgroups of 5 or 6 people, which had to collaboratively discuss their work further through web forum or chat (or other possible web-based communication tools) with the purpose of creating a final group product by means of wiki technology.

PROCESS

Learning activities	The course involves individual learning activities based on material provided by teachers and also readings and critical analyses of scientific articles.
Learning support arrangements	Students could collaborate and help each other by participating to the discussion forums available on the e-learning platform, so that peer tutoring was encouraged. Some students employed this resource both in order to solve technical problems (e.g., access to platform and platform tools), and to exchange suggestions and information or help each other while completing the didactic activities assigned.

OUTPUT

Student assessment	The final evaluation was based on the following elements: results obtained from the three activities assigned; participation to face-to-face lessons; and online participation to the several activities. The three online activities (2 individual activities and 1 group activity) received one evaluation, which took into consideration the students' participation to group discussions as well. Their participation could be observed through the analysis of different indexes obtained from web tracking.

Results

Results show some salient differences between "mastery" and "performance" students in terms of grades received. Our statistical analyses, which take into account both the grade assigned to students for the three activities, and their average grade, indicate that the grades received by mastery students are significantly better than those received by their peers characterized by performance goal orientation[1]. This seems to confirm that mastery students may obtain more positive results. This, in turn, suggests that mastery students demonstrate better participation, engagement, and a more fruitful knowledge acquisition, even despite the fact that the course did not assign a final grade, which plays a role in individual careers, but just a pass certificate.

As for the collaborative online work, our web tracking shows that mastery students have preferred the "blog" module and have made a greater use of the "upload function"[2]. This means that mastery students' participation to online activities is more active than that of performance students, at least as far as these two indexes are concerned. Particularly, the upload index, which represents the number of files uploaded by each student (e.g., attached to assignments, to messages posted to a forum, etc.) seems to reveal that mastery students have been more collaborative than performance students, in that it shows that mastery students have shared or provided more information on their work.

The "blog" index provides information on whether students have employed the "Blog" module offered on the e-learning platform. Considering that the use of such a blog was not explicitly recommended, it may be argued that those that have

[1] Mann-Whitney test: first activity: U = 1018.5, p. = .03; second activity: : U = 950.0, p. = .02; final test: : U = 966, p. = .03; average grade: : U = 818.5, p. = .006.

[2] T-test: "blog": t = -2.26 (df=66.8), p. = .03; „upload": t = -3.89 (df=98.0), p. = .000

employed it have done so out of curiosity or interest, thus demonstrating a greater interest in the platform's potentialities and in the several tools available.

Conclusion ("lesson learned")

We believe that these results are important, since, as it has been shown, achievement goal orientation may be manipulated by environmental cues or structures (although performance goals are likely to prevail in natural academic situations). Typically, forms of manipulation in this sense may solicit teachers and/or e-tutors to evaluate the meaning—in terms of mastery and performance goals—that various educational practices seem to convey to students. Some of the interventions lead to the modification of central educational practices, such as those involving task structure and evaluation methods, in ways that are more likely to emphasize mastery goal orientation at the expense of performance goal orientation. Indeed, quite a few of the practices that have been recommended as facilitating mastery goals overlap with practices that have been found to facilitate students' motivation and learning in other domains such as problem-based inquiry, communities of learners, and learner-centered learning environments. (See Guideline: "GROUP ACHIEVEMENT GOALS ORIENTATION and MOTIVATION" p. 82).

3.2.2 Course 2: NEW TECHNOLOGIES AND TRAINING

Rationale

One of the most important problems in e-learning and blended-learning courses is the level of students' participation, particularly during the first phases. Frequently, a number of students do not actively participate in discussion, whereas others tend to reply only to the tutor/teacher, or they send/post messages without receiving any reply. What we may generally observe, therefore, is a sort of sequence of monologues in which conversation-like exchanges involving questions, suggestions, and direct replies may be found only occasionally. This critical point seems to be particularly evident in the case of web artefacts such as web forums. Although these web artefacts are, today, the most popular means for activating web group/community discussions, the type of interaction they allow is quite particular. As a matter of fact, it may be suggested that such an interaction develops within a public area, in which individuals are given the opportunity to write a message and hope for an answer, without having the certainty, however, that their message will actually receive a response. These web artefacts are normally proposed to students in order to stimulate group discussion on the course's subjects, as if in the same web forum there's the motivation for discussing in group; in fact, this web artefact is principally based on interactions, which do not necessarily imply the establishment of explicit relations within groups .
Web forums generated by web 1.0 technology, i.e., web 1.0 forums, do not allow students to choose among group members and, normally, they do not offer the possibility to activate private conversations with one student or the other. This means that all messages are accessible to all the subscribers and members of this type of forum. In general, as far e-learning and blended-learning are concerned, web forums are not presented as the only interactive resource for the course: they are part of a wider range of various tools that constitute the Learning Management System (commonly known as web platform). All of these systems are normally called Virtual Learning Environments (VLE) by which one can activate a distance course in similar way of a presence course: in fact these web artefacts have also the same problems and critical aspects of a conception of learning as a mere vertical knowledge transmission from the top (tutor-teacher) to the bottom (students) based on contents distribution and other activities well structured.
The evolution to web 2.0, which allows users to play a more active role in content production in the form of wiki, blog and social networking, has meant a passage from VLE to PLE, i.e., to Personal Learning Environments. These environments are focused on the individual, and support both formal and informal learning elements (i.e., contents originating from traditional learning schemes of an institution, but also resources obtained through a more personal use of the web). As a result, students have more possibilities in terms of group choice and content production, i.e., they are free to create their own discussion groups by selecting the members of their groups, and they are free to publish contents in a blog and to decide which people may read and reply to such contents, etc.

Research questions

Given the previous points, this experience develops out of the idea that the activation and participation to web forum discussions may be more fruitful if it is introduced by an initial phase dedicated to constructing personal relations within a network. The first research question considers two different levels of web interactions (formal vs. informal) and it focuses on whether the structure of collective interactions in a web social network differs depending on web tools, i.e., either blog or web forum. The second research question refers to the students' perception of these two different types of interaction. It is particularly aimed at investigating to what extent students consider these interactions useful for creating their own trustworthy network, which may allow them to activate discussions and rely on collective support.

Materials and method

With the purpose of observing and describing the evolution structure of interactions between students, data have been analysed principally through Social Network Analysis (SNA). This type of analysis was applied to students' interactions which occurred in their personal zone (informal level) as well as in the web forum (formal level).
We have also analysed the content of a number of students' discussions regarding the usefulness of the social network preset for this experience during their university course.

Course Description

INPUT

Main objective of the course	The course "New Technologies and Training" is aimed at offering a survey about the utilization of web artefacts in education and vocational training, and it particularly focuses on the psychological effects (both individual and collective) that such virtual environments imply.
Target group	During the first lesson, all students were invited to subscribe themselves to "NewTeF", a web social network specially designed for the course by the NING network creator. In total, 30 students participated to this experience: 22 female and 8 male students. All participants had attended their second year of the specialist degree in Work, Organizational, and Personnel Psychology with an age between 23 and 50. 17 students were commuters and 29 students completed their subscription within a period of 15 days following the invitation.
Duration	The course duration was two months, i.e., one month before and one month after Christmas holidays; a further month may be added to this period, if the exam preparation is considered as part of the whole experience, so that the total duration was about three months.
Learning resources (web-based materials)	The course required the study of specific on-line contributions, of two books indicated by the teacher, and of all the didactic materials proposed during the lessons and uploaded on NewTeF.
General course organization	Our analysis proceeded according to three different phases we identified within the whole period: 1. The first phase comprises the familiarization with NewTeF and the completion of the first on-line activities proposed by the teacher (e.g., constructing a personal blog page, searching online articles related to the course subjects); 2. The second phase refers to the opening of the web forum discussions; 3. The third phase corresponds to the exams period, in which forum discussions did not only focus on this course subjects, but also on subjects related to other courses. It is important to point out that the activation of discussions on the web forum was not a teacher's prerogative. Students could propose and open forum discussions as well.
Didactic structure	The course program was based on 15 face-to-face lessons (2 hours per lesson) and on the participation to on-line activities (e.g., web search exercise, personal blog construction, and group discussion together with other students).

PROCESS

Learning activities	During the first lesson, the teacher introduced NewTeF and explained the potentiality and importance of this web artefact for the course. The course started with face-to-face lessons. At the same time, however, students were also required to carry out some on-line activity: • constructing a personal blog with a self presentation; • searching four scientific contributions related to the topics "digital divide" and "activity theory"; • participating to a web forum discussion about the usefulness of NewTeF for university courses; • constructing the ego-network of relations for the subsequent application of SNA (a subject treated during the course).
Learning support arrangements	The course developed according to a blended-learning layout, i.e., it involved a set of face-to-face lessons supported by distance activities and discussions via NewTeF social networks. The use of a social network allowed us to analyse the two forms of web interaction of interest: a formal and collective type of interaction (web forum), and a more informal one, which is mainly focused on the establishment of relations (blog and personal zone). NewTeF web forum was already set up with a specific section dedicated to the subjects, problems and tasks to be dealt with in the course. The teacher did not explicitly request the activation or the participation to the discussions, but students were free to activate discussions on their own initiative.

OUTPUT

Student assessment	The final evaluation was based on an oral examination in a face-to-face context. Students were required to hold a discussion with the teacher on the course subjects, on relevant on-line contributions they found following the teacher's recommendations, and on the books proposed. The final part of the evaluation was based on the on-line activities carried out. Particularly, it was focused on the creation and management of the personal blog (and the activation of a personal network of relations), and on the participation to web forum discussions.

Results

A first important result that emerged from our analysis was the massive usage of NewTeF during the first days that followed the presentation. This was principally a consequence of the request of constructing the personal blog and publishing a self-presentation. 29 of the 30 students accessed NewTeF in the first two weeks and constructed a personal contact network with an average of 8 relations for each student, and 18 messages in the personal zone and blog. As far as the content analysis of the forum messages about the usefulness of NewTeF is concerned, it is interesting to note that students perceived blogs mainly as an important tool for getting to know their colleagues, for requesting help in the construction of the personal blog (e.g., for inserting a music tool), but also for comparing each other's work As a matter of fact, some students explain that they were initially not interested in blog construction. However, as the other students were constructing it, and their web pages looked very agreeable, they decided that they could do that as well.
While all on-line activities of this first phase were focused on personal zones, blogs, and on the construction of personal relations with the other students, participation to web forum and activation of collective discussions were not very consistent. Obviously, the web forum's most used sections were those dedicated to course subjects and to problem solving guidelines for social network use. Although these sections are of collective interest, students have shown a preference for the use of students' personal zones in order to request specific help.
The second phase is characterised by a consistent decrease in the number of messages posted to blogs, which is probably due to a reduction of the "initial enthusiasm"; nevertheless, the interactions involved the majority of students, and cases of isolation, i.e., of students that had no exchange with other students, were few. We could observe a decrease in web forum exchanges, as was the case for blog exchanges, but this time it was not as consistent as it was for blogs. In web forum exchanges we could notice a drastic decrease of discussions concerning the social network and its use, and a progressive increase of discussions concerning subjects of wider interest, such as other courses' exams.
The third and last phase revealed a further decrease in blog exchanges, whereas web forum exchanges maintained the same level that was observed in the previous phase. A further interesting element is that while blog exchanges involved most students, web forum discussions involved just some of them. Given that the number of students involved decreased, and the quantity of exchanges remained the same, it may be argued that message exchanges between the students involved in web forum became more consistent, and that relations became therefore more solid.

These observations seem to indicate that web artefacts such as blogs play an initial important role in constructing a network of relations and personal web interactions between students. However, as soon as the subjects of discussion become of more collective interest, the use of blogs decreases, while web forum exchanges do not vary in frequency. In the third phase we can actually observe that most discussions are focused on exams, i.e., on a subject that concerns all students and that is likely to stimulate the use of the forum. It is interesting to note, however, that most of these discussions are generated by specific groups created by students on the basis of what exams they decide to take. As a result, we may suggest that even if web forum is important for collective discussion, it is more effective if students have the possibility to create their specific group and develop discussions within it.

Conclusion ("lesson learned")

The results obtained from this descriptive enquiry seem to stress the importance of an initial informal level of interaction, based on personal information and on the creation of personal networks of relations, which may facilitate the subsequent proposition of collective discussions through web forum. The content analysis on the discussion focusing on the usefulness of NewTeF seems to confirm these results: students appreciate the first phase dedicated to the blog as an important space, which allows them to get to know their colleagues, request information, and establish personal relations. This is an important initial relational aspect which is not often considered within web forums. In web forums, in fact, students are invited to develop a discussion in a context in which they do not understand or perceive the type of network that surrounds them, because it is not the network that he/she has constructed.
Thus, drawing on the previous observations, we would like to suggest the following good practices:

- before organising a phase of collective discussions through web forum, or other similar web artefacts, it could be useful to introduce a previous, more informal phase which may stimulate the creation of personal networks of relations;
- positive results may be obtained if students are left free to introduce and activate discussions within web forums, but also to create their own discussion groups, without being forced to use a collective zone where everything is public;

– leaving the web forum open to discussions that are not directly linked to course subjects could be important for encouraging initial participation to discussions and for allowing students' familiarization with this web artefact and its interaction modes.

3.2.3 Course 3: PROMOTING THE QUALITY OF ARGUMENTATION IN FORUM DISCUSSIONS: AN EXPERIENCE IN A FULL DISTANCE STATISTICS LAB

Rationale

Since most of the human cognitive activities are based on argumentation, either in the form of inner speech (i.e., self-talk), or in the form of an exchange of alternative viewpoints with other arguers (Billig, 1992), the ability to produce sound and effective arguments is crucial for learning and understanding most of the school subjects. Comparing alternative perspectives, discussing pros and cons, linking causes and consequences in a sound conceptual chain are the epistemic activities through which learners may acquire and elaborate new knowledge. Therefore, improving the quality of learners' argumentation is a highly valued transversal educational objective in a variety of school subjects and academic disciplines. Nonetheless, educators frequently complain about learners' weaknesses in producing sound and effective arguments (Kuhn, 2007). One of the most common shortcomings is the so-called *confirmatory bias* in argumentation, i.e., the arguers' tendency to limit their attention to the facts and warranties that support their own claims, without considering facts that undermine their viewpoints and eventually support alternative claims. Even though confirmatory bias appears to be particularly widespread in argumentation, a number of factors have been proved to moderate it, such as arguers' expertise and interest in the topic at issue, prior specific training in argumentation, but also the availability of specific instructions and scripts during the exchange of arguments (Mandl, Kopp & Ertl, 2007).

Moreover, recent research has suggested that the social context in which argumentation takes place, i.e., the group dynamics and the roles played by the arguers, may affect the quality of argumentation as well, and namely reduce the extent of confirmatory bias. In particular, recent studies have shown that arguers take more frequently into account alternative points of view (i.e., they are less subject to confirmatory bias) when they are confronted with a minority rather than a majority, even if the debated issue is not particularly relevant to them (Tomasetto et al., in press). This is in line with the abundant literature concerning the differential effects of majority and minority influence on other cognitive activities, such as problem solving, creativity, and formal reasoning. According to such literature, when the issue is of low relevance, individuals that are confronted with a counterpart that warrants the correctness of his/her viewpoint (i.e., a majority, and expert, somebody who has a higher status, and in a more general vein somebody who is expected to be right) are not motivated to engage in a systematic scrutiny of the different available alternatives, since they can rely on the information provided by the source. Conversely, when the issue is of high relevance, the source advances an alternative point of view, but he/she cannot be viewed as a warranty of its correctness (it is the case for minorities, groups of equal of lower status, peers, and so on). Thus, individuals are motivated to scrutinize the issue in depth, in order to come to a sound conclusion.

The lack of quality in argumentation has been documented also in the context of online discussions. Therefore, educators who wish to design and implement distance learning activities based on cooperation, information exchange, and knowledge construction, should take measures to improve the quality of argumentation during online discussions. Drawing on the research evidence summarized above, this objective may be pursued by creating a social and relational context that motivates learners to overcome confirmatory bias. In particular, we contend that if learners are confronted with alternative solutions to the same problem, and these solutions are provided by peers rather than by the "expert" tutor or teacher, learners are encouraged to take into account a wider range of perspectives as far as the topics at issue are concerned. This, in turn, may stimulate them to overcome their tendency to focus only on the most accessible point of view (i.e., their own or the teacher's solution to the problem).

Effective peer-to-peer confrontations, or any other kind of "minority" influence, however, require that all participants engage in the group activity, put forward their point of view, and are encouraged to sustain their claims even if their contribution seems to be incorrect. Though, it should be acknowledged that holding a minoritarian position is not easy at all for many group members. On the one hand, in fact, minority members may not resist the pressure of the majority, and may be likely to converge toward the dominant point of view without defending their own ideas. On the other hand, the majorities may be likely to rule out, or simply to ignore, participants that hold different points of view. In both cases, confrontation would become impossible, and the beneficial effects of social interaction would be lost. In order to avoid such problems, we believe that the teacher/tutor should provide learners with explicit instructions which prescribe to take their peers' claims into account when posting their own contributions to the online discussions.

Research questions

In the context of a full-distance introductory statistics lab for undergraduate students in Psychology we designed a didactical intervention, which was aimed at improving the quality of learners' argumentation in online discussions. On the basis of the principles mentioned above, this intervention was intended to promote knowledge co-construction through peer-to-peer discussion in the web forum of the course. To this purpose, the main objective of our pedagogical intervention was to prevent learners' tendency to limit their attention to their own claims (i.e., their own contribution to the discussion), without taking into account their peers' interventions.

Materials and method

The description of the case study we report here is based on a variety of sources of information:

- Content analysis of students' messages posted to the web forum of the course. the quality of argumentation produced by the participants was scored according to the number and content adequateness of the reasons (justifications) given to support conclusions, based on Means and Voss' (1996) argument scoring. For instance, each post was coded with a score ranging from 0 (no argument, e.g., "I agree, I disagree…") to 4 (valid arguments supported by two or more good reasons). We also adopted a separate scoring grid to evaluate the presence or absence of valid rebuttals to alternative claims. Scores ranged from 0 (absence of rebuttals) to 3 (presence of 2 or more correct rebuttals). Therefore, each contribution posted to the forum generated two separate scores: one referred to the correctness and justification of one's claim, and the second referred to the presence/absence and justification of one's rebuttals of alternative claims.
- Quantitative analysis of the log file of the Platform that hosted the course (learning objects, posts sent/opened in the forum). The number of visits to each page of the platform was taken as a raw score. Indeed, a user's click on a page does not necessarily mean that that page content has been read; however, what may be inferred from web tracking is that some attention has been devoted to the exploration of the platform contents and the forum contributions.
- Students' assessment (exam score).
- Final course evaluation questionnaire. At the end of the course, after having passed the exam, students were asked to voluntarily fill in an evaluation questionnaire concerning the course materials and methods.

Course Description

INPUT

Main objective of the course	The introductory statistics lab is compulsory for undergraduate students in Psychology at the University of Bologna. The course's main objective is to teach students how to use a widespread statistics package (SPSS), and to provide them with the opportunity to apply to case-based problems the knowledge they have acquired during prior seminars and regular courses in statistics and methodology. At the end of the lab, learners are expected to be able to manage data in SPSS, to choose and run the appropriate analyses for their data set and their research problem, and to correctly report the results they have obtained.
Target group	All undergraduate students that are enrolled at the 5th of the 6 semesters of the Psychology course (on average 270 per year) have to attend the statistics lab. The description we provide here concerns the activities to be carried out by students who opted for a full distance didactical modality, and who decided to complete a set of dedicated practical exercises in the time span indicated by the teacher. In sum, 160 students decided to attend the lab in a blended modality that included either face-to-face lessons, or web-supported materials, whereas 110 opted for a full-distance didactical mode. This latter group was offered the chance to prepare the exam either in complete autonomy, throughout the whole year, or to engage in teacher-guided activities, which were scheduled for the same semester as face-to-face lessons. Thirty-five students opted for the latter modality, and thus participated to the experience we will describe in the following paragraphs.
Duration	The course provided students with 3 credits and its duration was two months.
Learning resources (web-based materials)	The lab was supported by a dedicated web platform that provided: • complete contents of the course in the form of accessible learning objects; • case-based exercises covering the whole course program; • web forum for information exchange and discussions about the topics of the course and the exercises. Teachers answered to students' questions twice a week, and ensured more frequent feedback in the period before exams. The above-mentioned web resources were available to all students, whether they decided to attend face-to-face lessons (upon registration, in groups of 40) or not. Students who could not/did not wish to attend face-to-face lessons had the possibility to attend the course in a full-distance mode. In this case, students were also provided with: • extra exercises with increasing difficulty, which were made available on the platform at fixed delays, in the same period in which face-to-face lessons were delivered; • the possibility to send their exercises back to the teacher in order to obtain individual feed-back. Moreover, the SPSS software, which was necessary for solving the case-based exercises, was installed in all computer desktops of the Faculty.

General course organization	The full distance course was delivered in the same period as the face-to-face lessons of the in-presence course. At a 15-day interval, from 5 to one week before the final exam, students who enrolled in the course were delivered three case-based exercises, whose solutions had to be posted and discussed with the other participants in the web forum of the course. The forum was moderated by the teacher. Due to the relatively high number of participants, students were divided into two groups, who worked out the same exercises on two separate forums.
Didactic structure	The full-distance didactical modality with extra exercises was organized as follows: 1. students were at first required to familiarize themselves with the course contents, which were available on the web platform; 2. three case-based exercises covering the different contents of the program were delivered by the teacher, at a 15-day interval, from 5 to one week before the final exam; 3. after the delivery of the exercises, the teacher activated a dedicated forum on the web platform, in which a variable number of discussions was opened (from 3 to 5). Each discussion concerned a problematic aspect of the exercise (one question per discussion), and students were asked to propose and discuss their solution to the problem; 4. on the forum, students could also discuss their solutions to other case-based exercises which were made available on the platform, and/or send the solved exercises to the teacher in order to obtain an individual feed-back; 5. students who completed all the discussions requested on the web forum within the delays indicated by the teacher were admitted to a dedicated exam, immediately after the end of the course.

PROCESS

Learning activities	Besides the standard material and exercises available on the platform, students who engaged in the full distance course were also requested to perform three supplementary tasks. Each of the three supplementary exercises was related to a different part of the program, and featured increasing complexity. The first exercise required students to create and manage a data file in SPSS, starting from a given set of questionnaires (identifying and defining variables, inserting cases in the data matrix). The second exercise required participants to perform descriptive statistics in order to describe a complex data set. The third exercise required performing all the analyses in order to verify an experimental hypothesis on a given data set. Students had to perform each task and exercise individually, and had to provide their solution via web forum. According to this procedure students did not receive any direct feed-back from the teacher as far as the three supplementary task were concerned, but were forced to identify the correct solution(s) through confrontation with solutions suggested by their peers. In order to avoid that students simply copied and pasted other contributions to the forum, or posted their own solution without considering their peers' contributions, a set of rules was established: • it was not possible to post a solution to a problem (e.g., "the variable sex is nominal") without providing a valid justification to one's claim; • if somebody had posted a different solution to the same problem in a prior post, subsequent contribution did not only have to justify its specific claims, but it also had to explicitly explain why the alternative solution(s) could not be accepted. For instance, basic netiquette rules were also established.
Learning support arrangements	The teacher played the role of moderator in the forum. He/she did not provide solutions to the problematic tasks, not even upon specific request by students. For each discussion, teachers periodically summarized the different options emerged from students' posts, and eventually integrated them with supplementary cues when necessary. If students reached an agreement on an incorrect solution to the task, the teacher intervened to reactivate the discussion. At the end of the discussion, teachers summarized the discussion and provided content-specific feedback. In order to avoid forum overcrowding, students were randomly divided into two groups, each group receiving the same tasks from the teacher.

OUTPUT

Student assessment	At the end of the semester, students who had completed the three extra tasks had the possibility to take part to a supplementary exam session, together with students who had opted for the blended-learning modality with face-to-face lessons.

Results

Thirty-five of the 90 students that were eligible for the course decided to take part in the full-distance course, which constitutes this study's main object, and 32 of them completed all the activities requested. It is worth noting that those who did not attend the course in the format we described had the possibility, in any case, to prepare for the exam autonomously, since the materials were available on the platform all the year long, and the teacher kept the forum active as well. Those who took part in this course had the additional opportunity to receive extra exercises, and to participate in the forum discussions with the other students who were engaged in the course in the same period.

As first step, a face-to-face meeting was organized, in order to explain the rules and methods of the course to participants. Furthermore, every time a new exercise was made available on the platform, students were alerted via email, since each of the tasks had to be completed within a limited time period (about one week).

The fact that students had to explain and argue about their solutions to the problematic questions, and to elaborate their answer through a peer-to-peer exchange, gave rise to a certain number of complaints since the very beginning of the course. Indeed, some students intervened in the forum and questioned the efficacy of the method, arguing that they expected *teachers* to give them information on whether their answers were correct or not. These challenges were a chance to explain again that the method was intended to foster cooperation and knowledge construction, rather than simple knowledge transfer from the teacher to the learners. As a matter of fact, if they had doubts about the solutions emerging through the discussion, they had the possibility to formalize their questions in the forum and argue about them. 32 out of the 35 students who had registered for the course, however, posted their contributions to all the requested discussions, and once the delay for posting forum contributions had expired, the teacher provided a detailed feedback for each of the discussions concerning the task.

After the forum discussions related to the three tasks were completed, all messages posted in the forum were content coded by an expert collaborator of the teacher, and two summative score of argument quality was calculated for each student: the first one concerned the quality of the arguments produced, and the second one concerned the presence/absence, and the quality of the rebuttals addressed to alternative solutions posted by other students. Although most of the students provided correct solutions to the problems they were faced with in forum discussions, the analysis of the arguments' quality showed that the overall quality of their arguments was good but not excellent. In fact, on a 0 to 4 scale, the average score was 2.67 (SD = .80), thus indicating that students provided, on average, correct answers with either incorrect or incomplete justifications (in this case the score was 2), or with one correct reason (in this latter case the score was 3). Nonetheless, the score that measured the presence/absence and the quality of rebuttals in the post generated extremely low scores. On a 0 to 3 scale, the mean score was .25 (SD = .28), and such a score derived from the fact that 13 out of 32 students (41%) did not include any rebuttal of alternative solutions in none of their 12 posts in the forum. In few cases some student had immediately detected a correct solution and fully argued for it since the beginning of the discussion. In these cases, the teacher himself suggested some plausible (although incorrect) alternative solution to the task, in order to make discussion possible, and to stimulate the argumentation from other participants.

Besides evaluating the quality of the arguments produced, we sought for information concerning the students' use of the resources made available on the platform. Such resources were the learning objects that explained the course contents, the peers' contributions in the web forum, and also the consultation of the materials inherent to the theoretical course of methodology, which were accessible via the same login to the platform. The examination of the log files revealed that students opened on average 124 (SD = 102.44) page contents of the platform (it should be considered that they may have opened the same page several times). Moreover, students also opened on average 55 times (SD = 52.81) a page of contents that was not included in the learning objects of the lab, but that belonged to the theoretical course in research methodology: this information is important, because one of the objectives of the course was to apply theoretical knowledge in statistics and methodology to practical case studies. Therefore, students were supposed to integrate prior theoretical knowledge with the new practical contents of the lab. Finally, students had on average 155 (SD = 129.69) contacts with the forum. This number is undoubtedly relevant, since the discussions opened during the course were only 12: therefore, as required, students also explored a number of contributions that their peers had posted to the forum.

In a subsequent step of analysis, we tried to verify whether the scores of argument quality were also related to the students' behavior on the platform, i.e., to their access to the different platform and forum contents. Results show that the quality of the arguments was basically related to the frequency of access to the contents of the learning objects, $r = .37$, $p < .07$, and was significantly related either to the access to the web resources of the methodology course, $r = .43$, $p < .05$, or to the visits to the forum discussions, $r = .43$, $p < .05$. Interestingly, the correlations appeared to be even stronger when we measured the association between the presence/quality of rebuttals in the contributions posted by the students, and their access to the web resources of the course. In fact, the presence and quality of rebuttals was significantly correlated with the access to the contents of the lab, $r = .40$, $p < .05$, and strongly correlated either with the exploration of the resources of the methodology course, $r = .62$, $p < .001$, or to the visits to the forum discussions, $r = .54$, $p < .01$. These results indicate that what is strongly related to a deep exploration of the available resources, and to a more systematic check of peers' contributions to the same discussions, is not the correctness of the contributions posted by the students to the forum, but rather the fact that they take into account and rebut possible alternative claims.

It is particularly noteworthy that no association emerges between the final exam result, the measures of argument quality, or the access to the web resources of the course. This result can be easily explained by a ceiling effect, since only 3 students out of 25 did not pass the examination on the first attempt (7 students decided to take the exam at a subsequent session, and they all passed it). For instance, there was no difference in the percentage of students who passed the exam on the first

attempt. This means that this outcome was irrespective of the fact that they had attended the lab in blended learning (with face-to-face lessons) or in the full-distance mode with supplementary online activities.
To conclude, we have to remark that only seven students completed the evaluation questionnaires delivered after they had passed the exam. Interestingly, those who completed the questionnaire emphasized that the collaborative organization of the didactical activity, in which solutions to case-based problems were constructed through forum discussion, and not provided/checked by the teacher, had been unsatisfactory to them. As a matter of fact, they expected feedback on their skills and knowledge from the teachers, and not from their peers' objections. Moreover, some respondents pointed out that they had perceived peer-to-peer discussions on the forum as a loss of time. Rather than being qualified as mere provocation, such reflections should be carefully taken into account when designing collaborative activities, since students themselves, at least in this academic context, are not positively oriented toward collaborative co-construction of knowledge, and explicitly prefer traditional didactic practices.

Conclusion ("lesson learned")

This study indicates that collaborative knowledge construction through forum discussions may be an effective way to foster students' learning in full-distance contexts (for instance, more than 85% of the students passed their exam on the first attempt, as was exactly the case with face-to-face students). However, teachers who design and implement such pedagogical devices should take some measures in order to either prevent dysfunctional social phenomena that are disruptive for cognitive processes (e.g., the fact of relying on the teacher's advice, and to ignore peers' contributions), or to foster effective interactions among discussants (i.e., it should not be taken for granted that learners are able to discuss and argue in effective ways).
As to the former point, (i.e., the prevention of dysfunctional social phenomena), we organized the forum in such a way that pieces of information, and content-related, problem-solving contributions did never come from the teacher. The expertise of this latter source of influence, indeed, may induce students to rely on the teacher's view without any further cognitive elaboration on the issue. By contrast, contributions to the discussion came exclusively from other students, and teachers had simply the role of discussion moderators. As a result, students were exposed to the influence of other non-expert arguers. This means that they were exposed to a situation that may be compared to a form of minority influence, which is proven to foster deeper cognitive elaboration of the issue, and in particular the ability to take into account different perspectives on the same problem. Students' commentaries, either in the forum or in the final evaluative questionnaire, indicate that such a device actually induced greater uncertainty on the correctness of the students' solutions to the problem. If, on the one hand, this uncertainty caused complaints among students, because they were not sure to be prepared enough to pass the exam, it may be seen, on the other hand, as a powerful pedagogical device, since, as predicted by minority influence theories, students were motivated to elaborate more in depth on the tasks they were confronted with.
As to the latter point, some of the devices that were implemented in the present course were explicitly aimed at fostering the quality of argumentation in the forum. The forum's rules included specific scripts (e.g., providing justifications for one's claims, and explaining why alternative solutions posted by other students were not considered correct), which were aimed at increasing the quality of argumentation. The evaluation of the arguments' quality clearly showed that students' contributions to the forum were in many cases correct, but of weak quality, particularly because of the complete absence of rebuttals of alternative solutions. In other terms, the confirmatory bias in argumentation persisted, even though we had formulated a rule to contrast it.
In sum, the lesson learned by this experience is that putting into practice collaborative forms of knowledge construction in e-learning contexts requires careful governance of the social dynamics, and of the discussions' quality in which learners are engaged. Although this experience was developed with a limited number of participants, it has allowed interesting observations, and has provided evidence that the promotion of discussions' quality should be a major concern for teachers, because shortcomings in the quality of the discussion may undermine the chance to construct new knowledge through peer-to-peer interaction.

3.2.4 Course 4: PROMOTING STUDENT COLLABORATIVE WORK IN A SOFTWARE ENGINEERING COURSE

Rationale

Collaborative work in groups of peers and collaborative work among groups of peers seem to help students to learn. When students collaborate altogether for a common task, they begin the active part of the learning process, in fact they have to act and to apply the knowledge acquired from the teacher in order to execute the task assigned them. Moreover, students are lead to reason more on their work and on their acquired knowledge and to improve them in order to collaborate with other group members to execute the common task.

Research questions

Real effectiveness of collaborative work and collaborative work among groups of peers in student learning, in particular, in what we consider to be important abilities that should have to be acquired by students: auto-organization, auto-criticism, auto-evaluation, critic analysis of work executed by other students, and consideration of options promoted by other students.

Materials and method

Promoting student collaborative work dividing students into groups of five members, and assigning to each group a task that it had to be executed during the course. In order to avoid competition in each group participating students chose a specific and different role to take in his / her group. In order to execute the task, students had to apply what they had acquired through the teacher lessons in classroom during the course and they had to produce an outline. Moreover, to promote the critic analysis and the consideration of options promote by other groups, during the task execution a critic evaluation among groups is contemplated. In fact, at the end of each task phase, each group had to give to another group the produced outline. The last one had to give to the first one a critic feedback on the received outline. Finally, at the end of the course the outline produced by each group was evaluated by teacher and each student was subject to individual oral meeting with the teacher in order to understand the effectiveness of the student collaborative work and evaluate students.

Course Description

INPUT

Main objective of the course	The first objective of the course was student comprehension, in the software engineering context, of: the objectives and roles of the software development process phases – with particular attention to the analysis, modelling, design, implementation and test phase –, the role of the model construction (exploiting the Unified Modeling Language – UML), the analysis impact on planning and organizing of the work, the technology impact in design, the possible feedbacks among phases and the methodologies for the convergence control, the design importance and the modular construction of the software, the role and technique of the re-factoring, the importance of the test, the role of the instrument production and the economic impact of the development process. Another objective was to promote in students: auto-organization, auto-criticism, reflection, analysis of work executed by other students, and consideration of options promoted by other students. Beyond to be important to improve student learning, these are abilities requested to a software engineer.
Target group	Around 80 attending students, University.
Duration	January 2008 – March 2008, 3 months.
Learning resources (web-based materials)	The course provided on-line material that was discussed in classroom by the teacher. The on-line material, consisting in pdf files and htlm pages, provides to students the basic notions of the course. Moreover, at the beginning of the course, teacher published on-line the task (see below) that had to be executed by each group. Furthermore an on-line glossary was used in order to provide definitions to students and a forum was used by students in order to ask questions to teacher. So, this forum became a knowledge repository built during the course, useful to student learning.

General course organization	The course was composed by lessons in classroom with the relative study resource (see above) provided by the teacher. At the beginning of the course participants were divided into groups; the number of members per group was around 5. In each group participating students chose a specific and different role to take in his / her group. Moreover, at the beginning of the course teacher assigned a task (see below) to each work group that had to be executed during the course and that had to produce an outline (see below). During the task progress a critic evaluation among groups is contemplated. Finally, at the end of the course, the outline produced by each group was evaluated by teacher and students was subject to individual oral meeting with teacher.
Didactic structure	During the course students had to attend lessons in classroom with the relative study resource (see above), in order to acquire the base notions of the course provided by teacher. In order to learn in an effective way, during the lesson period, students of each group had to apply what it had acquired through lessons in the execution of the task assigned by the teacher: the design of the same case study. Moreover, during the task execution, a critic evaluation among groups is contemplated. In fact, at the end of each task phase (the design process is composed of a set of phases), each group had to give to another group the produced outline (see below). The last one had to give to the first one a critic feedback on the received outline. Furthermore during the course students was invited to ask questions to teacher using the forum, in order to clarify possible doubts about lessons or the case study design.

PROCESS

Learning activities	Below activities realized in the course are listed: • Lessons in classroom, with the relative study resources. Through the lessons the teacher provided to students the base notions of the course; • Publication of a case study by teacher at the beginning of the course; • Student subdivision in groups at the beginning of the course; • During the course, each group had to apply what it has acquired by lessons to case study design; • Mandatory construction of common artefacts, as outline of case study design, in order to avoid that students follow their objectives instead of the group objective. In particular each group had to: o Build a site artifact as outline of the case study design; o Build a meta-site artifact as site artifact documentation. The meta-site allowed to collect the theoretic basis acquired during the course and used to the case study design by a student group; • A documentation and process model was provided to the artefact realization through the maven system in order to promote the integration of the different perspectives and participant information. In this reference schema was proposed an explicit point on the work planning in order to promote the long term planning into each work group; • The work group was supported by workspaces, both synchronous (e.g. chat) and asynchronous interaction tools (e.g. forum, e-mail), and glossary; • A critic evaluation among groups was contemplated to promote the critic analysis and the consideration of options promoted by other groups; • Through the group final artifacts, the teacher collected elements to evaluate the work executed and the knowledge acquired by the group; • Individual oral meeting was contemplated to avoid that the work group is non balanced among the group members; • Moreover students were evaluated through their ability to do critic analysis of the work executed by other students.
Learning support arrangements	Normal tutoring was provided. In particular, through forum students could ask question to the teacher.

OUTPUT

Student assessment	Students and, as a consequence the working of the course, are evaluated through: 1) outlines/artefacts (site and meta-site) produced by each group; through artefacts the teacher collects elements to evaluate the work executed and the knowledge acquired by each group; 2) individual oral meeting of students; this is contemplated to avoid that the group work is not balanced among group members; 3) student ability to do critic analysis of the work executed by other students.

Results

Through the student evaluation mentioned above and the teacher and students' feeling, collaborative work in groups of peers and collaborative work among groups of peers was effective. Below the case study results are listed:

- Collaborative work (in group and among groups) with the limited presence of teacher represented only by lessons in classroom and forum used by students to ask questions to teacher, promoted auto-organization, auto-criticism, and reflection of students;
- Proposing work planning in groups promoted auto-organization of students;
- The subdivision of roles has avoided competition in groups;
- In order to avoid students follow individual goal instead of the group goal, a construction of a common outline was mandatory for each group;
- The critic evaluation among groups promoted student critic analysis and the consideration of options, hence reflection, auto-organization, and auto-criticism; in fact groups had modified work organization and their outline through feedback obtained by other groups;
- In order to check and promote a balanced members' contribution to the work group an individual oral meeting between each student and teacher was done;
- The most used collaboration tool was the forum, but this was not ideal for the work group;
- Students used e-mail very much to collaborate; the motivation was that e-mail is a familiar tool for students.
- Through producing the outline of the case study design, a student of the following years can be exploit an initial knowledge base built by colleagues of the previous years in order to start its educational process through a "learning by example" process.

Conclusion ("lesson learned")

Collaborative work in groups of peers and collaborative work among groups of peers is an effective tool to promoted:

- auto-organization of students;
- auto-criticism and reflection of students;
- taking on alternative points of view by students.

Some useful guideline could be drawn in order to obtain a more effective collaborative work in groups:

- A limited presence of teacher promotes a better auto-organization and reflection of students, and the taking on alternative points of view by students;
- Work planning in groups promoted auto-organization of students;
- The subdivision of roles has avoided competition in groups;
- In order to avoid students follow individual goal instead of the group goal, a mandatory construction of a common outline for each group is useful;
- The critic evaluation among groups promoted student critic analysis and the consideration of options, hence reflection, auto-organization, and auto-criticism;
- In order to promote a balanced members' contribution to the work group an individual oral meeting between each student and teacher is useful;
- Producing an outline by each group is useful because a student of the following years can be exploit an initial knowledge base built by colleagues of the previous years in order to start its educational process ("learning by example" process);
- A re-frame of existing collaboration tools is necessary to make them more effective from the standpoint of collaborative learning.

3.2.5 Course 5: REASONING ON DATA ANALYSIS FOR PSYCHOLOGY AND EDUCATIONAL SCIENCE

Rationale

Faced with complexity of scientific domains, it is necessary to find pedagogical strategies that give tools to students for expanding their knowledge by themselves. Most of these strategies are based on a higher students' involvement in "constructing" their knowledge; this option should enabling them in acquiring a wider learning capacities. One can operationalize this option by inviting, if possible, students to participate in the construction of their course's supports. This route transposes on a material plan the desired intellectual construction and from this point of view it is quite similar to the activity of constructing a portfolio.

Research questions

On a learning plan, classical studies on hypertexts proposed to consider these tools from three points of view: as learning supports, as learning metaphors, as platforms for interactive development[3]. Tools for web collaboration, as the Wiki, propose new facilities for operationalizing the previous three propositions, in particular the third.

The experience here presented can be inserted in this perspective. The objective is to collect some qualitative elements permitting to define the problems and the possible solutions that could take place when one wants to activate this activity based on the co-construction of a course support (in this case the Wiki).

One has to consider that the course presented is just set up. Other questions live with those arose from pedagogical course, in particular the question concerning the calibration of contents to specific students' needs and, in the short period, the possibilities to introduce some tools for calculating.

Materials and method

Data come from tasks realized by students and published on Wiki; in addition, there's also data coming from a short questionnaire about contents, the ability with wiki activity and the general problem of managing multiple technological tools.

Course Description

INPUT

Main objective of the course	Starting from case studies (papers), the first objective of the course "Reasoning on data analysis for psychology and educational science" of the Institute of Psychology and Education is to present different models and strategies carry out in psychology and educational science for constructing scenarios, collecting and analyzing data. The second objective is to bring some technical knowledge (at basic level), in particular concerning the Bayesian scheme, the information theory and the complexity science. A complementary objective, shared with other courses, is the introduction to web tools usage, an objective.
Target group	Students enrolled to the course "Reasoning on data analysis for psychology and educational science" are principally those (twenty) coming from "pilier principale B A" – educational science, during their 4th or 6th study semester.
Duration	The course is based on two weekly periods per semester.
Learning resources (web-based materials)	The basic tool use in relation to the pedagogical strategy is a wiki previously predisposed with a list of contents representing the structure of the course.

[3] Pochon, L.-O. (1993). Hypertextes pour apprendre. Neuchâtel : IRDP, Recherches 93.104.

General course organization	The course is based on two weekly periods per semester in which there's a succession of "theoretical" presentations and discussion about "practical" subjects. The period considered for the course is the spring semester 2008.
Didactic structure	The scenario is those of a classical course with an alternation of "theoretical" presentations and discussions about "practical" subjects. From one to the other week, students are invited to examine and comment some "question for reflecting" published on the wiki. The work is collective. Students also have to realize a personal or little group work, gradually along the semester. Actually, most students only tardily involved themselves in this work that they have finished at the beginning of summer.

PROCESS

Learning activities	The following web tools description permits to define the development of the course. First of all, the Claroline platform is used in classical manner. Its use is for publishing Agenda, for sending information and for supplying documents (subjects for discussions organized in chunk of practical works, papers, etc.), in some case repeating the same information published on the Wiki. This latter is the central tool of the scenario. It is presented as the support for the "global" task proposed: realizing an "encyclopaedia" (with reference to Wikipedia, well known by students) concerning the subjects treated during the course. The use of Wiki was intended for: a) Publishing the subjects of reflection. Students are invited to publish their elements for discussions. From a pedagogical point of view, this use is based on the hypothesis that the work distribution will encourage students to participate to discussions. This use has also to allow students for their gradually familiarization with the tool. b) Collecting and adjusting of the questions proposed. c) Presenting the theoretical units. It was asked that these units, adequately written, should be used for enriching the personal works. d) Supporting the personal works, in a manner to create, in the form of case studies and theoretical fragments, an embryonic "encyclopaedia". With respect to the editing of a classical monolithic "paper", the hypothesis is the support by wiki facilitates the work of editing by the distribution of work and the group collaboration. One can notice that wiki integrate some uses normally observed in various systems: web forum, tool for presentation, tool for group editing, etc... In addition to the question connected to the "hypertexts and learning" subject, this option comes from previous experiences in which one shown the difficulties of using multiple types of tools. The choice of the system has been addressed to Dokuwiki as it is quite similar to Mediawiki (i.e. the system on which is based Wikipedia) and it is easy to implement and to use.
Learning support arrangements	The basic tool use in relation to the pedagogical strategy is a wiki previously predisposed with a list of contents representing the structure of the course. At the same time, students also used the Claroline platform they already known. An independent web page (http://www.abord-ch.org.ch/cours/iperad08/) is linked to Claroline and offered to students a linear presentation of the resources. It is necessary to note that the wiki integrated in Claroline platform has not been used in this experience, but the option has been to choose Dokuwiki (see didactic structure and learning activities).

OUTPUT

Student assessment	(Internal) Evaluation has been based on a knowledge test and on the realization of a personal work. This latter consists of an analysis of the argumentation structure of a paper presenting an experiment in educational field or it consists of a summary and a commentary of a methodological paper. Some students will refine their works during the summer.

Results

First of all, it is necessary to stress that the previous objectives were too ambitious, both at contents and experimentation level. Comments concerning the scenario are not completely independent from this previous observation.

a) A previous experience shown sociable students willing to rapidly start their personal work and to collaborate in group for working on it. This scenario has been based on the same idea, but actually this idea has not been confirmed. With certain exceptions, students have proposed individual subjects and only tardily have involved themselves in the task. Many works will be refined only during the summer.
b) All students subscribed themselves on the wiki, but some students have collaborated regularly while others have collaborated very sporadically. Some student has not at all collaborated. The current enquiry should determine if the frequentation is connected to the work structure, to the content or to the equipment at disposal. Variations observed on the frequentation in relation to the subject treated permit to state the hypothesis that the content has an influence on the tool frequentation.
c) Comments are posted on the wiki as successions but without real interactions. Students show a tendency to rapidly intervene on the texts already published.
d) In general, students seem not to consider the collaborative work mediated by computer as an important aspects of their knowledge construction and for teacher this option is not an easily point to explain. So, first of all, students work in traditional way before copying or publishing their comments on the wiki. How can we consider this tendency? Some student speaks about the difficulty of accessing to Internet, while other students try to avoid the publication of wrong responses or comments.
e) In many courses, teachers proposed web tools to students. In particular, in another course they were asked to use the wiki integrated in the Claroline platform. One can propose the hypothesis of an "instrumental conflict[4]" that makes task more difficult.
f) Considering the difficulties of some students in using the web tools and in accessing to information, some important documents are delivered in many ways. Further to the wiki publication, the same documents are uploaded in Claroline in .pdf format and also delivered in paper version. This option could be the source of this problem.

Conclusion ("lesson learned")

Although the difficulties previously described, it seems possible to re-propose the course on the base of the same scenario, considering some adjustments:

- The organization of students' work: it is necessary to be more precise in the defining of the deadlines. Practical works could be less in quantity but more specific in contents.
- The familiarization to wiki: it should be useful a complementary support for those students that have enough some difficulties with this tool.
- Use centred on the wiki: it should be interesting to use more heavily le wiki as the only tool for the course. This implies that all other supports that duplicate the same information have to be eliminated and all documents have to be directly published on the wiki (and not previously on PowerPoint).
- The activation of students for collaborating: one should define more precisely the different ways for collaborating on the wiki, but first of all one should activate students for working online without being afraid to take some specific position or making some mistake.

This re-proposition of the course has the advantage of an embryonic encyclopaedia already existent as model. One of the objectives in the middle-term is to capitalize the different contributions and the wiki seems to be an appropriate tool for realizing this objective.

There's also some other aspects that should be more exhaustively treated:

- Which understanding students have about the project that mix web tools as objet and support for the course. Do they assent to the project?
- Which are the particular difficulties connected to the wiki use?

[4] Les problèmes issus de l'utilisation de plusieurs systèmes informatiques est évoqué dans Pochon, L.-O. & Favre, A. (à paraître). Pour un apprentissage instrumenté des statistiques, quel progiciel choisir ? Actes du colloque Didapro3.

3.2.6 Course 6: ACADEMIC COMPETENCIES ON PSYCHOLOGY AND EDUCATION (A COURSE TO FOSTER STUDYING COMPETENCES)

Rationale

The study here proposed is characterized by a blended-learning perspective and it has the aim of exploring the importance of online interactions in a learning context focused on the acquisition of complex competences.

In the tradition of vocational training and learning, professional competencies are acquired by modelling, scaffolding and trials and errors, normally with a more expert person. Nevertheless, when complex competences have to be acquired, traditional practices are not adequate; so an in-depth reflection on the adopted procedures seems necessary. This meta-cognitive reflection represents an individual task, but it is also collective when conditions are put together for favouring a discussion on the actions of one and the other.

Succeeding on university studies asks student to manage a lot of academic competences. This initiation to student's trade (Coulon, 1997) may be the object of pedagogical interventions, but it includes also important aspects of informal learning based on the exchange of experiences between students and on a reflection and a critical discussion about the best learning strategies to adopt in different pedagogical situations.

This study concerns specifically this learning model, with a specific attention on the communication and interaction modalities that could support the managing of novel competencies.

Research questions

Principal questions guiding this study are the following:

- How can we support group's exchange and reflection on learning practices within a group of about 100 students?
- In which pedagogical conditions could be helpful this critical reflection on the practices? Which factors could propose difficulties in this type of interaction?
- How can we articulate learning individual time and collective discussion for better stimulating the reflection on the manners for documenting, reading, annotating or learning?
- Which are the best communication tools that permit an exchange of experience and a critical reflection on the same learning activities?

Materials and method

Data collected and analyzed are various:

- Students tasks completed during the semester;
- Web forum discussions;
- Exchanges between students and between students and teachers during the course;
- Observations of interaction time of little groups of students organized during the lessons;
- Interviews with some student;
- Evaluation questionnaire about the course fulfilled by students.

Course Description

INPUT

Main objective of the course	The principal aim of the course is to initiate students to learning practices of university context and to "student's trade". The aim is first of all to develop more competencies than knowledge. So, a lot of exercises and practical task are proposed. In particular, the course aims to the acquisition of fundamental competencies that characterize the learning activity in a university context: competence related to documentary research, noting, reading scientific notes, writing in scientific way, group working. The course focus a particular attention to learning and working tools represented by the currently information and communication technologies.

Target group	87 students participate to this experience; all the students are on their first Bachelor year at the Faculty of Humanities of the University of Neuchâtel. Most of them are students coming directly from secondary school, so their experience as university students is new. Other students (a dozen) have already one or more years of experience as student of another university or high school.
Duration	Two weekly ours for a total of 28 ours.
Learning resources (web-based materials)	Two Canadian web sites have been used as facilities for managing some practice concerning documentary research and reading. An online course (on Canal-U) has also been used in-class for presenting aspects connected to the noting activity.
General course organization	The course takes place on the 2nd semester of the first year of study. It is based on two weekly ours for a total of 28 ours. Students are demanded to carry out an important work personally or with group for managing their competences.
Didactic structure	The course is structured on 6 modules concerning the following subjects: • Introduction: student's trade • The documentary research • The reading practices • Text annotation and noting • Rules for quoting and the risk of plagiarism • The scientific writing • The art of the exposition The most important modules, for ex. those concerning documentary research, have been carried out on 3 weeks, while other modules was 1 or 2 weeks long. Each module has been characterized by activities that students had to complete.

PROCESS

Learning activities	A lot of "macroscripts" (Dillenbourg, 2008) have been adopted for organizing the course of these different activities and, in particular, for timing the individual time and the discussion/collaboration time. We propose some examples in succession: Activity 1 Object: Analyzing in depth a question for an online discussion within a little group. a) 1st week: commenting a text individually (summary of the Alain Coulon's work "Le métier d'étudiant", 1997). b) 2nd week: group discussion in a web forum on the base of the following questions: can we really define a "student trade"? Can this concept be applied to learning activities? Activity 2 Object: Exploring library catalogues and databases a) Answer to some questions like: • What has been written on motivation to learn? • Is there some works about visual perception of musical partition? • Who published something about acquisition of new competencies? • Where can one found references about "tutor effect"? • Which works and articles of American psychologist Jerome Bruner can one found in French? b) Comment personal discoveries and trials in documentary research, both goods and not goods. c) Indicate on the web forum questions or difficulties faced during the documentary research. Activity 3 Object: Collecting "good practices" about reading within a web site with resources. a) Explore a recommended web site individually and outline 5 suggestions that seem to be useful; b) General in-class discussion on "good practices" that students have found. Activity 4 Object: experiment the supply of a conceptual map as tool for noting. a) Individual realization of a conceptual map for presenting the essential aspects of an article. Maps (scanned or realized with adequate software) are uploaded on the platform. b) Critical in-class analysis of 5 conceptual maps realized by students. The analysis is realized in

	little groups of 2 or 3 students on the base of three criterions: readability, structure and relevancy of the map. c) Final in-class discussion about positive and critical aspects of a conceptual map as supply for the comprehension of an article. Activity 5 Object: Experimenting different functions for text annotation. a) Students have to learn a text individually. The task is concerning the use of two annotation types, i.e. outlining the principal elements or noting the content structure. b) in-class discussion about the best annotation practices. Activity 6 Object: re-investing the principal competences trained during the course. Students are demanded to: • carry out an individual bibliographic research on a proposed subject; • write 3-4 pages concerning bibliographic citations on the base of APA norms; • present the strategies adopted for their bibliographic research with a critical point of view (1 page).
Learning support arrangements	Principal support used is the Claroline web platform, adopted by the University of Neuchâtel. In particular, two of the platform tools are most used: WORKS for collecting individual or group contribution and the WEB FORUM discussion. For realizing the conceptual maps only a part of the students used specific software like Mind Manager or Cmap.

OUTPUT

Student assessment	Students' evaluation is based on a constant control of the works they completed during the semester.

Results

One can resume the principal observations in 5 remarks:

Remark 1: Students' activity is spontaneously oriented to the completion of the requested tasks, with the aim to deliver the work within the delay defined by the teacher. But the reflection and the discussion about the competences trained is difficult to activate. Students seem not to perceive the interest on a critical discussion about the learning practices they adopt.
One can propose various explications about this point. In the first year, students aren't necessarily perceptive about new requests coming from university activity. Practices they acquired during the secondary school seem to be adequate and sufficient. A student says: "… for a long time we have learnt during the secondary school for ex. to resume some text or to note". The reasons for diversifying or improving their learning approach seem not to be understood. Further, a reason proposed by students is that everyone has developed their personal habitudes for working, so learning strategies are seen as coming from the private sphere.

Remark 2: The use of a web forum doesn't propose difficulties if the discussion is an opinions exchange. For ex., the discussion on "student trade" proposed during activity 1 really activates various interventions in the forum, but these interventions seem to be more personal points of view juxtaposed than actual discussions. Students principally manifest the worry of writing something about the proposed question and expressing their point of view. Debate practice aiming to in-depth analyzing a proposed question is difficult to activate.

Remark 3: The web forum is spontaneously used by students for resolving some organizational problems connected to work and, if necessary, re-discuss some need. For ex., at the end of the semester one of the latest activities proposed by teacher has been perceived as too many by students. Within a day, a thread of messages has been exchanged about the pertinence of this latest work.

Remark 4: When students are requested to work in little group (face to face) for examining critically the productions of other students (for ex. activity 4), the critical analysis is concise and cautious, as if they are not really authorized to evaluate the production of their colleagues.

Remark 5: A script has been proposed lot of times for demanding a personal work and, then, activating a collective discussion-reflection on the practices adopted by everyone. The time for discussion-reflection on the activities realized activates only a part of students, while the others focused the attention on the completion of the task and seem to not perceive the usefulness of a post-activity reflection.

Conclusion ("lesson learned")

The principal difficulty that characterized this blended-learning course is connected to the fact that most students at the beginning of the semester of the first year don't show an interest for a critical exchange about their competences. The course's challenge is to construct a sharing comprehension of course's intentions within students. This is not possible with a simple presentation of the objectives during the beginning of the semester but through the weeks, on the base of the work realized that progressively it's possible to increase a first interest to activate a critical reflection on learning practices.

But within the different approaches experimented, which are the most fruitful for supporting reflection and discussion time on learning practices adopted?

One can outline 3 approaches:

1) As it is simple to activate an exchange of opinions in a web forum, the reflection on practices could be the subject of a debate that permits the expression of everyone's point of vies (for ex. starting from a question like "does a quick reading favourite a text understanding"?). Everyone has an opinion about the question, so it's a good starting point for in-depth analyzing the question on the base of lectures, personal experiences or experimentations completed during the course as practical works. In this case the strategy considers the debate as a moment for increasing the analysis of practices.

2) Another strategy is that to put students in front of very difficult tasks (too difficult to manage), for destabilizing their idea that "all" is simple. This has been experimented by demanding students to organize in 15 minutes an oral presentation on the base of a predefined structure and concerning a subject proposed during the lesson. The art of oral presentation (one of the course's modules) in fact appeared to students more difficult than they thought. The consequence has been that a space of discussion-reflection has been opened for discussing about the quality of an oral presentation and on the request for managing this activity.

3) A final pedagogical strategy concerns the need of linking exercise activity to actual learning tasks. A bibliographic research for simply exploring the functioning of a database or the characteristics of a search engine doesn't undertake sufficiently students. On the contrary, if they are asked to realize a wide work for some course, the question concerning practices becomes important and they are ready to reflect on the practices. A strong relation between initiation to knowing how to learn and the works to realize (writing a text, organizing a research project or preparing an oral presentation) is necessary. Starting from October 2008 the course here described will be integrated to the course "introduction to research methodology" in which the same students are requested to develop research projects.

Concluding, e-learning practices activated seem to support the realization of activities by students and also some exchange concerning learning practices. But in reason of the particular character of the course, both considering contents and the progress, communication and interaction time in-presence show itself indispensable for clarifying each time the didactical expectations and perspectives adopted. One rests to experiment if it is possible to activate discussion and collaboration online time that could contribute not only to acquisition of students' competences, but also to a reelaboration of their own learning conceptions on the matter.

3.2.7 Course 7: COGNITIVE AND SOCIAL ACTIVITIES AS WELL AS TUTORIAL SUPPORT IN A VIRTUAL SEMINAR

Rationale

In collaborative online learning, cognitive and social activities as well as the collaboration itself and the organization of the group work are of interest in the context of fostering learning processes. The question is, how groups evaluate these activities, their collaboration and the organization of their group work over time so to see whether groups are engaged in adequate learning activities. Therefore, the following seminar was evaluated over three points of time. The seminar was didactically designed problem-based. Every single topic was introduced with a specific case that had to be solved by every group.

Research questions

In our study, we asked groups to evaluate their cognitive activities, social activities, group planning/organization, group collaboration and tutorial support. In a second step, we rated the group solutions and gave individual feedback to every single solution. Therefore, we are interested in the question, how do groups perform in the seminar?

Materials and method

In this case study the interaction and collaboration among the students in a virtual course were measured. Therefore a definite questionnaire was used to measure cognitive activities, social activities, group planning/organization, group collaboration and tutorial support.

Design of the study
The evaluation of the seminar was a longitudinal survey with three points of measurement. The analysis was conducted during winter semester 2007/2008 at Ludwig Maximilians University. The data was collected three times. The first data collection was conducted from the 22nd until 29th of November, 2007. The first data was collected 5 weeks after the beginning of the virtual seminar. The subsequent data was collected 2 more times every four weeks using an online questionnaire. The second point of measurement was from 21st until 28th of December, 2007. The last point of measurement was from 31st of January until 7th of February, 2008. The students received an online questionnaire per e-mail. In the same way they were supposed to return the filled in questionnaires (see Figure 3-1).

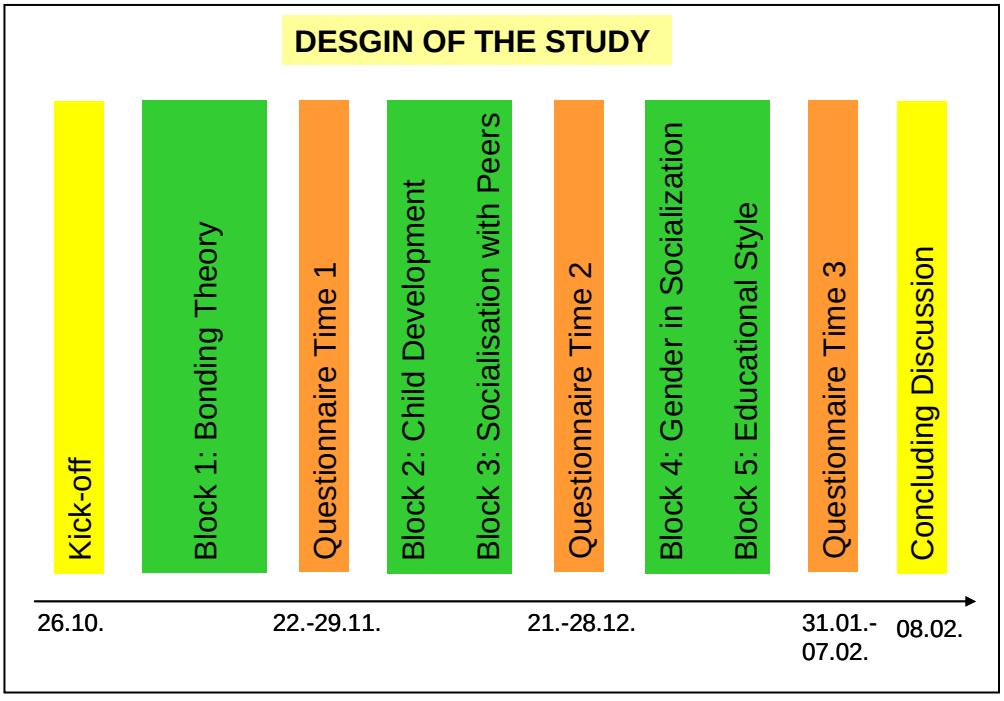

Figure 3-1: Design of the study

Course Description

INPUT

Main objective of the course	The main objective of this course is knowledge acquisition and knowledge application in the domain of pedagogical psychology. Main topics were how socialization and education processes are organized and what influences and effects they have on the development of children in early childhood. The main topics of the seminar were socialization theories, gender specific socialization, physical and psychological development and advancement of children in early childhood.
Target group	The participants were especially undergraduate students who studied pedagogy as main subject. Altogether there were 15 participants in the seminar. There were 14 female and one male.
Duration	The duration of the course was 14 weeks, two hours per week throughout the semester lasting from mid October to mid February.
Learning resources (web-based materials)	The learning materials of the seminar were twofold: First of all, every week, the participants received a deeply elaborated PowerPoint version of the main content of the respective topic. Second, there was further literature illustrating and deepening the excerpt. All materials were web-based, so that the participants were able to download them after logging-in.
General course organization	The course was organized fully virtually with one face-to-face meeting in the beginning and one meeting in the end of the semester.
Didactic structure	The course was didactically designed problem-based. Every week, a new problem or case was introduced that had to be solved.

PROCESS

Learning activities	The course includes individual learning activities, like reading the material and thinking about the task solution, but also collaborative learning activities especially for creating the task solution.
Learning support arrangements	The support for the learners included three methods: • The definition of group rules: Every group had the task to formulate obligatory group rules which were binding for every group member. • The definition of a student moderator: Every week, one group member had to be the moderator so that the role of the moderator rotated during the seminar between the group members. The task of the moderator was to guarantee that the task was solved in the time schedule and that every group member participated in the task solving process. Usually, the moderator divided the task in sub-tasks or assigned specific tasks to the group members. Furthermore, he finalized the solution. • Feedback on group solutions: Every week, every group received a feedback on its task solution from the tutor. Sometimes, the feedback was given on the individual solutions, sometimes the feedback was in the form of a sample solution for all groups.

OUTPUT

Student assessment	Every week, the students had to solve a collaborative task. These group soluations as well as the individual contribution of every group member was used for the student assessment. The group solutions were measured following sich qualitative criteria, namely correctness of the content, completeness, coherence, structure, verbal comprehensibility, overall impression. The student assessment was calculated as mean of all tasks.

Results

Question 1: How did groups evaluate their cognitive activities?
In respect to cognitive activities, we looked at all three points of time to see, how the four groups evaluated their cognitive activities. Overall, the evaluation of the cognitive activities did not differ between the three points of time. In the beginning, the mean was 3.85 (SD=1.09), in the middle it was lowest with 3.76 (SD=1.06) and in the end, it was again 3.87 (SD=1.20). Looking at each group separately, the overall tendency shows in group 1 the lowest scores and in group 4 the highest.

Question 2: How did groups evaluate their social activities?
The social activities were very highly rated from all four groups. Overall, the mean was 5.46 (SD=.58) in the first point of time, 4.96 (SD=.98) in the second and 4.79 (SD=.77) in the third point of time. This means that the social activities decreased during the seminar about .70. Looking at the four groups separately, the biggest decrease was in group 1 from time 2 to time 3, while in all other groups, social activities decreased from time 1 to time 2 and almost stayed similar to time 3

Question 3: How did groups evaluate their group organization?
The groups evaluated their group organization differently: While groups 1 (except of point of time 3), 2 and 4 evaluated their organization very highly and on a constant level, group 3 rated it much lower. Overall, the mean decreased over time from the first evaluation with a mean of *M=5.60* (*SD=0.60*), over the second with a mean of *M=5.25* (*SD=1.38*) to a mean of *M=5.04* (*SD=1.42*). This is due to the fact, that group 3 evaluated their group organization lower at point 2 and point 3 and group 1 at point 3, even though groups 2 and 4 stayed constant respectively increased their evaluation.
The specific group evaluation could be verified by looking on the way group members organized their task solving process. We detected three different ways of solving the task: In group 1, every member solved the task himself and sent it to the moderator who put the different solutions together to one solution. Groups 2 and 4 subdivided the task into mostly 2 sub-tasks which two group members solved. The moderator put the different solutions together. In group 3, a different way was chosen. One group member started with the task solution in a document and all other group members changed this solution according to his/her opinion. To see which modification was made by which group member, every member used a different color in the document. In the end, the moderator put the different suggestions together to one final solution. Therefore, the way how to collaborate was more effective in groups 1, 2 and 4 than in group 3.

Question 4: How did groups evaluate their group collaboration?
The evaluation of group collaboration included cohesion, taking responsibility, goal-orientation and task completion. All four dimensions decreased from time 1 to time 2 and from time 2 to time 3. This means that in the beginning, group members rated their collaboration better than in the end. Looking at the dimensions individually, cohesion decreased from a mean of *5.12* (SD=*.95*) to *M=4.95* (SD=*.97*) and *M=4.62* (*SD=1.19*), taking responsibility from a mean of *M=4.73* (*SD=1.28*) to *M=4.13* (*SD=1.49*) and *M=3.86* (*SD=1.65*), goal-orientation from a mean of *4.73* (SD=*.76*) to *M=4.57* (SD=*.83*) and *M=4.48* (*SD=.94*) and task completion from a mean of *5.68* (*SD=.62*) to *M=5.07* (*SD=1.03*) and *M=4.84* (*SD=1.09*).

Cohesion
Regarding cohesion, groups 1 and 3 show a decrease, while groups 2 and 4 stayed almost stable in their evaluation. Groups 2 and 4 evaluated their group cohesion on a high level, group 1 in the beginning very high and in the third point of time considerably lower, while group 3 showed lowest rates in all three points of time.

Taking responsibility
Looking at the groups taking responsibility for their task, two main phenomena could be recognized: First of all, again groups 2 and 4 show a relatively stable evaluation even though, both evaluations show decreases at the second point of time and again an increase at the third point of time. Second, groups 1 and 3 both show a decrease at the third point of time, even though, the overall evaluation rates are much higher in group 1 than in group 3. Group 3 shows again the lowest rates

Goal-orientation
All groups showed almost the same evaluation rates in goal-orientation. That means that all groups were very interested in achieving the group goals which were the solving of diverse tasks to get a certain degree. Only in group 1, the evaluation decreased in the third point of time, because one student skipped the course so that there were only 2 members remaining.

Task-completion
Regarding task-completion, groups 1, 2 and 4 evaluated this dimension on a very high level, while group 3 was definitely lower. Again group 1 showed a decrease in the third evaluation, because at this time, one group member left the group

Question 5: How did groups evaluate the tutorial support?
The tutorial support was measured with four different dimensions: Continuity of support, giving support, feedback and motivating learners. All four dimensions decreased during the seminar. In the beginning, continuity was measured with a mean of *4.94* (*SD=1.58*), then with *M=3.80* (*SD=1.87*), and in the last point of time with *M=2.91* (*SD=1.56*). Giving support was overall rated with *M=4.89* (*SD=1.40)*, then with *M=3.60* (*SD=1.54*) and in the end with *M=3.50* (*SD=1.38*). Giving feedback was evaluated with *M=4.60* (*SD=1.58*), then with *M=4.54* (*SD=1.49*), and in the third point of time with *M=4.21* (*SD=1.35*). Motivating the learners almost stayed at the same level of about 3.40 (M_1*=3.44* (*SD=1.55*); M_2*=3.63* (*SD=1.65*); M_3*=3.23* (*SD=1.64*)).

Continuity of tutorial support
According to the evaluation, the continuity of tutorial support was highest in the beginning (except of group 1) and decreased during the seminar to point 3. Group 2 seemed to be most satisfied with the continuity of the support, while group 3 rated this lowest Post hoc contrasts according to Bonferroni showed significant effects between group 3 and all other groups at point of

time 2 as group 3 evaluated the continuity of tutorial support considerably lower than all other groups (between group 1 and 3 *p=.01*; between group 2 and 3 *p=.01*, between group 3 and 4 *p=.02*). At time 3, there is a significant contrast between group 2 and group 3 as group 2 evaluated the continuity of support highest and group 3 lowest (*p=.04*).

Giving support
The evaluation of giving support by the tutor changed during the seminar. While groups 2, 3 and 4 rated the support highest at point 1, group 1 rated it highest at time 2. Lowest rates received the support in time 3 from group 1 and group 4, groups 2 and 3 rated the support lowest at time 2.

Giving feedback
Giving feedback was very highly rated. Group 2 seemed to be most satisfied with the tutor giving feedback, while group 3 was least satisfied.

Motivating learners
Learners perceived the tutor motivating them differently. Overall, there was no tendency all groups followed. While in groups 2 and 3 the evaluation slowly decreased over time, in group 1 it was lowest at point 1 and highest at point 2, and in group 4 it steadily increased over time.

Question 6: How did groups perform in the seminar?
All groups had to perform eleven tasks to get the degree. The first three tasks were in the first evaluation period, tasks 4 to 7 were in the second evaluation period and tasks 8 to 11 in the third evaluation period. In the first evaluation period, all groups received high scores at a level of 5.00 (maximum 6.00) and higher.

In the second evaluation period, the performance of the groups differed more. Groups 1 and 2 showed a very constant high performance, while groups 3 and 4 differed more in their performance, so that the evaluation went down to a mean of 4.2. The third evaluation period showed again a more consistent performance of all four groups.

Conclusion ("lesson learned")

Group collaboration
Overall, the evaluation of the seminar showed one important thing: Groups have very heterogeneous ways of collaboration. In e-learning, the collaboration seems to differ between groups according to their different task solving processes even though all groups had a moderator and group rules.

When we look at the single groups in more detail, we can conclude that especially groups 2 and 4 were very effective. Why? These groups organized their group work very simple: Every task was sub-divided in sub-tasks when possible so that group members did not have to solve the whole task, but only half of it. Only the moderator had more work every week, but as the moderator rotated permanently, the work load was equal for every group member. These group members evaluated their cognitive and social activities as well as their group collaboration (cohesion, taking responsibility, goal-orientation and task completion) almost on the same level. This indicates that these two groups worked together under the same conditions all the time.

Group 1 shows a specific phenomenon: The evaluation shows a decrease at time 3. At time 1 and 2, the evaluation rates show very similar and high scores in all dimensions. As all group members had to solve the task and the moderator put the solution together to one single solution, collaboration was well-balanced in this group. The reason, why the decrease happened at the third point of time is due to the fact that one of the group members suddenly left the group without any further explanation. Therefore, the two group members remaining in the group were according to their evaluation data a little bit frustrated about this action of their third group member. Especially social activities, group cohesion, taking responsibility, goal-orientation and task-completion decreased enormously about 1.5 to 2.8 points.

In group 3, the collaboration was not as good as in the other groups. The reason for this mainly lies in the fact that the task solving process was very time-consuming and not well-balanced. In this group, always the same group members started with the task solution, whereas two of the group members almost always were the last who added something to the group solution. Often, they did not have any suggestions for further changes of the solution. Therefore, group members had the impression that some group members are free riding (Salomon, 1983) that means not all group members equally participate in the group collaboration.

These data shows in concrete terms that the way how groups organize their task solving process is essential for their effectiveness, independently of any support methods of the tutor. Groups who assigned tasks in a balanced way and participated equally rated their collaboration with high scores. Further on, the leaving of a group member frustrates the remaining group members – a phenomenon no e-tutor can stop. Especially this last phenomenon is much easier in online collaboration than in face-to-face collaboration where group cohesion and the commitment to the group is higher as group members directly have to face their collaborators.

Tutorial support

The evaluation of the tutorial support shows overall a more or less decrease over time. This is especially due to the fact, that in the beginning, the tutor has to support the groups much more than afterwards, when groups are very well functioning. In some cases, the tutor did not intervene as the groups organized themselves in a very efficient and effective manner.

Looking at each dimension separately, continuity of support especially decreased at time 3 in groups 1 and 3 – both groups in which collaboration was not balanced according to their own group evaluation. Therefore, it is not surprising that they evaluated the tutorial support on a lower degree. That one group member left group 1 was not foreseeable to the tutor and at this point of time he had no chance to intervene. Even though in group 3 group members criticized their group that the participation was not equal at time 2, there was no reaction of the group members in their behaviour. In these two situations, the groups expected some more support from the tutor which could be seen in the evaluation of the support dimension.

Giving feedback was highly rated – except of group 3. This is surprising as all groups received the same kind of feedback even though specified to the task solution. Again, the explanation may be that as the group was not satisfied with their group collaboration itself, it affected also the evaluation of the tutor. This also may be the reason for the evaluation scores of the dimension for motivating the learners. As all groups were motivated by the same way, the differences in evaluation are noticeable – and again more an effect of the overall impression of group members regarding their collaboration than an objective evaluation of the tutor.

Even though, all groups were not satisfied with their group collaboration and the tutor, all groups performed on a very high level – a fact that does imply that group performance was not influenced by group collaboration or tutorial support. Another explanation could be that groups evaluated their collaboration and the tutorial support lower as they really were – so that their performance was not really affected by this phenomenon.

4 Practical Guidelines

This chapter presents the practical guidelines emerged from the research and applied work realized during the project will be presented. A first section will be dedicated to the design principles. Design principles concern all aspects relevant for creating an e-learning environment, like the technical characteristics, the didactics, the learning task or the group composition. The computer plays in e-learning environments the crucial role as it is necessary as a tool to provide information, to give individual feedback and to allow collaboration, as well as to technically realize collaboration. The didactical design principles comprise less or more structured content, the task characteristics which are important to stimulate collaboration and the support given by the teacher has a great impact on learning processes. In the next section practical guidelines concerning the process of Knowledge acquisition will be presented. As a matter of fact, It is assumed that the design of the learning environment – especially the support of the teacher – has an influence on the learning processes which are subdivided into cognitive and social activities. Therefore, another section is dedicated to the teachers/etutors giving feedback. These learning processes again have an influence on the output variables. Mainly knowledge application and transfer as well as the acquisition of collaboration competencies are relevant outcome factors in this context. Consequently, the last section will be dedicated to these output variables.

The teacher especially influences the design of his e-learning course and the support of the learning processes. Other factors influencing the learning process are input variables like individual or group characteristics. In this paper, we want to stress the different design possibilities and support methods and, in a last step, the way how specific processes could be supported (see Figure 4-1).

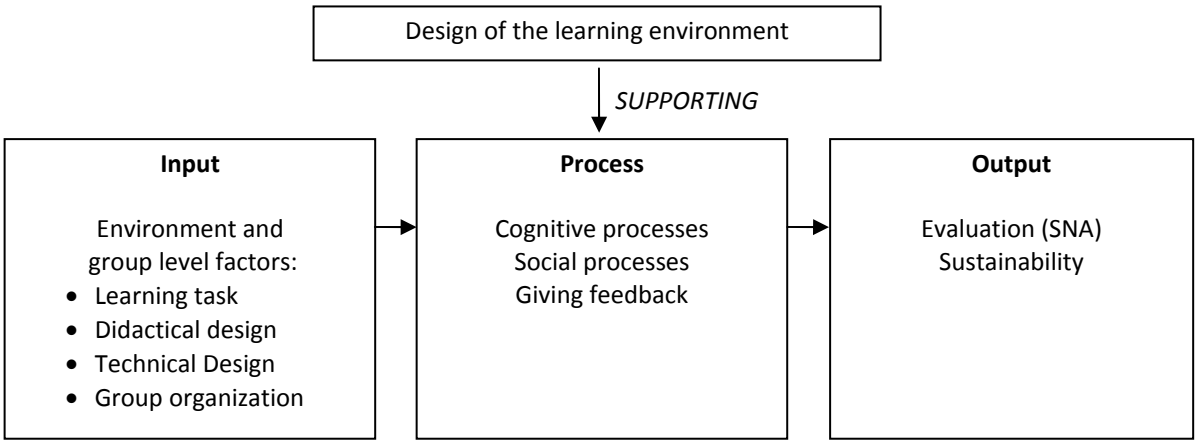

Figure 4-1: Model of the analysis

Section 1 "INPUT"
DESIGNING EFFECTIVE LEARNING ENVIRONMENTS: PRACTICAL GUIDELINES

4.1 Environment and group level factors

4.1.1 Learning task

Collaboration requires always specific tasks which stimulates group work. Mainly, collaborative tasks should develop social interdependence between the different learners (Johnson & Johnson, 1989, 1992, 1998). That means that every learner is relevant for solving the task successfully and that learners have to collaborate – not only in the sense of getting one correct solution, but also in the sense of negotiating about it (Cohen, 1994). When contributions of every group member are necessary for solving the task, they are deeply socially interdependent on each other (Cohen, 1994). Johnson, Johnson, and Stanne (1989) subdivided social interdependence in resource and goal interdependence. While resource interdependence is given when resources are distributed between group members, goal interdependence is determined by the fact that individuals achieve only their own goals, when the group achieves also the group goals (Johnson, Johnson, Ortiz, & Stanne, 1991; Ortiz, Johnson, & Johnson, 1996). Research has shown that the combination of both resource and goal interdependence provides the best "ingredients" for collaboration. There are especially three different kinds of approaches concerning group work: peer tutoring, cooperative learning, and peer collaboration (Damon, & Phelps, 1989). Because the differentiation between cooperative learning and peer collaboration is very sophisticated, we focus on two kinds of tasks: Peer tutoring and collaboration. Both provide tasks with resource interdependence.

Peer-tutoring

Peer-tutoring respectively *peer-teaching* is a kind of collaboration where students have different knowledge about a topic they try to explain to each other. That means that one person instructs another in material on which the first is an expert and the second a novice (Damon, & Phelps, 1989). It is assumed that the tutor has greater information of knowledge about a specific topic than the tutee. Often, reciprocal peer-teaching is realized where both learners change the roles as tutors and tutees (Palincsar, & Brown, 1984). Giving learners the task of peer-teaching, it is expected that the tutor is able to deepen his knowledge through explaining (Chi, 1996) and that the tutee could close his knowledge gaps

through asking meaningful questions which have a positive influence on his achievement (Graesser, & Person, 1994). The learning goal for tutor and tutee is content-specific knowledge acquisition, but also social competences like giving constructive feedback.

Peer collaboration

Peer collaboration is realized when learners have to solve a task together based on their different individual information, knowledge, abilities and skills. There are especially two kinds of tasks which are relevant for peer collaboration: decision making and problem solving.

In decision making tasks, group members use their different information and knowledge to create a better solution than an individual. Learners have various information which must be put together to get a correct solution. In this context, shared and unshared information must be differentiated (Kopp, & Mandl, 2006). Information is shared when every group member has individually access to this information. Unshared information is given when only one group member knows this information respectively has access to it. Especially in the last aspect lies the advantage and necessity of collaboration: Different, unshared information must be put together to get an adequate task solution. But groups have the tendency to disseminate only shared information and not unshared information (Wittenbaum, & Stasser, 1996). Especially in tasks where unshared information is necessary for a correct solution – so called hidden profile tasks – this effect is very stable as research showed (Kerschreiter, Mojzisch, Schulz-Hardt, Brodbeck, & Frey, 2003). That means that even though resource interdependence is given, it is necessary that learners are aware of the fact that they have exclusive access to specific information to solve such collaborative tasks successfully.

Problem solving tasks require different skills and knowledge of various individuals. Therefore, it is necessary that they put their experiences, knowledge, information and abilities together for solving the task. Especially wicked problems which have no single correct solution are relevant for collaboration (Van Bruggen & Kirschner, 2003). Such problems need different perspectives and exhaustive discussions for solving the problem in an elaborated and justified way in which different theoretical concepts are deeply linked to the problem. That means that in peer collaboration task, knowledge is mainly applied and transferred to specific problems or cases. Collaborative activities which characterize such tasks are e. g. building a joint understanding of the task, generating new ideas together, testing different solutions, question asking and answering.

According to the media-synchronicity theory, there are especially two phases relevant in solving learning tasks in collaboration: “Conveyance” and “convergence” (Dennis & Valacich, 1999, p. 4). Conveyance processes comprise the collection of relevant information. That means that in the beginning of a task solving, group members must search for relevant information and disseminate them to everyone. This could be done by task-

sharing. Convergence processes are related to joint decision making. When all group members have access to relevant information, they are able to make a decision based on all these information. The exchange of different points of view and the evaluation of and reflection on the information are mainly necessary in this process. Such convergence-processes are relevant for developing a shared problem space and generate a joint comprehension (Paechter, 2003).

4.1.2 Didactical design

One major point concerning the design of learning environments is the didactical design. Here, we could differentiate closed, more structured and open, less structured learning environments (Reinmann & Mandl, 2006).

Structured learning environments

Structuring means that the content is organized in such a way, the designer thinks it is best for achieving the learning goals. In such knowledge-centred learning environments the focus lies on the content of teaching and learning. In this context, it is assumed that the content could be presented as a close and complete system (Reinmann, & Mandl, 2006). That means that the content is systematically planned, constructed step-by-step, and evaluated. The main effort of the teacher/designer lies in the optimization of the instruction. They are concentrated on the question how teaching is planned, organized and regulated in such a way that learners understand the presented content and its systematics and acquire not only the content but also its structure. Such knowledge-centred learning environments are concentrated on a specific content and therefore closed.

Unstructured learning environments

A less structured way of designing learning environments is based on situated learning approaches. These assume that learning is an active, constructive, self-regulated, situated, social and motivational-emotional process (Capon & Kuhn, 2004). Therefore, designing learning environments is not knowledge- but learner-centred. Because learning is a constructive process every learner has to fulfil, active knowledge construction is an important aspect. That concerns not only the knowledge acquisition, but especially knowledge application to avoid inert knowledge (Renkl, Mandl, & Gruber, 1996). Not the teaching, but the learning is focused in this approach. Therefore, every learner has the possibility to gain knowledge not in a stable structure, but according to his own learning process concerning prior knowledge and motivation.

4.1.3 Technical design

Looking at the technical realization of collaboration, computers allow either an asynchronous or a synchronous mode of communication. The modes affect the selection of the learning scenario. Synchronous communication requires learners to be online at exactly the same time, whereas asynchronous communication allows learners to be online any time they choose (Mandl, Ertl, & Kopp, 2006).

Asynchronous collaboration

When the computer provides asynchronous communication, learners often communicate through discussion boards in the learning environment. Such learning environments are quite commonly used for virtual seminars in higher education (see Koschmann, Suthers, & Chan, 2005; Schnurer, 2005; Weinberger, 2003). Using the discussion board, learners express themselves by typing statements into the computer interface. Learners can post messages to the system and also have the opportunity to read and reply to the messages of their learning partners. The communication is asynchronous, which means that there is no immediate reply to each learner's contribution. However, this method also provides enough time for learners to compose thoughtful replies to other learners' contributions (see Schnurer, 2005; Weinberger, 2003). The written messages are permanent and usually allow for later access (see Paechter, 1996). Furthermore, many systems allow learners to edit and improve their contributions (see Clark & Brennan, 1991; Dennis & Valachic, 1999). The advantage of discussion boards and other asynchronous learning scenarios is that each learner can proceed with the learning process at his/her own pace. This means that learners have time to think when writing contributions because there is no immediate need for response (Ellis, 2001; Lipponen, Rahikainen, Lallimo, & Hakkarainen, 2003). On the other hand, learners are often dependent on each other's contributions, e.g., when working on a team assignment collaboratively. It is often necessary for learners who depend on one another to have a 'similar pace' for their collaborative work (see Fischer & Waibel, 2002). This means that learners should contribute to the discussion in a timely manner so that the other learners have the chance to pick up statements and reply to them.

Synchronous collaboration

The computer can provide synchronous communication in the form of a chat or videoconferencing tool. In this learning scenario, learners are permanently connected with one another throughout the learning process. They communicate either by typing statements or sentences when using computer chat or by speaking into a microphone during videoconferencing. The communication partners receive these communication acts

instantly. In this way, synchronous communication enables highly frequent learner interaction. Videoconferencing enables learners to communicate in spoken words through an audio and a video channel (see Ertl, Fischer, & Mandl, 2006). The audio channel transmits spoken discourse and the video channel generally provides an image of the head and the chest of the learning partners. In such collaboration scenarios, learners often find a shared application on their screen. This shared application functions as a tool for making the contents of the spoken communication permanent, which is an important aspect when dealing with demanding learning tasks.

4.1.4 Group organization

On the group level, there are different aspects relevant which influences the learning processes in groups.

Group size: A meta-analyses of Lou, Abrami, and d'Appollonia (2001) showed that a group size between 2 and 5 people is best for computer supported collaborative learning. This group size allows all group members an active participation in collaboration. More people increase the risk of dysfunctional group phenomena like social loafing (Salomon, & Globerson, 1989).

Majority – minority: The influence of minorities on group decisions is proven in a lot of empirical studies. That means that e. g. in a group of three persons one member has a different opinion on a certain topic than the other two. This member as a minority is able to influence the decision of the group, when he constantly expresses the same point of view even though not in a static, but in a flexible way (Maass, West, & Clark, 1993).

Status differences: Status differences occur because of e. g. race, sex, age, or job tenure. But there are also other reasons why the status of the group members may differ. The consequence of status differences for collaboration are the followings: Members with lower status have often no influence on the collaboration process and therefore on group decisions or task solutions, because the other group members do not accept their opinion in the same way they accept points of view of status-higher members (Cohen, 1994; Webb, 1989). The problem is, that learners with lower status do not profit from collaboration in the same way, higher status learners do. Virtual collaboration was assumed to avoid such status differences, but research has not found any differences between face-to-face collaboration and virtual collaboration, yet (Hollingshead, 1996). Status differences remained in the virtual learning environment as well as in the face-to-face learning environment.

4.1.5 *Guideline title:* DESIGNING EFFECTIVE LEARNING ENVIRONMENTS

Guideline text

*To design effective **learning tasks**, you can (e.g.):*

- Design a **task that must be solved collaboratively** (e. g. including different perspectives). That means that all participants are necessary for the task solving process (joint product in the end). Tasks may include collaborative problem/case solving with the construction of a joint document as result, answering a research question, discussing different perspectives, etc.
- **Stimulate** the learners' **interest and intrinsic motivation** with **inspiring starting points**. This could be own experiences of the students, interesting news or actual political decisions.
- **Structure the task in phases or in sub-tasks**. E. g. "Phase 1: Collect as much information as necessary.", "Phase 2: Discuss the important information and find different solutions.", "Phase 3: Discuss the results.", "Phase 4: Implement one solution."

*To design successful **e-leaning course (from the didactical point of view)**, you can (e.g.):*

- Design the e-learning course as **blended learning scenario**, including face-to-face sessions and online phases. The presence meetings should be more often than only in the beginning and in the end of the course.
- **Start the collaborative discussion in presence**. This is very important as for learners it is much easier to discuss orally than textually.
- **Discuss the topics in the face-to-face phases**.

*To design effective **collaborative learning environment** from the **technological point of view**, you can (e.g.):*

- Use a learning environment that is **portable** to make the platform easily accessible for group members so that they can interact at any time and any place.
- Use a learning environment that is **easy to handle for everyone**.
- Use **different kinds of collaboration tools** like email, forum, chat.

*To **compose groups and organize the group work** in an effective way, you can:*

- Assign **different and clear roles to collaborators**, e. g. one moderator, one reviewer, one summarizer to avoid the diffusion of responsibility which is also one problem in online collaboration.
- Assign **different tasks/sub-tasks and responsibilities to the group members or to every group**, e.g. one group member who is responsible for information research, one for summarizing relevant aspects, one for reflection etc.
- Assign **specific material to every group member**. If every group member receives different information, they have to exchange these information for the task solving so that information exchange, argumentation and discussion is fostered – a main problem in online learning.

- Create **interest groups** with the same expectations/preferences.
- Create **groups of learners with different points of view** (e. g. to stimulate discussion, argumentation).
- Create **small groups of 3 to 4 people**. When groups grow bigger than a number of four or five, the danger of free riding is much higher.

Section 2 "PROCESS"
COGNITIVE AND SOCIAL ACTIVITIES IN COLLABORATIVE E-LEARNING COURSES

4.2 Promoting effective cognitive processes: practical guidelines

Collaboration in e-learning courses is mainly used to improve knowledge acquisition respectively knowledge application of learners in comparison to individual learning. But collaboration is only advantageous, when learners engage in cognitive activities that mean all activities which are related to knowledge or information exchange between the collaborators. Collaborators have to communicate with each other about the learning content respectively about their knowledge to guarantee an effective collaboration in e-learning. But the way, how collaborators communicate with each other could differ enormously in respect to learning. There are some activities which seem to have a greater influence on collaborative learning than others. We focus on three main activities: online discussion/knowledge-sharing, argumentation/considering different perspectives, collaborative problem or case solving.

Online discussion and knowledge-sharing. One main advantage of collaboration is the fact that more persons with a different knowledge base and diverse information interact with each other to achieve a specific goal. In this interaction, one key aspect is the dissemination of knowledge among the collaborating partners – otherwise, collaboration does not take place (Kopp & Mandl, 2006). In this context, it is immensely important, which kind of information/knowledge is disseminated as in most cases, group members tend to disseminate only shared information to which all group members have access to (Stasser & Titus, 1985; Wittenbaum & Stasser, 1996) and not to unshared information which only one group member has access to. Particularly this last aspect is the main advantage of collaboration – the pooling of diverse information/knowledge of all group members which guarantees a better solution than an individual solution. Therefore, in online discussion there are two steps to follow: In a first step collaborators have to collect and disseminate all relevant – shared and unshared – information which they need in respect to their collaborative learning (Dennis & Valacich, 1999). In a second step, when all group members have access to the relevant information, they are able to discuss this information (Dennis & Valacich, 1999). The discussion itself includes the exchange of different points of view, the evaluation of and reflection on the information. These processes are necessary to generate a joint comprehension of the collaborative task (Paechter, 2003).

Arguing and considering different perspectives. Argumentation and the considering of different perspectives are important abilities in everyday life and scientific work. These include several activities: First of all, all group members have to elaborate and justify their points of view on the task. As collaboration usually includes the phenomenon that group members have different perspectives on the task or on the learning itself, it is in a second step necessary to exchange these diverse perspectives and compare them to arrive at a conclusion for deciding on the task. In this context, argumentation is defined as "a verbal and social activity of reason aimed at increasing (or decreasing) the acceptability of a controversial standpoint for the listener or reader, by putting forward a constellation of propositions intended to justify (or refute) the standpoint before a rational judge" (Van Eemeren, Grootendorst, & Henkemans, 1996, p. 5). Argumentation is important to consider and explore diverse perspectives in a collaborative task-solving process (Andriessen, Baker, & Suthers, 2003). These perspectives comprise different knowledge, information or points of view which are necessary for solving an interdependent task collaboratively (Jonassen, 2000).

Collaborative problem or case solving. Usually, in e-learning courses learners have to solve problems or cases collaboratively. In this context, content-specific and coordination-specific problem solving activities are important (Hasenbein, Kopp, & Mandl, 2008). Content specific problem solving activities include *"gathering information",* referring to the collection and preparation of all information needed to solve a task, and *"developing a solution",* which includes the development of a problem solution on the basis of the collected and prepared information. The *coordination-specific problem solving activities* are of great importance to avoid process loss in coordination. These include *"planning the common proceeding"* and *"steering the interaction process"*. The first consists of all contributions concerning the distribution of tasks and time management. The second includes all other contributions related to proceeding during the task.

Organizing and planning group activities. In e-learning, the organization and planning of the group work is a key activity of the collaborators. This is due to the fact that e-learning makes it possible to work and learn at any time and any place. But this advantage has an oppositional effect, when collaborators do not use the e-learning environment at all or do not adequately plan their proceeding – then, groups will not work efficiently. Therefore, it is necessary that all group members know their tasks and organize and plan their timetable according to these tasks to get their work done. Such activities require meta-cognitive skills: the planning, evaluation and reflection on the whole group work as well as on specific processes and activities. Changing strategies, the organization of the group work, work-plans or responsibilities when the group is not functioning the way it should, is also part of these activities.

4.2.1 *Guideline title:* SHARING KNOWLEDGE AND ONLINE DISCUSSION

Issue definition

In collaborative learning, the sharing of knowledge is seen as important advantage: As every learner has access to a different knowledge base, collaboration usually benefits from these differences as higher amount of information as well as a bigger knowledge base increases the probability of correct solutions (Kopp, & Mandl, 2006). But this is only the case, when learners do not only disseminate knowledge respectively information, but effectively discuss them collaboratively. Discussing means that content-relevant aspects are examined under different perspectives, that they are evaluated and reflected (Dennis & Valacich, 1999). As in e-learning contexts the discussion is mainly based on written communication, it is often much harder to discuss on a deep content-specific level. Therefore, it is necessary to guide learners for ensuring the sharing of knowledge and online discussion, especially in the sense of reflecting on the different task solutions.

Guideline text

To foster sharing knowledge and online discussion in group work, you can (e.g.):

- stimulate the online discussion by (e.g.)
  - **asking provoking**, open-ended **questions**, summing up the discussion and providing new lines for the group's discussion
  - asking learners for their **personal experience** or knowledge (e. g. asking learners to apply theoretical knowledge on a practical example from their working experience to share information with others and broaden knowledge.)
  - **criticizing** different perspectives
  - directly **contacting** learners with personal e-mails asking them to discuss online
  - providing motivational and content-specific **feedback** on the learners' contributions (e. g. "You are on a good way. Try to integrate also the opinion of XY.")
- stimulate the sharing of knowledge by
  - presenting **different perspectives** (e. g. when the topic is "advantages and disadvantages of the building of a new highway", then you e.g. present the perspective of a politician, of an environmentalist, of a managing engineer and of a resident)
  - using an **inspiring starting point** (e. g. political news, own experiences, etc.)
  - using an adequate **collaborative task** with sub-tasks in order to structure the discussion (collaborative task means that this task can only be solved with more than one person)
  - **assigning different tasks** and specific material to every group member (e. g. "collect different perspectives", "reflect on the groups opinion", "state a counter-argument", etc.)

- provide **further information**, literature, documents, databases
- give **specific instructions** for online discussion and reflection (e. g. the moderator starts with explaining his perspective and appoints someone of his group to state his opinion next. Again, this person then appoints another group member and so on. In the end, the moderator summarizes all perspectives with help of his group members. On this basis the group can discuss in more detail about their different opinions.)

Notes/commentary

The design of the e-learning experience in respect to provoke the sharing of knowledge and online discussion is a main precondition. Especially constructing a collaborative task is necessary to provoke the sharing of knowledge and online discussion. But this is often not sufficient as learners often do lack meta-cognitive skills which are a main precondition for online discussion. This includes especially the sufficient evaluation and reflection of different perspectives and task solutions. This problem occurs in a much greater amount in online learning as not seeing each other in presence is hindering an intensive discussion – writing thoughts and opinions is much harder for learners than just saying them.

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4.2.2 *Guideline title:* ARGUMENTATION AND CONSIDERING DIFFERENT PERSPECTIVES

Issue definition

Argumentation is a main ability for convincing other people of the own opinion. One main precondition for that is the adequate justification of ones point of view (Kuhn, 1991). Justifying the own standpoint with reasons and adequate empirical data is enormously important for an effective performance. To benefit from collaboration, different perspectives should be argumentatively exchanged. Arguing about the different opinions and perspectives and balancing reasons as well as pros and cons of the data is necessary to get a profound collaborative solution (Andriessen, Baker, & Suthers, 2003).

Guideline text

To stimulate argumentation and the exchange of different perspectives in group work, you can (e.g.)

- design specific group activities by
  - assigning **sub-tasks** or subdivide learners in **small groups** of 2 to 3 people
  - organizing **discussions between learners with different points of view** (e.g. when discussing the topic of globalization, one learner who supports globalization and one learner who refuses it)
- implement specific support, e. g.
  - **provoking**, open-ended questions
  - **superficial, incorrect or opposite opinions** or **statements** (e.g. “It would be better for children to grow up without their parents. Collect pros and cons for this statement.”)
  - **advocatus diaboli** – someone who represents the opposite position
  - **scripts** with specific **instructions for argumentation**, e.g. labels with “argument”, “counter-argument”, and “integration/reply”
- give specific feedback by
  - asking the learners to **consider their collaborators’ perspectives** and to **exchange their points of view** respecting and accepting the different points of view
  - asking for an **integration of the individual perspective** into a collaborative perspective
  - **summing** up the different viewpoints

Notes/commentary

Learners often do not argue in an adequate way. Even with using the above mentioned activities, learners do not know how to realize them in their collaborative work. Therefore, sometimes it is very helpful for learners when they receive one example how to correctly argue collaboratively. Example-based learning is a very well-known method for improving knowledge acquisition (Stark, Gruber, Hinkofer, Mandl & Renkl, 2002).

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4.2.3 *Guideline title:* COLLABORATIVE PROBLEM OR CASE SOLVING

Issue definition

The activities, which are part of collaborative problem or case solving, are content-specific and coordination-specific (Hasenbein, Kopp, & Mandl, 2008). Content specific problem solving activities include "gathering information", referring to the collection and preparation of all information needed to solve a task, and "developing a solution", which includes the development of a problem solution on the basis of the collected and prepared information. The coordination-specific problem solving activities are of great importance to avoid process loss in coordination. These include "planning the common proceeding" and "steering the interaction process". The first consists of all contributions concerning the distribution of tasks and time management. The second includes all other contributions related to proceeding during the task.

Guideline text

To foster collaborative problem/case solving in group work, you can e.g.:

- design specific group activities by
  - presenting a task including a **problem that must be solved collaboratively**
  - **structuring the task in phases** (e.g. "Phase 1: Collect as much information as necessary.", "Phase 2: Discuss the important information and find different solutions.", "Phase 3: Discuss the results.", "Phase 4: Implement one solution.")
  - **assigning different responsibilities** to the group members, e. g. responsibility of organizing the whole task solving process, of asking provoking question or evaluating the task
  - creating **interest groups**
- implement specific support, e. g.
  - **gradually** provided solutions
  - **different answers** to the same questions
  - **scripts** that provide learners with a specific **sequence for collaboration**, which makes it necessary that always another group member states his opinion to continue with the collaboration
  - guidelines or instructions for **problem solving**, e. g. "Formulate the main problem", "Define necessary material/information to solve the problem", "Collect the data", "Disseminate the data", "Compare the data with the problem", "Solve the problem with help of the data"
- give specific feedback by
  - asking learners to take part in the **collaborative problem solving process**

Notes/commentary

Research has shown that in collaborative e-learning both, the content-specific and coordination-specific activities are essential for effective collaboration. Regarding content-specific activities, the developing of a solution is of main importance, while on coordination-specific level the steering the interaction process is essential (Hasenbein, Kopp & Mandl, 2008).

References (online and published)

Hasenbein, M., Kopp, B. & Mandl, H. (2008). *Case-based learning in virtual groups – problem solving activities and learning outcome in a virtual professional training*. Paper presented at the 89th American Empirical Research Association (AERA), New York (USA).

4.2.4 *Guideline title:* ORGANIZING AND PLANNING GROUP ACTIVITIES

Issue definition

Organizing and planning group activities are two essential aspects in group work. Organizing group activities includes the assignment of roles and responsibilities, so that group members know the specific tasks of their roles (like moderator), and their responsibilities to come to a group solution.
Planning the group activities is the starting point of every group work as it is usually time-limited. Therefore, a timetable is the key factor for the planning. In a second step, the individual activities necessary for group solution must be listed and related to the timetable.

Guideline text

To support the organization and planning of group activities, you can (e.g.)

- Design specific group activities by
  - **assigning clear roles** and **responsibilities** to every group member (e. g. the role as moderator with the responsibility of organizing the whole task solving process, as critical person with the responsibility of asking provoking questions, or as reflecting person with the responsibility of evaluating the task)
  - **dividing the task in sub-tasks** (e. g. Task: “Define 4 advantages and 4 disadvantages of synchronous communication.” Sub-Task 1: “Define 4 advantages”, Sub-Task 2: “Define 4 disadvantages”)
- Implement specific support, e. g.
  - a **time schedule with deadlines**
  - a **tool** that **supports planning activities** (e.g. calendar)
  - consultation hours
  - **clear rules** (e. g. “Guarantee an enjoyable atmosphere in your group”. This can be achieved by “Behaving respectful without insulting group members”, “Respecting rules and agreements of the group” or “Equally participating with all the available knowledge and abilities” (Reinmann-Rothmeier & Mandl, 2001).
  - **guidelines** or **instructions** with detailed information on work organization, timing, milestones, and outputs/results
- Give specific instructions by
  - asking learners to **make a plan** of their group activities
  - **showing** learners **how to organize their work in the beginning** and **fading the support** (e. g. “1. Define a moderator for this task, 2. The moderator fixes the schedule for the task solving process and defines responsibilities, 3. Stick to the schedule and fulfill your respective task, 4. Reflect on the task and finalize it.”)

- **reminding** learners to the **deadlines** and **schedule**, e. g. by writing e-mails with the deadlines or by using an online calendar, outlook etc.

Notes/commentary

Even though these guidelines look as if they are not specific for online learning, it must be stressed that the above mentioned aspects are much more demanding and not self-evident in an online learning environment. Therefore, it is essential to stress these activities, because how learners organize and plan their group work is essential for effective collaboration. Especially in the beginning, the schedule has to be discussed carefully so that every learner knows what he has to do in order to achieve the group goal.

References (online and published)

Reinmann-Rothmeier, G. & Mandl, H. (2001). Virtuelle Seminare in Hochschule und Weiterbildung: drei Beispiele aus der Praxis [Virtual seminars in university and further education: Three practice examples]. Bern: Huber.

4.3 Promoting effective social interactions: practical guidelines

By definition, collaborative e-learning courses imply that participants perform their cognitive activities together with other individuals, i.e., other participants, tutors, and teachers. Although there is significant empirical evidence that the cognitive processes that are necessary for learning and knowledge construction occur in social interaction, and that "collaborative learning" is the "royal road" to knowledge acquisition (e.g. Kreijins et al. 2003), putting two or more people in the same context is not a warranty neither that they will be able to collaborate, nor that they will be able to learn. On the contrary, it is important to stress that the presence of other people in the same situation, even in absence of any kind of communication, is per se a factor that leads to focalization of attention, i.e., to limit one's attention to a restraint set of available information. Hence, if we want course participants to take profit from their collaboration with other partners, we must be able to avoid focalization effects, and to promote forms of social interaction that stimulate cognitive decentration, i.e., the ability to integrate different points of view, to seek for more pieces of information, to elaborate original solutions to complex problems, to go beyond what is already known and ready-to-be-learned.

Moreover, also the fact that participants undertake a confrontation with other partners who hold different viewpoints on the same issue is not, per se, a warranty that such confrontation will lead to desirable cognitive outcomes. In fact, conflict of viewpoints may be solved in relational ways (i.e., individuals seek for a compromise, avoid deepening the discussion, or simply try to overrule the partner in order to defend their positive self image), and in this case no positive cognitive gain occur. Conversely, when conflicts are solved in an epistemic way (i.e., by means of in-depth information scrutiny and critical examination of both the partners' contributions), social interaction becomes fruitful for cognition.

Research in social psychology has described some of the features that may effectively sustain cognitive activities in collaborative e-learning courses. In particular, attention should be paid to the type of confrontation and conflict regulation, the goal orientation and group's motivation, the individuals' involvement in group activities, and the relationships between participants and teachers/tutors.

CONSTRUCTIVE CONFRONTATIONS AMONG STUDENTS AND CONFLICT REGULATION. Some condition are required to promote productive and fruitful confrontation among students. One important pre-condition consists in participants' social skills, namely the ability to control progress through the tasks, the skills to manage competition and conflict, and the ability to modify and use different viewpoints as well as the willingness to give mutual support (Cohen, 1994). Although social skills predict effective collaboration, they

may also be one of its outcomes; thus, the relation is reciprocal. Collaborative competence consists of e.g. the ability to take different points of view into account, to resolve conflicts and to reach a final solution (which is satisfactory to all parties involved). Moreover, the way in which confrontation with other partners is carried out it's very important: if the partner is a trustworthy adult, or a peer who has the strength to impose his point of view, a relational regulation of the conflict occurs, and no cognitive progress appears (the students go on focussing on the most available solution). On the contrary, confrontation with peers who hold incompatible points of view is more likely to be solved in epistemic ways, i.e., partner pay attention to the issue and elaborate in depth the diverging elements, thus arriving to elaborate alternative and original solutions. In recent developments, the achievement of epistemic resolutions has been linked to the quality of argumentation processes: if partners engage in arguing and rebutting about their claims, then an advancement is possible, contrary to discussions in which partners only defend their own points of view without undertaking possible alternatives (Schwarz et al., 2000).

GROUP ACHIEVEMENT GOALS ORIENTATION and MOTIVATION. Although motivation has often be studied as an inner property of individuals, recent developments have moved towards more social conceptualizations. Theories and research about achievement goals (Dweck & Elliot, 1983; Elliot & Mc Gregor, 2001) has shed light on the positive/negative effects of goal pursuit in learning contexts. In brief, goals have been distinguished into mastery/learning goals ("my aim is to improve as much as possible") vs. performance goals ("my aim is to perform well/better than others"). It appears that holding mastery goals induces persistence in the effort, self-regulated learning, open-mindedness since the goal is not to perform but rather to profit as much as possible from learning opportunities. On the contrary, effects of performance goals are more complex. Holding "performance-avoidance" goals (trying to avoid failure) induces negative emotions and cognitions, low persistence in effort, withdrawal, and is negative related to achievement; holding "performance-approach" goals (seeking for good performance and success) is related to high achievement when intermediate feed-backs are positive, but is related to negative emotions and withdrawal in case of ongoing negative feed-backs. This results are important since it has been shown that goals can be manipulated, although in natural academic situations performance goals are prevalent. In point of fact, common practices in learning context, including the use of competitive incentives, the social comparison of students, the strong emphasis on evaluation *per se*, and the salience of the possibility of failure may emphasize "performance" goal achievement context (Kaplan & Martin, 2008). Another important issue deals with group goals and members' interdependence: when contributions of every group member are necessary for solving a task, they are deeply socially interdependent on each other (Cohen, 1994). Johnson, Johnson, and Stanne (1989) subdivided social interdependence in resource and goal interdependence. While resource interdependence is given when resources are distributed between group members, goal interdependence is determined by

the fact that individuals achieve only their own goals, when the group achieves also the group goals (Johnson, Johnson, Ortiz, & Stanne, 1991; Ortiz, Johnson, & Johnson, 1996). Research has shown that the combination of both resource and goal interdependence provides the best "ingredients" for effective collaboration.

SOCIAL INFLUENCE PROCESSES. Research on learning and instruction, particularly the research on conceptual change, has shown that peer groups without more advanced expert tutoring may be unable to learn complex scientific concepts requiring radical restructuring of prior knowledge (Merenluoto & Lehtinen, 2004; Vosniadou, 2003), therefore the value and role of expert guidance should not be underestimated. However, classical studies on socio-cognitive conflict have shown that interaction with peers (rather than with experts, adults, teachers, etc.) may be beneficial for acquiring more advanced cognitive skills. Moreover, a huge amount of studies has proposed that minority influence (i.e., being exposed to a source of influence that is minoritarian in our groups of reference) is more likely to promote deeper scrutiny of information (Moscovici, 1980), creative and divergent thinking (Nemeth, 1986), knowledge transfer and generalization of learning (Quiamzade & Mugny, 2001). Conversely, uni-directional, vertical knowledge transmission may reproduce a form of from an expert source, that experimentally-based social psychology has shown to stimulate convergent thinking, restriction of attention to elements already present in the cognitive field (focussing; Butera and Buchs, 2005), confirmatory bias in formal reasoning (Butera et al., 2005), tendency to protect one's own points of view rather than considering alternatives (either in formal reasoning or in argumentation; Tomasetto et al., in press). Anyhow, holding minoritatian or "loosing" position is not easy under group pressure. On the one hand, participants who find themselves in such situations may be likely to retire from group work, or to adopt the positions of the majority. On the other hand, the majorities may be likely to rule out participants with different points of view. In both cases, confrontation would become impossible, and the beneficial effects of social interaction would be lost. The role of teachers/tutors in supporting minorities is therefore essential.

PARTICIPATION AND RESPONSIBILITY IN GROUP WORK. For minority, or peer-to-peer influence to be effective, it is necessary that all participants engage in the group activity, put forward their point of view, and are encouraged to sustain their claims even if they are minoritarian in the group, or they appear incorrect at a first sight. However, active participations is a feature that should not be taken for granted, since social loafing (i.e., when participants exert less effort in group work than they would do in individual work; Latané et al., 1979) and free-riding (i.e., when one or more students in the group does little or no work, thereby contributing almost nothing to the group's task; Kerr and Bruun , 1983) are amongst the most common pitfalls in all forms of group collaboration. Possible remedies to social loafing and free-riding include making individual contribution recognizable (i.e., to evaluate either group performance or individual contribution to the group goals'

attainment), providing each member with different and complementary pieces of information, and rotating the role of group leadership and group monitoring among participants. Moreover, recent developments in automatic techniques for monitoring group activities in virtual environments (such as SNA) may facilitate teachers' and learners' awareness of the extent and quality of individuals' in group work (Janssen et al., 2007; see also Mazzoni, this report).

An important corollary of the participation dimension, is that learners should not only be involved in group activities, but should also trust that their peers will do the same. Trust in the peers' involvement and active contribution is essential, in order to overcome the tendency in CSCL settings to rely only on the tutor/teachers to solve problems, to obtain task-relevant information, and to obtain reassurances on the correctness of one's own performance. By consequent, teachers/tutors should foster participants' trust in each other, as potential sources of information and contributions, and solicit effective replies from learners when other group members ask for some help.

4.3.1 *Guideline title:* PROMOTE CONSTRUCTIVE CONFRONTATIONS among students

Issue definition

Confrontations may create the conditions for cognitive development and reasoning. Nevertheless, not all confrontations (or conflicts) are constructive and some conditions are required to promote productive and fruitful confrontations among students. Conflicts are constructive when the elaboration is of a socio-cognitive nature (both cognitive divergence, that is conflict of responses, and social discrepancy with a partner are required), and less beneficial or even disruptive when the elaboration is relational (e.g., by means of conflict avoidance, acquiescence/submission, etc.), (Carugati et al., 1980-1981). Students' cognitive development, academic learning and retention are promoted by confrontation of points of views, inter-individual intellectual confrontation and by communication conflicts between peers (the so-called "socio-cognitive conflict"). In particular, students focused on task resolution obtain positive cognitive outcomes in a collaborative relationship (Butera et al., 2004). Thus, e-tutors and teachers have to create conditions under which intellectual confrontations and conflicts/controversies are constructive.

Guideline text

DESIGNING THE COURSE

Use an operational model to avoid competence threat and to encourage the collaborative construction of knowledge, by (e.g.):

- Working with **small groups** (e.g. 4-5 members)
- Arranging tasks in such a way that **different points of view** are possible and can be confronted
    - Learners have to try to **defend points of view different from theirs** (like in a game)
    - Learners have to formulate **rules that emphasize tolerance** and the right for different opinions
    - Groups create **different products**, then they have to **compare them**
- **Assigning and rotating roles** (e.g. chairman, secretary, observer etc.)
    - Every member is an **expert in something** and other members have turn to the peer expert
    - Each student has **to peer coach** his pair according to a script and then act as a reviewer
- Assigning the goal to realize a **common artifact**
- Giving **collaboration scripts**

MANAGING THE COURSE

Encourage the comparison of points of view of all learners stressing the importance of differences and active participation of everyone in order to obtain the task resolution, to acquire knowledge, and /or to find the optimal resolution of the problem, by (e.g.):

- Promoting the search for the **correct response** instead of the quest for recognition of positive competence.
- Beware of the detrimental effect of **competence threat** when your students work on identical information.
- Beware of the **quality of information transmission** when your students work on complementary information.
- Encouraging the representation of knowledge as the construction of **complementary positions**
    - Guiding the debate by showing the ways to **argue in a friendly manner**, but still emphasizing the importance of different opinions
    - Trying to integrate **different points of view**
    - Moderating the debate through a summary of **positive points from all points of view**
    - **Appreciating differences** and analyzing differing opinions and arguments
    - Encouraging **controversy** in pro-con issues while stressing collaborative context
    - Discouraging **avoidance of conflicts**, but avoiding **competition**
- Strengthening reciprocal and **active participation.**
- Avoiding negative **judgment** on competence.
- When using **forum** or other similar asynchronous communication tools, resuming the forum situation and ask members to post a small number of messages (avoiding short simple posts) but deeply argued.

Notes/commentary

Teachers intending to use conflicts to improve learning and cognitive outcomes should pay attention to social comparison dynamics, because, as suggested stated by some authors, *generally speaking, acquisition is good in controversy, moderate in debate, and poor in concurrence seeking (Johnson and Johnson, 1993)*.

References (online and published)

Buchs, C., Butera, F, Mugny, G., & Darnon, C. (2004). Conflict Elaboration and Cognitive outcomes. *Theory into practice. 43(1),* 23-30.

Carugati, F., De Paolis, P., & Mugny, G. (1980-1981). Conflit de centrations et progrès cognitif , III : Régulations cognitives et relationnelles du conflit socio-cognitif*. Bulletin de Psychologie, 13,* 9-19.

Johnson, D.W., & Johnson, R.T. (1993). Structuring academic controversy. In S. Sharan (Ed.), *Handbook of cooperative learning methods.* Westport, CT: Greenwood.

4.3.2 *Guideline title:* GROUP ACHIEVEMENT GOALS ORIENTATION AND MOTIVATION

Issue definition

Goal orientation refers to the motive that students have for completing a task. Dweck's theory (1986) differentiated goal pursuits in terms of the contrast between demonstrating competence and developing competence. In particular, students may pursuit different educational goals: developing, improving ability, and learning the task (mastery goal), demonstrating ability and prove one's own competence (performance –approach goal) , and also hiding lack of ability (performance-avoidance goal). When learners are oriented toward mastery goals, the intrinsic motivation system is involved in initiating, sustaining, and rewarding the activity, whereas performance goals can supplant or undermine intrinsic motivation (Dweck, 1985). Moreover, in collaborative situations, when students are instructed to master the task, conflicts appear to be beneficial for learning. On the contrary, performance instruction steers to disruptive conflicts, not beneficial for learning (Darnon & Butera, 2003). A lot of evidences confirm that performance goals orientation might be problematic, whilst mastery goal provide the basis for enhanced achievement and students' well-being. Thus, e-tutors and teachers have to foster mainly a mastery goal in their e-learners in order to promote motivation and obtain a higher quality of engagement in tasks.

Guideline text

DESIGNING THE COURSE

Use an operational model in which, to reach the outcome, knowledge is needed, by (e.g.):

- Arranging tasks **devoted to develop, improve and increase competence**, instead of obtaining a mark which is directly linked to pass the exam.
- Avoiding demonstration of individual performance by **arranging tasks which imply a collaborative group solution**.
- Arranging tasks so that learners must use their competence in order to **solve problem-based inquiry**.

MANAGING THE COURSE

Encourage a climate less evaluative and more supportive of the intrinsic desire to learn in order to provide the basis for enhanced achievement and students' well-being., by (e.g.):

- Encouraging mastery goal **priming students with a mastery goal orientation** while stressing the importance of learning competence and task rather than pass the final exam.
- Providing **guidance** to students who have beliefs and goals that c**ontain maladaptive patterns of learning** that sabotage their ability to success.
- Prompting students **towards mastery of the task** – instead of demonstrations of performance – when they discuss conflictual issues.
- Encouraging **construction of complementary positions** and not the prevailing of a position on another one.

- Promoting the search for the **correct response instead of the quest for recognition of positive outcome**.
- **Avoiding negative judgment on competence**.

EVALUATION STRATEGY

Use an evaluation strategy which can promote mastery goal, by (e.g.):

- Request learners' **auto-evaluation** (learners reflect on ability advance).
- Express **clearly assessment criteria from the beginning**.
- **Evaluate the process** as well as the result.

Notes/commentary

In point of fact, it is necessary not only to consider what goals learners pursue but also why they pursue them in order to understand the goals' effects. In particular, The effects of the performance goals are likely to be quite different depending on whether they are pursued for relatively autonomous or relatively controlled reasons (see Decy & Ryan, 2000).

References (online and published)

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Kaplan, A & Martin. L.M. (2008). The Contributions and Prospects of Goal Orientation Theory. *Educational Psychological Review, 19,* 141-184.

Peggy, P., Sullivan, J.r., & Guerra, N.S. (2007). A closer look at college students: self-efficacy and goal orientation. *Journal of Advanced Academics, 18*(3), 454-476.

4.3.3 *Guideline title:* SOCIAL INFLUENCE PROCESSES

Issue definition

Interaction with peers (rather than with experts, adults, teachers, etc.) may be beneficial for acquiring knowledge and more advanced cognitive skills. Confrontation with peers who hold incompatible points of view is more likely to promote cognitive progress and knowledge acquisition, e.g. arriving to elaborate alternative and original solutions. In this process, the quality of *argumentation* is essential: if partners engage in arguing and rebutting about their claims, then an advancement is possible, contrary to discussions in which partners only defend their own points of view (Schwarz et al., 2000). The interaction between peers is also influenced by the so-called *minority influence* (i.e., the opinion of a person or of a little group position, which is minoritarian in the group of reference), which is more likely to be beneficial for knowledge acquisition (e.g., Butera et al., 2005; Quiamzade & Mugny, 2001; Tomasetto et al., 2008). Anyhow, holding minoritatian or "loosing" position is not easy under group pressure, and the role of teachers/tutors in supporting minorities is therefore essential. E-tutors and teachers should avoid the risk that participants who find themselves in minoritatian or "loosing" position retire from group work, or adopt the positions of the majority.

Guideline text

DESIGNING THE COURSE

Use an operational model in which the participation of all learners is needed /necessary, by (e.g.):

- Working with **small groups** (e.g. 4-5 members)
- **Assigning and rotating roles** (e.g. chairman, secretary, observer etc.)
    - Establishing a **group leader** (and rotate the role), who is the only one who can communicate with the teacher/tutor
    - Establish the role of the **devil's advocate**, in order to stimulate the emergence of alternative points of view
    - Every member is an **expert in something,** so that each cover the role of expert in something and non-expert in other topics
    - Each student has to **peer coach** his pair according to a script and then act as a reviewer
    - Giving activities in which **peer role is important** like the role of teacher/tutor
- Assigning the goal to realize **common artifacts**
- Giving **collaboration scripts**
- Organizing the activity with **rules requiring the involvement of everyone** (e.g., every member produces summaries of read materials useful to the group, every group produces course schemes useful to all the course, and so on)
- Proposing **new tasks** and **redistribute the work** in the group

- Stressing that the **participation is evaluated as well as the group products** for the final assessment

MANAGING THE COURSE

Encourage and promote argumentation in learners and the possibility that minoritarian positions will be taken into account by (e.g.):

- Pressing students in order to **consider different point of views**, at least arguing why they are correct /incorrect or why they agree/ disagree with them.
- Asking learners to try to defend points of view different from theirs ("devil's advocate")
- Giving **feedback** concerning the specific **aspect that "minority" group did mention**
- Trying to **highlight ideas** that are not noticed by the group

Notes/commentary

Nearly all-early research on minority influence concentrated on the way in which the majority influenced the minority. But minority is able to change the opinions of the majority as well (Moscovici, 1969). Several factors may affect minority/majority influence (e.g., size of minority/majority; behavioral style, situational factors, etc.). What is important is to support the participation of all e-learning students/learners in group works.

References (online and published)

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Quiamzade A., Mugny G., (2001). Social influence dynamics in aptitude tasks. *Social Psychology of Education*, 4, 311-334.

Tomasetto, C., Mucchi-Faina, A., Alparone, F. R., & Pagliaro, S. (in press). Differential Effects of Majority and Minority Influence on Argumentation Strategies. *Social Influence*.

4.3.4 *Guideline title:* PARTICIPATION AND RESPONSIBILITY IN GROUP WORK

Issue definition

Active participations in group work is a feature that should not be taken for granted, since social loafing (i.e., when participants exert less effort in group work than they would do in individual work; Latané et al., 1983) and free-riding (i.e., when one or more students in the group does little or no work, thereby contributing almost nothing to the group's task; Kerr and Bruun, 1983) are amongst the most common pitfalls in all forms of group collaboration. Possible remedies include making individual contribution recognizable (i.e., to evaluate either group performance or individual contribution to the group goals' attainment), providing each member with different and complementary pieces of information, and rotating the role of group leadership and group monitoring among participants. Also automatic techniques for monitoring group activities in virtual environments (such as SNA) may facilitate teachers' and learners' awareness of the extent and quality of individuals' in group work (Jenssen et al., 2007). Fostering active participation and responsibility in group work is also a remedy against the common tendency for learners to rely only on the teacher/tutor, and not on their peers, when they need information or feed-back on their performance.

Guideline text

DESIGNING THE COURSE

Organize the course to foster collaborative activities and students' responsibility in group work, by (e.g.) :

- Working with **small groups** (e.g. 4-5 members)
- Making **individual contribution** to the group work **recognizable**
- Designing **tasks that need the active contribution of each participant** to be successfully completed
- **Assigning and rotating roles** (e.g. chairman, secretary, observer etc.)
    - Establishing a **group leader** (and rotate the role), who is the only one who can communicate with the teacher/tutor
    - Every member is an **expert in something** and other members have turn to the peer expert
    - Each student has to **peer coach** his pair according to a script and then act as a reviewer of other learners' work
    - Giving activities in which **peer role is important** like the role of teacher/tutor
- **Limiting the number of questions by group**
- Imposing the **use of the forum** instead of sending e-mail to the teacher/tutor

MANAGING THE COURSE

Organize your intervention to promote the autonomous and collaborative search for the right solution, by (e.g.):

- Giving students **alternatives instead of the right** and unique solution, asking students to **choose and to defend/argue their choice**.
- Giving **method indications instead of content-related indications** (e.g. where and how find resources, which steps take to achieve the right solution)
- Stressing that **active participation is an antecedent for getting a degree**
- Trying to **(re-)propose again to all students questions** sent to the tutor (e.g. opening a discussion in the forum)

Notes/commentary

When monitoring individuals' participation in group work, the teacher/tutor should avoid the risk of marking the free-rider: assigning a stigmatized identity may activate harmful social dynamics within the group.

References (online and published)

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4.4 Giving effective feedback: practical guidelines

Supporting learners in virtual learning environments could be realized twofold: First, in presenting and offering pre-structures or specific rules which are directly implemented in the learning environment, and second in giving direct support just in time concretely adapted to specific problems.

In particular, to support collaborative learning, teachers/e-tutors can use immediate feedback. According to Hattie and Timperley (2007) feedback "is conceptualized as information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding" (p. 81). Research in classroom settings showed that teaching with feedback is more effective than teaching without feedback. Especially in e-learning courses, feedback respectively the support of tutors is of great importance, because without any adequate contact person, learners in e-learning environments get the impression of being totally alone and unguided. Therefore, feedback is very helpful for e-learning (Schweizer, Paechter, & Weidenmann, 2001).

When we look at feedback in classrooms Hattie and Timperley (2007) formulated a model of feedback to enhance learning. The purpose of feedback is to reduce the discrepancies between the current understanding/performance of a student and a desired goal. To achieve this goal students and teachers have various possibilities. Students may increase their effort to reach the goals or they change and lower them. Teachers could provide appropriate challenging goals or they assist students in reaching them through feedback. Effective feedback answers three questions: *Where am I going*? (Feed Up), *How am I going*? (Feed Back), and *Where to next*? (Feed Forward).

- *Where am I going?* This aspect concerns feedback about the information given to students about the attainment of learning goals related to the task or performance. A clear definition of goals is the main component in this question. Appropriate challenge and commitment of teachers and students to the goal are important antecedents in this context.
- *How am I going?* This kind of feedback consists of information about progress, and/or about how to proceed.
- *Where to next?* In this context, feedback is a way of providing information that lead to greater possibilities for learning. "These include enhanced challenges, more self-regulation over the learning process, greater fluency and automaticity, more strategies and processes to work on the tasks, deeper understanding, and more information about what is and what is not understood." (Hattie, & Timperley, 2007, p. 90).

There are four kinds of feedback: Feedback about the task, feedback about the processing of the task, feedback about self-regulation, and feedback about the self as a person.

Feedback about the task

This feedback includes the way how well a task is being accomplished or performed (Hattie, & Timperley, 2007). This corrective feedback is related to the concrete accomplishement of the task. The feedback about the task is the most often used kind of feedback. Meta-analyses of feedback about the task showed a very high effect size (e.g. Walberg, 1982; Tenenbaum & Goldring, 1989). But it is necessary that this feedback is not only about correct or incorrect answers, but e.g. give a more detailed and specific answer concerning faulty interpretations, provide detailed instruction or promote successful task solving strategies. But too much feedback only on the task level may focus learners only on the goals, but not on the process and strategies how to achieve this goal. Necessary for the effectiveness of feedback on the task are also a few components on the learner's side. First of all, the learner must be attentive to the feedback. Second, they must memorize those features of the task they get feedback on, and third, they have to decide which strategies are necessary to improve their performance.

Feedback about the Processing of the Task

This kind of feedback refers to the processes taking place in task solving. This feedback concerns especially aspects of deep understanding in learning. In this context, especially strategies for error detection and cueing mechanism are of importance. Feedback concerning error detection implies that learners get information on how to improve and change their activities to solve the task correctly. Information about the processes underlying a task could function as cueing mechanism that leads to more information search. Overall, feedback about the processing of the task is often more helpful than feedback about the task performance, because it enhances deeper learning.

Feedback about Self-Regulation

This kind of feedback "addresses the way students monitor, direct, and regulate actions toward the learning goal." (Hattie & Timperley, 2007, p. 93). This includes all activities learners apply in their learning process to plan, monitor and evaluate their learning (King, 2007).

Feedback about the Self as a Person

Personal feedback, such as “great effort”, expresses positive evaluations and affect about the student. It is often mixed with feedback about the task, the processing and the self-regulation. Often, feedback about the self is not detailed enough and too uninformative about performing the task to be effective for understanding the task. Closely related to feedback on the self is praise. Praise could be distinguished in praise about the self and praise directed to the effort or engagement on the task. Praise about the self is not helpful for the student, because it provides not enough information about the task. Praise on the effort or engagement has greater effects on performance, because this feedback on the process or performance could be ascribed to the task and therefore enhances self-efficacy (Hattie, & Timperley, 2007).

Motivational feedback

Another kind of feedback lying transverse to these four kinds of feedback is motivational feedback. Motivating learners is a very important task of every teacher/tutor. Motivation could be given in the feedback on the task (e. g. “This task was solved outstanding”), in the feedback about the processing of the task (e. g. “You are working together very efficiently”), in the feedback about self-regulation and about the self as a person. Motivational feedback always tries to positively stress the work already done in respect to get engagement for the work that still has to be done. As motivation is a main prerequisite for learning (Deci & Ryan, 1983), motivational feedback is a very important task of the teachers/tutors.

4.4.1 *Guideline title:* CONTENT-SPECIFIC FEEDBACK AND FEEDBACK ON COLLABORATION

Issue definition

Giving feedback and evaluating the group work is one main task of the e-tutor. Two aspects must be considered: First, the way the feedback/evaluation is communicated to the group and second, the kind of feedback and evaluation which is given. According to Hattie and Timperley (2007) feedback "is conceptualized as information provided by an agent (e.g., teacher, peer, book, parent, self, experience) regarding aspects of one's performance or understanding" (p. 81). Especially in e-learning courses, feedback respectively the support of tutors is of great importance, because without any adequate contact person, learners in e-learning environments get the impression of being totally alone and unguided. Therefore, feedback is very helpful for e-learning (Schweizer, Paechter, & Weidenmann, 2001). The purpose of feedback is to reduce the discrepancies between the current understanding/performance of a student and a desired goal. There are two kinds of feedback mostly provided: content-specific feedback about the processing of the task which relies on group solutions and feedback on collaborative activities which focuses on the collaboration itself.

Guideline text

- **Informative feedback on the group solution could be given by**
  - Written analyses
  - Test results and corrections
  - Discussion of group work/solutions
  - Explanations
  - Self-assessment tests
  - Practical exercises
  - Notifying the best and the worst group work
  - Answering questions (encourage learners to ask questions and to create a feedback culture, Reinmann-Rothmeier & Mandl, 2001)
  - Expert solution (e. g. to present new ideas and to facilitate a comparison of the group and the expert solution, Reinmann-Rothmeier & Mandl, 2001)
- **Feedback on social processes could be given by**
  - Reminding the groups of their rules
  - Proposing improvements and giving advice (e.g. telling the group how to gain a balanced participation of all group members)
  - Prompting learners for optimizing group processes (e.g. calling attention to dysfunctional group phenomena like free riding)

- Discussing collaborative activities (e.g. the blaming of one group member or the leaving of a group member)

➢ **Motivational feedback could be given by**

- Encouraging learners to attain to the requested goals
- Providing additional material

Notes/commentary

Giving feedback in e-learning courses is a very important activity of the tutor. It is not only necessary to tell learners how they perform on the collaborative task, but also to tell them how they socially collaborate and to motivate them. Especially the last aspect is immensely important as learners who do not see each other personally are becoming easily absent during the e-learning experience.

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Section 3 "OUTPUT"
(GROUP AND INDIVIDUAL LEVEL)

4.5 Evaluation and sustainability

The final expected aim/goal of an e-learning course is, obviously, students' knowledge acquisition and their ability to apply these know ledges to other fields/contexts. Aiming at pursuing this goal, e-learning courses focus their action on online activities. Now we can wonder how monitor and evaluate the students' online work in this section a particular technique useful for monitoring and analyzing individual and collaborative actions in e-learning environment: the Social Network Analysis (SNA). This method nowadays object of interest especially in e-learning context. As a matter of fact SNA, by means of the analysis of relationships existing between members of a certain group, allows the evaluation of the work done by the members of a certain group and, consequently, it fits very well to the purpose of CSCL.

Next we will present briefly the issue of sustainability, that is of possibility and necessity to design e-learning courses which allow to acquire knowledge that could be applied in the concrete workplace situation.

4.5.1 Social Network Analysis for monitoring and analyzing individual and collaborative actions in e-learning environment

Social Networks Analysis (SNA) is a technique of analysis coming from sociological and ethnographic fields that is based on relationships existing between members of a certain group, focusing the investigation on the group structure and the influence that the individual members have on the group as a whole (Reffay and Chanier, 2002). In fact, rather than focusing on the subjects and their attributes (as the greater part of analysis methods in social science), the SNA concentrates on relations between people (Hanneman, 2001; Wasserman and Faust, 1994). This type of analysis has been applied to various fields of social and behavioural sciences and behavioural studies in order to analyze a number of phenomena. Wasserman and Faust (1994), for example, have outlined the application of SNA to many fields of interests such as political and financial systems employment mobility, impact of urbanization on individual well-being, social support, group problem solving, diffusion and adoption of innovation, exchange and power, social consensus and influence, and also other.

Recently, one of the most interesting field of application of SNA concerns web interactions. In this new field of research, the interest is particularly focused on virtual groups and virtual communities that collaborate in a virtual space for a shared goal. The first studies achieved in online contexts are those of L.C. Freeman (S.C. Freeman and L.C. Freeman, 1979; L.C. Freeman and S.C. Freeman, 1980; L.C. Freeman, 1986), one of the most eminent scholars of SNA, in which researchers analyzed the relational structure of interaction and exchanged performed by participants of an electronic conference via e-mail. Others important contribution are suggestions made by Garton, Haythornthwaite and Wellman (1997) and Cho, Stefanone and Gay (2002) regarding the application of SNA to virtual collaborative environments, in which authors stressed the useful of this technique for analyzing computer mediated communication (CMC). Importance of SNA for monitoring virtual interaction and detecting, throughout, a problem or a decline in the interaction of a certain virtual group is stressed also by Reffay and Chanier (2002) and Sha and Van Aalst (2003). From this point of view SNA became a useful technique for tutor/teacher for analyzing the possible changes to bring about in order to solve a possible problem in interactions (e.g. for assuring a good sharing of information) and to ensure that the acquisition of knowledge takes place.

Finally, some authors have used SNA in combination with content analysis of messages exchanged in virtual learning environments. By using this mixed technique, Palonen and Hakkarainen (2000) analyzed the possible effects of scholastic success and gender (male or female) on productive participation in an environment for virtual interaction, while Aviv, Erlich, Ravid and Geva (2003) analyzed the knowledge and network structure (cohesion, roles and power) construction process in two different asynchronous communication learning groups: a structured one and a non-structured one. The effectiveness and usefulness of this mixed technique has been outlined also by Martinez and colleagues (Martinez, Dimitriadis, Rubia, Gómez, de la Fuente, 2003; Martinez, Dimitriadis, Rubia, Gómez, Garrachón and Marcos, 2002) providing a response to the technical innovative analysis requirements for studying interactions in the field of web collaboration for learning.

Some basic characteristics of SNA

In SNA, analysis are based on relationship data representing connections, contacts, links or exchanges activated between a specific collectivity (groups, families, organizations, nations or peoples in general). So, the focus of the analysis is not only on the individual variables (such as age, gender, school level and so on normally analyzed by classic social studies), but on various kind of relations that link a person to another (i.e. friendship, money, flows of material or information, assessments that an individual makes of another, etc.) and constitute couples' properties more than individuals characteristics.

Being based on *Graph Theory*, SNA makes it possible to apply matrix algebra to relationship data and offers both specific network measurements (SNA indexes) and sogiograms representations of groups' relational dynamics (Figure 4-2).

		Receivers					
		Stud1	***Stud2***	***Stud3***	***Stud4***	***Stud5***	***Stud6***
Senders	**Stud1**	0.0	0.0	3.0	4.0	0.0	0.0
	Stud2	0.0	0.0	2.0	0.0	0.0	0.0
	Stud3	3.0	4.0	0.0	0.0	0.0	0.0
	Stud4	2.0	0.0	3.0	0.0	0.0	0.0
	Stud5	0.0	0.0	0.0	0.0	0.0	0.0
	Stud6	1.0	3.0	2.0	2.0	0.0	0.0

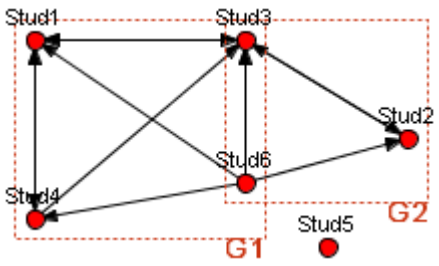

Figure 4-2: An example of exchanges between students that interact by a web forum. On the left is represented the adjacency matrix of the relational data and on the right the representation of the same data by a sociogram.

Considering the focus of the analysis, SNA is normally applied for achieving two different goals that depict also two level analyses:

- *Ego-centred Analysis*, that focuses attention on the individual actors and their personal network;
- *Whole Network or Full Network Analysis* that, on the contrary, concentrates its attention on the entire network and its structural characteristics (Hanneman, 2001; Garton, Haythornthwaite and Wellman, 1997).

The first permits to obtain an illustration of the "local" or "neighbourhood" networks which characterizes individuals, providing useful information for understanding how whole network influences individual relation. The latter examines the total structure of a certain social network as well as its components and connections with the external environment.

On the bases these initial characteristics of SNA, it's fairly clear that this type of analysis requires an exhaustive collection of relational data characterizing a collectivity for obtaining a complete and adequate representation and description of its relational structure. Normally, this is a critical aspect in real contexts, specifically if a collectivity is very large and characterized by multiple relations: in fact, data collection methods in real contexts, such as observations, questionnaires, interviews, archive data, diaries (Wasserman and Faust, 1994; Garton, Haythornthwaite and Wellman, 1997), request in some case a strong effort to researcher both during the data collect and during the following data elaboration. At the same time, as these classical methods are based on people recollection, they often don't permit an exhaustive collection about the amount of relation or exchanges performed by a collectivity. The recent expansion of SNA fields of inquiry to virtual contexts, such as web groups and web communities, has permitted to consider the web tracking as

powerful method for collecting data as it allows a constant and exhaustive registration of all the messages exchanged within a specific virtual collectivity.

So, which are the main interests for using SNA in virtual contexts and, specifically, which are its potentialities for analysing groups and communities of peoples that collaborates in by Web?

SNA for analysing web interaction

Focusing the attention on virtual communities, researchers are primarily interested on the application of SNA to networks of people (groups or communities) interacting on the net for a collective goals, in particular groups that co-operate and collaborate for work purposes or for acquiring and constructing knowledge and skills (Computer Supported Cooperative Work, Computer Supported Collaborative Learning).

Some of the first studies concerning virtual groups have been performed by L.C. Freeman, one of the most eminent researchers on social networks centrality indexes. In his studies, Freeman has analyzed the network of interactions created within a virtual community of researchers, coming from different fields of interest, which communicate by a mailing-list (S.C. Freeman and L.C. Freeman, 1979; L.C. Freeman and S.C. Freeman, 1980; Freeman, 1986).

More recently, another very important contribution is a close examination on the usefulness of SNA for analyzing virtual environment proposed by Garton, Haythornthwaite and Wellman (1997). In their contribution, these authors outlined the principal features of SNA and described a number of tools that make it a useful perspective for analysing the situations of communication mediated by computer (CMC). Importance of SNA for monitoring and analysing virtual interactions has been outlined also by Cho, Stefanone and Gay (2002) in their study concerning the analysis of e-mail messages of a group of students in learning context.

In the field of knowledge construction and management in virtual groups, some authors have underlined the important role which this type of analysis can have to monitor constantly the development of interactions during collective discussions and reveal promptly a problem or loss in group interactions. As this is a main aspects to consider for the knowledge construction and management, starting from the results of this analysis coordinator, tutors and/or teacher could then bring the necessary changes for a better efficiency in transmission and exchange of knowledge and information within a community (Reffay and Chanier, 2002; Sha and Van Aalst, 2003). The analysis of these networks for knowledge construction and management often has been performed by using mixed techniques, which combines for example SNA with other qualitative data analysis, mainly analysis of the messages' contents (Aviv et al., 2003; Martinez et al., 2002; 2003; Palonen and Hakkarainen, 2000).

Interesting SNA indexes for web interactions

Two of the main SNA analyses used in most studies concerning web interactions are Neighbourhood and Centrality.

The first type of analysis is specifically focused on aggregation of a specific groups and one could say that it's a measure of the direct and indirect relations that characterizes both individuals and the community as a whole. The main indicators of this type of analysis are the inclusiveness and density indexes.

The inclusiveness index can be expressed in terms of the proportion of connected persons in a graph compared to the total number of group persons. For example, a web group composed by 10 members and having 3 members isolated will have an inclusiveness of 0.7 or rather 70% (10-3/10 = 0.7 = 70%), while a group comprised of 20 members, including 5 isolated, will have an inclusiveness of 0.75 (20-5/20 = 0.75 à 75%).

The density index represents the proportion of lines actually present within a graph compared to the maximum number of possible lines. More simply, it sums up the global distribution of the relations in order to check how far away the graph is from a "complete graph[5]" configuration (Wasserman and Faust, 1994; Scott, 1997). The density of a group is normally calculated using dichotomized data and considering only the presence/absence of a link between the members of the group. In this case, the density index is a value that fluctuates between a minimum of 0 and a maximum of 1 (complete group). The calculation of the density index in a dichotomized and unoriented graph (i.e. the graph without direction of relations but only the existence of a relation) can be carried out using the following formula:

$$\frac{l}{n(n-1)/2}$$

in which l is the number of links and n is the number of nodes.

However, in the case of a valueless but oriented graph, the density formula is

$$\frac{l}{n(n-1)}$$

The two formulas differ because unoriented graph does not consider the reciprocity of the links, but merely their presence: for example, if X sends a message to Y and Y sends a message to X, an unoriented graph only counts one link, while an oriented graph features two links.

Considering a web groups and the analysis of web interactions, surely the most interesting formula is that for oriented graphs, as in web groups it's important to consider

[5] A graph in which each node is connected to all the other nodes.

not only the relation between two members, but also which the direction of the exchanges is.

While neighbourhood considers the aggregation of a graph, centrality and centralization are indexes focused on status, power, influence and relevance of the members for the group.

Centrality identifies the most central, most important or most significant actors in a social network and has been one of the main indices to be considered by SNA scholars. As we will see, centrality is not defined by a single index, but rather by several indices in correspondence to structural aspects of the interactions that the researcher intends to focus on. Firstly, it is necessary to make a distinction between point centrality indexes and centralization indexes or graph centrality indexes (Wasserman and Faust, 1994; Scott, 1997). The actor centrality index expresses the strategic importance of a certain individual for the overall graph structure, or rather its importance with respect to the entire relationship network. As it is a specific individual measurement, the centrality index makes it possible to check whether there are any differences between the various nodes in relation to their significance for the structure of the relationship network and, if necessary, to identify the most central nodes and the most peripheral nodes. The value of this index varies from a minimum of Ø (very peripheral actors) to a maximum of 1 (extremely central actors). Unlike the centrality indices, the centralization indexes regard the entire structure of a graph and describe how it is centralized around its most central actors. Centralization may also be considered a measurement of the variability and dispersion of the individual centrality indexes (Wasserman and Faust, 1994). Like centrality indices, centralization indices also vary from a minimum of Ø to a maximum of 1, but can also be expressed in percentages from Ø to 100%. So, in case of a high centralization index there's a greater probability that one ore some actors are very central, while with a low centralization index, the differences between the centrality indices are reduced and it is likely that there are no particularly actors in central position with respect to others.

Summering, as the density describes the general level of cohesion in a graph and the centralization index describes the extent to which this cohesion is organized around particular focal actors, both indexes are interesting complementary measurements for analyzing web groups (Scott, 1997). Centrality and centralization indexes are not defined by a single index, but rather by several indexes in correspondence to structural aspects of the interactions that the researcher intends to focus on. Degree and Eigenvector centrality (and the relative centralization indexes) are focused on the sum of the relations each node has, so the most important actor is that having the major number of relations/exchanges. Betweenness and Flow Between centrality are focused on the power of intermediation of each node, so the most important actor is that positioned in strategic parts of the network. Information centrality is focused on the amount of information that passes through each node, so the most relevant actor is that managing a great number of exchanges between the groups.

The usefulness of SNA in e-learning collaborative environments

Nowadays there are many software (including Ucinet, NetMiner, Siena, Multinet, Negopy, Krackplot and Gradap) for applying SNA and easily building the sociogram of interactions and calculating the indexes previously presented. All these software are based on the adjacency matrix of relational data, which can be automatically elaborate starting from a database that collects data deriving from web tracking. Thanks to these technological devices, researchers who want to analyze interactions in virtual contexts have a great facilitation, even though the interest in the use of SNA is not only on the research side but also on the monitoring side throughout the training process. In fact, we can consider three principal aspects of using SNA for analyzing web collaboration:

- Research/Analysis
- Monitoring (both for tutors/teachers and for individuals
- Assessment of groups and individuals

About research, structural SNA indexes allow researchers to analyze and describe aggregation and participation within a group or virtual community as well as to highlight any subgroups or components. Thanks to these indexes, it is possible to compare two different groups or communities to each other for verifying if differences have effects on the groups' efficiency for attaining final outcome. It is also possible to measure SNA indexes over time to highlight the development of the structure of interactions between members of a group.

By calculating SNA indexes throughout, the tutor and/or moderator can also obtain an efficient support for monitoring the trend of interactions and timely identify possible critical events that could influence groups' collaboration.

Finally, concerning assessment, SNA could be an important technique for assessing individual actions (by individual SNA indexes) and collective activity performed by members and groups. In fact, by the number of relations, the number of exchanges and the SNA individual indexes like centrality, SNA permit to assess the individual participation and collaboration for the collective benefit. At the same time, the SNA whole indexes (density, inclusiveness, centralization) permit to evaluate if the group has been characterized by an actual collaboration or maybe there was some segregation or other difficulties that has influenced the final performance.

Some critical aspects for applying SNA to web interactions

A first critical aspect to consider for applying Social Network Analysis to web groups and communities is that SNA indexes could have different efficacy depending on dimensions of the group/community one analyses. Not all SNA indexes, in fact, are equally effective for describing and analysing interactions within web groups and web communities. SNA appears to be particularly appropriate for large virtual communities in which other types of analysis

(like content or conversation analyses) are very costly due to the number and length of exchanges. Conversely, with small groups some SNA indexes are weakly indicative of the dynamics between participants because, always or almost always, indexes reach the top values (for example, density and inclusion indexes in small groups are probably maximal). For small groups certainly longitudinal analysis is more effective, because it shows the development of interactions, but also ego-centred analysis because it focuses on single participant and on networks of relations which characterise each participant of the group.

A second critical element concerns the artefacts used for interacting on the net. The e-mail or mailing-list pose no great problems for the reconstruction of the adjacency matrix of exchanges between participants as these tools provide a person-to-person massage sending, so it's quite simple to senders and recipients. On the contrary, the web forum is conceived in a manner that:

- messages are not sent but posted for being visible to all the group/community;
- messages have no a specific recipient but are inserted into a public area accessible by every members of the group/community.

Now the problem is how should we consider such messages within the matrix of relational data? As sent to all the participants or only to the person who answers the message?

This second point is also related to another aspect, i.e. the intention of a participant which posts messages in a forum: he really wants to communicate with all the other participants or his message is simply an attempt to strike up a conversation hoping that someone will answer. On this question the size of the group probably plays a crucial role: in fact, in small web groups it is probable that the intention of the member is effectively the involvement of the entire group, while in large virtual communities for free discussions it is possible that the intention is not to involve everyone, but to throw the bait hoping that at least one person will answer. So, the appropriate attribution of these messages within the adjacency matrix is very important for the subsequent analysis.

4.5.2 Sustainability

In online learning, sustainability is a very important output criterion. This is connected to the question whether the learned content could be applied in the concrete workplace situation – the main objective of almost all e-learning courses. In this context, learning transfer is a hot topic. Transfer is defined as process in which the learned content as

source could be transferred to a specific target (Lemke, 1995). Furthermore, it includes the transfer and application of acquired knowledge on tasks and problems in the everyday workplace.

To achieve sustainability in everyday workplace, the theory on identical elements (Thorndike & Woodworth, 1901) and the theory on principle transfer (Judd, 1908) are relevant. The theory on identical elements stresses the fact, that for successful transfer it is necessary that elements of the original learning situation, the learning source, are also part in the application situation, the target (Thorndike & Woodworth, 1901). In the theory on principle transfer the teaching of general rules and principals is crucial to simplify the application of the learned content in new situations (Judd, 1908). The building of general thought patterns is stressed in this theory on transfer.

Both theories focus on the learning context which is crucial for learning transfer. Therefore, embedding problems in concrete situations which are relevant for the learner is essential for the didactical design of the learning environment. Enhancing the contextual knowledge through different problems and increasing knowledge adaptability through diverse perspectives are further criteria for learning transfer and sustainability.

But not only is the didactical design essential for sustainable knowledge transfer, but also the workplace (Baldwin & Ford, 1988; Bergmann & Sonntag, 2006; Rank & Wakenhut, 1998). The workplace mainly influences the sustainability of the learning transfer besides the online course itself and the co-worker. Support of the superior or of the colleagues, adequate working conditions and sufficient possibilities to apply the content of the course in the everyday context are main factors. Considering the workplace enables the application of the learned at the workplace.

5 Technological aspects

5.1 Introduction to existing technological tools/instruments (for online social interactions)

According to Dimitracopoulou (2005), by focussing on *social interaction* — the key element of collaboration (Kreijins et al., 2003) — and *collaborative learning*, existing e-learning platforms — a comprehensive list of the most adopted platforms for collaborative learning can be found in The 1st Report of Minerva-RESET Project (2007; Online Collaborative Learning in Higher Education, 2007) — usually address this issues by providing collaboration environments that include two main necessary spaces of interaction:

- The *Task space*, that is where students interact with task objects (e.g. a graphical or a textual workspace). According to Dimitracopoulou (2005), on the basis of the task space, two kinds of collaboration system can be identified: *i*) *action-oriented collaboration systems* — systems where students interact with the task objects producing knowledge. The knowledge produced represents itself a subject of discourse; *ii*) *text-production-oriented collaboration systems* — systems where students mainly produce a written text in a collaborative way.

- The *Discourse space*, that is a mean of dialogue (Dimitracopoulou, 2005) (e.g. a chat, a forum, or a audio channel). Discourse spaces provide either an asynchronous or a synchronous communication mode. Usually, systems — either action-based or text-based — all provide one or more dialogue tools. In fact, according to (Dimitracopoulou, 2005), dialogue tools are considered crucial not only for collaboration but also for learning. Dimitracopoulou (2005) states that: *i*) "*externalization achieved through written dialogue that is conducted during collaborative activities may have significant effects, especially for conceptually rich learning activities*"; *ii*) "*interactive linguistic exchanges among people play an essential role in the elaboration and perpetuation of concepts, while the primary use and mechanism for acquisition of these concepts is the result of social interaction*".

According to Mühlpfordt et Stahl (2007), the activities in task space and discourse space are typically related to one another but often, this two kinds of space provided by e-learning platforms are physically and functionally dissociated (The 1st Report of Minerva-RESET Project, 2007; Mühlpfordt et G. Stahl, 2007; Nardini et al., 2008), so, for example, according to Dimitracopoulou (2005) and Mühlpfordt and Stahl (2007) it is hard for user to track and specify content and temporal relationships between the dialogue and the actions in the task space. In particular, Mühlpfordt and Stahl (Mühlpfordt & Stahl, 2007) identify three main issues: *i*) *Deictic references* — the referencing of objects in the task space from the discourse space. This is an important feature that has to be provided by platforms because in virtual environments the gestural pointing is not possible; *ii*) *Decontextualization of action and messages* — whereas often the discourse space history represents the complete temporal sequentiality of the discursive contributions, the same does not often hold for the task space. This is another important aspect that has to be taken into account by platform developers in order to preserve the workspace context at various time instants and represent its evolutionary process making possible reflection on the whole collaborative construction. Space history is important not only for group members, but also for other groups that want to observe and exploit the built knowledge. In other words, space history can promote an effective reuse of the knowledge generated by different groups: this is viable with respect to groups belonging to different courses; *iii*) *The coordination of communication and interaction* — different participants can simultaneously be typing and posting messages in the discourse space or producing objects in the task space. In collaboration, these various activities are interrelated, so the awareness of the activities of the other people is a prerequisite for the construction of common ground.

Accordingly, most existing distance learning systems provide the task and discourse spaces that do not share a common conceptual framework, so as to make it difficult to exploit them altogether in a coherent and effective way in order to overcome the previous-mentioned limits (The 1st Report of Minerva-RESET Project, 2007; Nardini et al., 2008).

In addition, most of the e-learning platforms provide statistical data related to on-line social interactions of students. Often such statistical data consists in log files that collect information like student access time and the time spent by students in the e-learning system (The 1st Report of Minerva-RESET Project, 2007). As a consequence, to make a quantitative and / or qualitative analysis of such data — useful for the sake of student-interaction analysis in order to evaluate students and give them feedbacks (Dimitracopoulou, 2005; Dimitracopoulou et Komis, 2005; The 1st Report of Minerva-RESET Project, 2007; Nardini et al., 2008) — teachers often have to adapt the information provided by log files and adopt external systems to the platform. This lead to some drawbacks because teachers are subject to an added overhead.

Furthermore, it is possible to enrich the above discussion on e-Learning platforms by introducing some important features an e-Learning platform should be characterized by. Indeed, from the first report of the project (The 1st Report of Minerva-RESET Project, 2007)

— which describes some of the results obtained in a survey on existing e-Learning platforms — it is possible to identify three key issues: adaptation (Graf et List, 2005), portability (Colace et al., 2003), and usability (Ardito et al., 2004).

Adaptation refers to the fact that an e-Learning platform should adapt to students' and teachers' needs as a course goes on (Graf et List, 2005). Adaptation can lead to: *i*) *adaptability*, which includes all facilities to customize the platform for the educational institution's needs; *ii*) *personalization*, which indicates the facilities of each individual user to customize his / her own view of the platform; *iii*) *extensibility*, which means the ability of a platform to be extended with additional features and tools. Since open-source — that offers practical accessibility to a system's source (goods and knowledge) (DiBona et al., 1999) — can be regarded as a feasible way for developing easily extensible systems, it seems suitable to develop e-Learning systems showing a high degree of adaptation; *iv*) *adaptivity* which indicates all kinds of automatic adaptation to the individual user's needs. So far adaptation has received a little coverage in e-Learning platforms (DiBona et al., 1999).

Software portability refers to the possibility for a software application to be easily moved on many different operating systems and hardware platforms (Colace et al., 2003). This in turns allows students and teachers to access platform tools independently of the adopted computer architecture and operating system. As a consequence, it is easy to recognize software portability as a key characteristic for e-Learning platforms also.

Finally, *usability* — the provision of e-Learning platforms with interfaces easy to be used by learners and teachers — is another required feature for e-Learning platforms and is also recognized as one of the main challenges that e-Learning system developers need to cope with (Ardito et al., 2004). Indeed, often e-Learning platforms provide users only with rigid usage protocols and awkward interfaces (Ardito et al., 2004): students should be involved in the learning process without being overwhelmed, so that it is fundamental to avoid the design of poor e-Learning platform interfaces and rigid protocols, which could become a barrier to effective student learning.

5.2 Guideline title: HOW TO SELECT TOOLS AND INSTRUMENTS FOR ONLINE SOCIAL INTERACTIONS

Issue definition

Open source is an important feature for e-Learning platforms for it offers practical accessibility to a system's source (goods and knowledge) so as to allow the upgrade of such systems with new functionalities or adaptation to new and growing requirements.
On the other hand, portability — the possibility of using a platform in any operating system — would be a desirable feature since it could promote an easier access of e-Learning platform by students.
Moreover, usability (user-friendliness) would give teachers and students an easier use experience of e-Learning platforms. In fact, complex e-learning platforms are not widely adopted by users.
In order to promote social interaction and collaborative learning in distance education context, two main spaces of interaction should be provided by e-Learning platforms (Dimitracopoulou, 2005): the task space and discourse space, which should be physically and functionally integrated with each other (Mühlpfordt et Stahl, 2007).
In addition, e-Learning platforms should automatically monitor social interaction among students, make an analysis (qualitative and / or qualitative) of student-collaboration activities, and give feedbacks to students and teachers based on previous analyses. For instance, this may allow to evaluate students, find out inactive students, give feedback to students, evaluate and improve both the provided courses and e-Learning platforms themselves.

Guideline text

To choose an e-Learning platform that supports social interaction, you need to make sure that the platform is:

- **open source** so as to **ease improvement** based on previous experience, and **adaptation** to emerging requirements;
- **portable** so as to make the platform **easily accessible** by users adopting different operating systems;
- **usable** so as to make the platform exploitable from **differently skilled users**;
- provided with **task spaces** and **discourse spaces** physically and functionally **integrated with each other** in order to promote student social interactions and collaborative learning;
- able to **monitor social interaction among students**, **make an analysis** (qualitative and / or qualitative) of student-collaboration activities, and **give feedbacks** to students and teachers based on previous analyses.

Notes/commentary

It is fundamental for the mentioned guidelines to be followed not only by platform users, but also by developers and engineers whose task is to develop and extend such platforms. In particular, in spite of what is usually common in e-learning platform development, it is key to adopt suitable paradigms to engineer such systems as a way for coping with their software complexity.

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5.3 An experimental platform and a prototypal artefact: integrating tools

5.3.1 The A&A Meta-model for Collaborative Environments

Accordingly to the Section 5.1, distance learning lacks a conceptual framework aimed at designing integrated collaboration spaces (both task and discourse spaces) and tools for monitoring collaborative learning by an automatic analysis of student social interactions.

In this context, Multi-Agent System (MAS) (Omicini & Poggi, 2006) — a set of autonomous, pro-active, and interacting computational entities called agents, situated in an environment where they interact typically producing a coherent global system behaviour — seems to be a suitable paradigm to engineer distance learning systems. In literature, MAS paradigm has proven to be a suitable paradigm for dealing with the engineering of complex software systems like distance learning systems, which are interaction-oriented, distributed, dynamic, and open (Omicini & Poggi, 2006).

In particular, the Agents & Artefacts (A&A) meta-model (Omicini et al., 2008) seems to be a suitable framework for supporting the development of MAS-based collaboration environments.

The A&A meta-model takes inspiration from Activity Theory (AT), which is aimed at studying collaboration activities in human organisations (Nardi, 1996). According to AT, human activities within an organisation are always mediated by some kind of artefacts — either physical or cognitive tools that enable and constrain human activities. In particular, by means of the artefact abstraction provided by the A&A, a designer could design, through function elements, mediation instruments for human collaborative activities. Moreover, if we look at the A&A meta-model from the standpoint of Distributed Cognition (Kirsh, 1999) — which proposes that human knowledge and cognition are not confined to the individuals, but is instead distributed by placing memories, facts, or knowledge on the objects, individuals, and tools in our environment — each artefact can work as a repository of the knowledge built through collaborative work of human beings, which is then properly stored, organised and effectively reused. In addition, artefact properties make it possible for software agents automatically to monitor collaborative activities of human beings and perform an automatic analysis of student social interactions.

As a consequence, the A&A meta-model seems to be a natural candidate as an effective and consistent conceptual framework since it provides a set of suitable abstractions for modelling systems supporting human collaborative activities. Accordingly, as showed in the next Section, through an appropriate design of artefacts, it is possible to frame collaboration spaces and monitoring tools as artefacts, then, by exploiting artefact

properties and the agent abstraction (Omicini et al., 2008), integrate such re-framed tools in a conceptually uniform collaborative environment.

5.3.2 A Case Study

Moodle — a wide-used, open-source, Web-based platform in e-learning (Mühlpfordt & G. Stahl, 2007; Ardito et al., 2004) — provides several tasks and discourse spaces that are physically and functionally dissociated. Moreover, Moodle allows to access statistical data related to on-line social interactions of students, but does not provide any tool for automatic analysis of such interactions.

In order to show the effectiveness of the A&A meta-model as a conceptual framework to design collaborative learning systems solving the aforementioned issues, we exploited the meta-model to re-frame and integrate two Moodle tools with each other: the chat tool — a discourse space that allows learners to communicate to each other in a synchronous way and coordinate their collaborative activities — and the wiki tool — a task space that encourages students to mainly produce written text or reports in a collaborative way. Moreover, we provided Moodle with an automatic analysis of student social interactions.

5.3.3 Model Design Abstractions vs. A&A Meta-model

Moodle is a Web application that does not lie on top of a conceptual framework providing the abstractions suitable to develop collaboration tools. Accordingly, it is complex to extend the functionalities provided by existing collaboration spaces. In particular, it is hard to integrate two distinct collaboration spaces from the functional and user interface standpoint—user interface is usually represented by a browser. Indeed, even though in this kind of Web-based, e-learning platforms, tools are conceived in terms of services — a set of functionalities — to be provided to platform users, the way such services are actually designed is left to designers. In particular, Moodle realizes the abstractions of service in terms of Web pages. Since a Web page is strongly related to what shown within a user's browser application, it does not seem to be a viable support to reify a service. In fact, it is difficult to concretely represent concepts that describe a service, like *service interface* — set of functionalities provided by the service — and *service behaviour* — how the service implements the provided functionalities —, by adopting a service implemented by Web pages.

On the other side, according to Ricci et al. (2006), the A&A meta-model provides a set of abstractions allowing to explicitly model both the concept of service interface and that of

service behaviour by adopting the abstraction of artefact. In fact, an artefact allows to model any collaboration tool in terms of *user interface* — by which an artefact can act for a specific purpose, i.e. the set of operations provided by an artefact — and *structure and behaviour* — representing how the artefact is implemented in order to provide its function (Ricci et al., 2006). Moreover, using the artefact property called *linkability* (Ricci et al., 2006) — allowing artefacts to invoke operations of other artefacts — it is possible to functionally integrate to one another the collaboration tools designed as artefacts (Nardini et al., 2008).

In addition, to realize collaborative environments able to automatically monitor social interactions arising within collaboration tools by students of a same group, it is fruitful to adopt abstractions that allow at design time to explicitly model the entities able to observe in a proactive way such interactions. On the one hand, this can be exploited in order to automatically analyze social interactions among students as a useful means to both evaluate students and give them feedback. On the other hand, it can be exploited to realize one of the necessary aspects to integrate different collaboration tools: the *awareness* on the activities performed by each member of a collaborative group, that is crucial for communication and interaction coordination as described in Section 5.1.

While the Web page does not represent a viable abstraction to explicitly model the aforementioned entities, A&A provides the agent abstraction (Omicini & Poggi, 2006; Omicini et al., 2008) introduced in the Section 5.3.1. Agents are autonomous and proactive entities that can exploit some interesting artefact properties, in particular *inspectability* (Ricci et al., 2006) — the capability of observing and controlling artefact structure (state) and behaviour at runtime. Such a property can be hence exploited by an agent to monitor the interaction occurring among student of each group within an integrated collaboration.

5.3.4 Improving Moodle Through A&A Meta-model

For the sake of simplicity, visual integration is not treated here as it would require additional technologies that are out of the scope of this work and will be matter of future work. Accordingly, here we focus on a functional integration between two collaboration tools provided with Moodle: wiki and chat. In particular, integration consists of giving a user the possibility of making a reference between a chat message and the wiki content object of the chat discussion the message is part of (see Figure 5-1). This makes it possible to solve the problem pointed out by Stahl as *deictic references* (see Section 5.1), which is due to the fact that gestural pointing is not possible in virtual environments. This makes it possible to solve also the problem known as *decontextualization of action and messages* described in Section 5.1. Indeed, since chat messages represent the complete sequentiality of a discursive contribution, references between chat and wiki allow to make a complete sequentiality also among contributions added to the wiki.

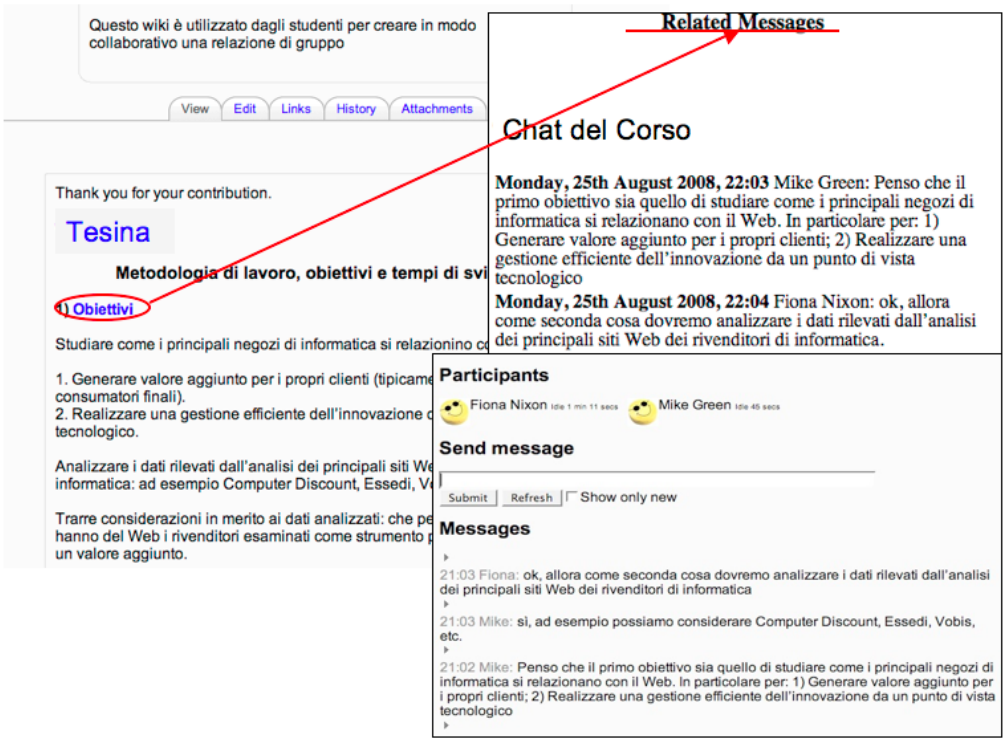

Figure 5-1. Relation between wiki content and one of its related discussions

To get into the details of the integration realized between chat and wiki, we defined three artefacts:

- *HttpMon*, which observes the HTTP requests coming from client browsers. In particular HTTP requests related to chat and wiki are translated in events that are sensed by the agents in charge of managing chat and wiki. To this end, *HttpMon* exploit *situation* (Ricci et al., 2006; Omicini, 2006) — i.e. the artefact property of being immersed in an external environment, and being reactive to environment events and changes so as to make it possible to intercept the requests coming from client browsers regarding chat and wiki targeted to Moodle server.

- Chat, which reframes the Moodle chat as an artefact managed by a chat agent. When such an agent perceives from *HTTPMon* an event concerning the insertion of a new chat messages or a request to create a new references targeted to a specific point of wiki content, it respectively registers the chat message and the reference into the artefact. In particular, when chat agent requests to create a new reference, the artefact exploits linkability (Ricci et al., 2006) with wiki artefact in order to know whether the point of wiki content to be referred exists. If such a point does not exist yet, the reference is not created. In addition, when perceiving from *HTTPMon* an event requesting to access references of a message, chat agent can exploit chat operations (Omicini et al., 2008) so as to get such

references and inserts them as HTTP parameters of the request to be sent to Moodle server.

- *Wiki,* which reframes the Moodle wiki as an artefact managed by a *wiki agent*. When such an agent perceives from *HTTPMon* an event concerning the insertion of a new wiki content, a point of wiki content to be referred by a chat message, or a new reference to chat messages referring a point of wiki content, it respectively registers the wiki content, the content point to be referred and the reference into the artefact. In particular, when wiki agent requests to access references of a specific content, it can exploit wiki *operations* so as to get such references and inserts them results as HTTP parameters of the request to be sent to Moodle server. On the other hand, the artefact exploits *linkability* with chat artefact in order to obtain the list of all the chat messages pointing to that particular content. Linkability is also used when a content is to be deleted from wiki. In this way it is possible to delete the chat messages referring to the content to be deleted before proceeding with content deletion.

As a second aspect of this work, we focus on the analysis of social interactions occurring among the members of each student group by collaboration tools. In particular, as a reference example, we show how it is possible to automatically perform a quantitave analysis of interactions by means of *Social Network Analysis* (*SNA*) (Calvani et al., 2005). To this end, the most remarkable collaboration tool is *forum* (see Figure 5-2) since it makes it possible to know both the sender and receiver of a message. On the contrary the chat and wiki tool provided by Moodle do not allow to clearly know the sender and the receiver of a message; each interaction involves all group participants. As a consequence, the subsequent SNA analysis would be meaningless.

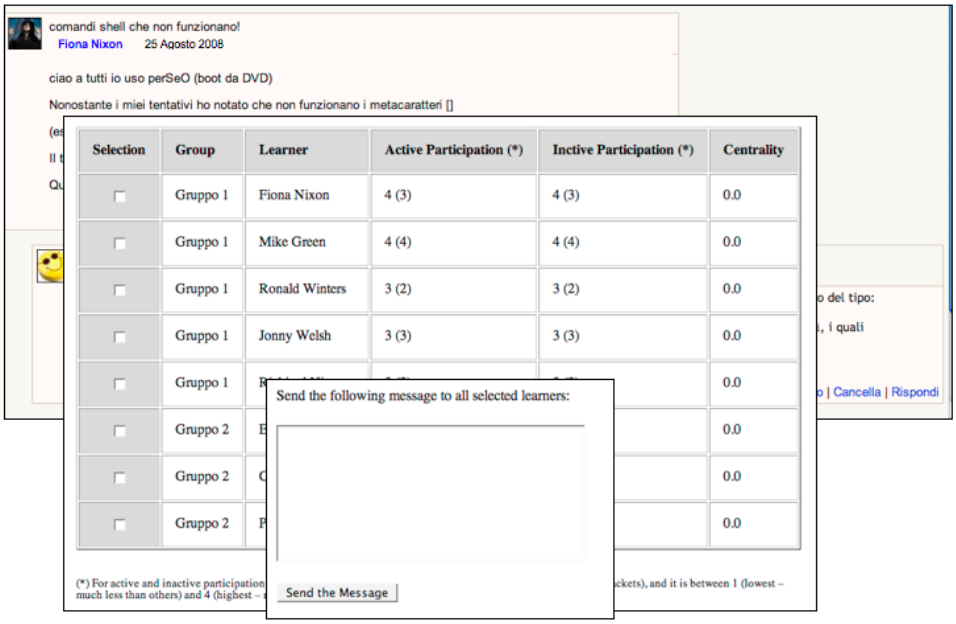

Figure 5-2. An automatic analysis of social interactions occurred through Moodle forum

In order to devise an automatic interaction analysis of the interaction occurred through forum, we developed the following components:

- *HttpMon*. Other than translating in events the HTTP requests related to chat and wiki, HttpMon translate the HTTP request related to forum in events that are sensed by the agent in charge of managing forum.

- A *Forum* artefact, whose goal is to reframe Moodle forum as an artefact. A *forum agent* is associated with such an artefact with the task of insert new forum message in the artefact itself.

- An *Interaction Analysis* artefact, having the goal of storing all the necessary data to actually perform interaction analysis. This artefact is as well managed by a specific agent that, when perceiving from *HTTPMon* an event requesting interaction analysis results, inserts analysis results as HTTP parameters of a request to be sent to Moodle server.

- A *Forum Analysis Agent*, whose goal is to observe the state of Forum artefact so that to insert into the Interaction Analysis artefact the data to SNA analysis on forum activities.

5.3.5 Conclusion and Future Work

In this work we focused on some of the required features of collaboration systems in distance education. In particular we considered functional and visual integration of collaboration tools as well as automatic interaction analysis (see Section 5.1). As distance learning systems often provide collaborative tools not integrated with each other and not sharing a common conceptual framework, an effective and integrated exploitation of such tools becomes difficult. On the other hand, such systems allow only to access statistical data about student social interactions, which often consists of log files. As a consequence, analyzing such a data in an automatic way becomes impossible if one does not rely on external tools.

Accordingly, in this work we sketched a possible conceptual framework defined in terms of the *A&A* meta-model in order to allow the development of collaboration tools conceived as *artefacts* that can be easily exploited altogether in a coherent and effective way. Furthermore, A&A provides also *agent* abstraction, which can ease the monitoring of student social interactions by observing the artefact counterpart of collaboration tools.

In order to provide an example of the applicability of A&A to this scenario, we have reframed *chat* and *wiki* tools of Moodle e-learning platform in terms of artefacts. Moreover, to give an example of automatic interaction analysis, Moodle *forum* was rethought is terms of artefact and by defining a few agents, developed a prototype of *Social Network Analysis*.

How showed in Section 5.3.4, even though integration of Moodle's chat and wiki is still feasible without the adoption of artefacts, nonetheless the exploitation of artefact can make integration more scalable and efficient especially as regards dynamic scenarios. Moreover, as far as *awareness* of group members' activities (see Section 5.1) and *automatic analysis of social interactions* among students is concerned, Moodle technologies appear inadequate: indeed, even adopting dynamic HTML technology on the client side, server side still need to be designed in terms of proactive entities (like agents) able to observe the activities each group member is involved in (see Section 5.3.4).

Visual integration of Moodle collaboration tools was not addressed as well since it would require a complete reengineer Moodle user interface. In the end, we think that a complete redefinition of collaboration tools in terms of A&A would provide more advantages than integration of existing collaboration tools. This will be matter of future investigation.

6 ICTs and social insertion / ICTs and the digital divide

From a strictly operational point of view, ITCs can be defined as techniques for recording, storing and communicating information (Reix, 2004). Seen more broadly**,** ICTs can be defined as "*technical resources involving devices for processing information, in the mathematical sense, making it easier to circulate messages and so to exchange information, interpretations, and productions arising from knowledge and know-how throughout society*" (Jeanneret, 2000). ICTs are made up of a heterogeneous range of tools, services and functions based on IT and telecommunications, involving procedures and connections tending to carry meaning and added informational value, not intrinsically but on the condition that they be associated with a process of human mediation. The generic term ICT therefore covers a multiple reality (from mobile phones to the Internet and intranet networks, to go no further).

ICTs continue to progress rapidly. They have been in use in industrialised countries for less than twenty years but have already become a part of our daily lives. We take them so much for granted in the workplace that it is hard to imagine carrying out our tasks without their support. In the home, after a slow start, they are being adopted more and more rapidly. Once we look beyond the sphere of privilege in which we live and work, however, we are forced to admit that the digital divide remains a reality, and not just in distant, poorer countries. It is all around us, another layer of the social divide which sometimes actually makes it worse.

6.1 Forms taken by the digital divide and representations of social insertion

There are two different aspects to the digital divide[6]: first, there is the physical divide, where the gap is in terms of a lack of hardware and access. This is a necessary condition for

[6] The contents of an issue of the French review Terminal deals with the two aspects of the digital divide. Review Terminal. Technologie de l'information, culture & société. Editions L'Harmattan: No. 95-96, Spring 2006.

crossing the divide (i.e. having the minimum physical infrastructures by which to connect) but not a sufficient one. The second aspect consists of a cultural divide: the gap here depends on a socio-cognitive deficiency. A lack of mastery of the fundamental methodological and conceptual elements for understanding and using ICTs obviously makes it impossible to integrate the necessary technology. These two aspects of the digital divide are intrinsically related: without physical access, there can be no adoption of ICTs. But for them to be adopted a foundation in technical culture is indispensable as well, whether or not the equipment is available[7].

6.1.1 Divisions, infrastructures and political declarations

To speak of the "digital divide" implies an ideological assumption: that necessary and beneficial progress can be achieved through these technologies. According to this point of view, digital divide and social divide are related, and the reduction of the first should automatically bring about a reduction in the second. Most political declarations are based on the assumption that digital media will have a positive impact on the fight to eliminate inequality. We have often heard politicians repeating their determination to do away with this injustice and announcing the high priority they give to providing everyone with as wide an access as possible to these technologies so that all will be able to meet the challenges raised by the arrival of the information society. Improving Internet access, equipping schools and colleges, multiplying training schemes for ICTs and opening public spaces for access to ICTs are all practical measures that demonstrate political commitment.

The political argument therefore suggests that ICTs are an indispensable tool for fighting exclusion, whether on a global scale (frequently represented in a simplified way as being North versus South) or at a national level (concerning those who are socially handicapped). Consequently, the most visible aspect of the digital divide is the one most often "dealt with", meaning the question of hardware and physical connection. We might reasonably suppose that "*political determination and the power of network effects are such that inequality of access must be reduced, if not eradicated. But inequality of access to the possibilities offered by digital media will remain because the greatest inequalities concern not exclusion but inclusion in the information society*" (Lamarche, Rallet, Zimmermann, 2006).

The development of ICTs has had the effect of accelerating the virtual dialogue between cultures. But has it at the same time helped reduce isolation and injustice? It is true that distance is no longer an obstacle to economic, cultural and political exchanges between

[7] See on this subject the work of Gérard Valenduc. For example [Vendramin, Valenduc, 2004].

peoples, which are often more dynamic and instantaneous than ever before. Ideally, exchanges on such a large scale should encourage mutual understanding. But despite these changes, there is still lively debate about universalism as opposed to local identities. Online access to information raises both ideological and social difficulties extending well beyond the simple matter of demonstrating the technical possibilities of local networks. Very few developing countries have either the resources or the capability of the industrialised countries to compete in the market for products and services. Globalisation thus seems to create an imbalance in the usual pattern of creation, distribution and consumption of information commodities via Internet. There is a danger that ICTs will force developing countries which are in a situation of dependence directly into a situation of exclusion. The issue of the visibility of minorities in the information society is more critical today than ever because of the massive influx of electronic goods and services from developed countries.

Indeed, resolving the hardware problem will not automatically remove the observed technology gap. The process of integrating ICTs cannot be reduced to a Manichean vision of the diffusionist model as some would like us to believe: either you are connected and consequently on an equal footing or you are not connected and are therefore excluded. The reality is more complicated and involves other parameters such as a willingness to accept change and the acquisition of an IT-friendly culture.

6.1.2 Sociology of use - Theories of innovation

A study of the way ICTs develop within a society naturally depends on the notion of technical innovation. A preliminary question inevitably arises concerning the possible added value or alternatively the disadvantages that may result from the development of these digital technologies in general, and more particularly regarding the acquisition of knowledge via digital technologies. We intend, however, to discuss innovation rather than invention, thus avoiding a discussion based principally on the novelty of the objects themselves. Our intention here is to evaluate how ICTs can be adopted in a particularly sensitive area of the social context, because we believe apprenticeship to be indispensable to the very concept of society. We have focussed less on the diffusion model suggested by Everett Rogers (1953)[8] in which innovation moves out from a source to multiple users, or the economy-orientated approach of Joseph Schumpeter (1990)[9], than on the process of how ICTs are implemented

[8] The diffusion model developed by Everett Rogers in the 1950s was one of the first studies of innovation. It postulates that an innovation is diffused if each category of "adopter" is interested successively, over five stages: Knowledge, Persuasion, Decision, Application and Confirmation. Everett Rogers. *Diffusion of innovations*, New York Free Press, 1953.

[9] Joseph Schumpeter sought to understand the nature of the capitalist system and the dynamic behind it. He proposed a theoretical construction opening the way to a conceptualisation of growth. For Schumpeter the motor driving evolution is innovation. He distinguishes five categories of innovation: manufacturing a new product,

or more literally “put to use”: how ready are users to accept and integrate ICTs by changing the way they seek information?

In order to follow up these questions we consulted the principal theoretical references concerning innovation and the adoption of digital technologies for common use.

The translation model proposed by Michel Callon and Bruno Latour (1991)[10] reviews and systematises the findings of American studies. The authors call attention to the fact that technical innovations (as with scientific knowledge) result from negotiations. In other words, an innovation is only worthy of the name if it is accepted by all the actors concerned and in particular the users. They also highlight the fact that there is no guaranteed continuity between technical innovation and social evolution.

Patrice Flichy (1991)[11], for his part, emphasises in his work that an innovation becomes stable only after a long process, when the functional and operational frameworks reinforce each other. The functional framework concerns the knowledge and skills of the technical community. The operational framework concerns the interaction between the producers and the consumers. A “usage value” emerges from this interaction after several identifiable stages.

Serge Proulx (1994)[12] takes a socio-political view of uses “*based on usage relationships, in other words the concept of uses in the context of everyday practice and/or the dynamics of the users’ family lives.”*

6.1.3 IT culture, technical culture and digital culture

The problem of “social autonomy" developed in particular by Michel de Certeau[13] has helped provide an explanation of the gap between the way tools are used and the intentions of the designers. If the way things are used does not meet expectations, this is because users need to be convinced that a new tool is worthwhile and genuinely useful, before it is adopted, used and integrated in an operational context. An interesting idea advanced by Michel de Certeau in *L'Invention du quotidien*, Chapter 6, is that: "For culture to exist it is not

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introducing a new method of production, creating a new market, acquiring a new source of raw materials, and implementing a new way of organising production. Joseph Schumpeter. Capitalisme, socialisme et démocratie. Paris: Editions Payot, 1990

[10] Michel Callon and Bruno Latour. La science telle qu'elle se fait. Paris: Editions de La Découverte, 1991.

[11] Patrice Flichy. L'innovation technique, La Découverte, 1991

[12] Serge Proulx. Les différentes problématiques de l’usage et de l’usager, directed by André Vitalis, Médias et nouvelles technologies. Pour une socio-politique des usages. Paris: Apogées, 1994.

[13] Michel de Certeau L'Invention du quotidien. Tome 1: Arts de faire. Paris, Editions Gallimard, 1980. La culture au pluriel. Paris: Editions Points Seuil, 1993

enough to invent a social practice, the social practice must have meaning for whoever carries it out."

The notion of an "IT culture" is denied by some, who see IT as merely a set of tools to be used. But, as Charles Duchâteau recognised, "perhaps we should regard IT and the acquisition of literacy that it requires as a single whole, as stable and well-adapted as possible, of knowledge and skills that prepare the user to confront computers and IT tools, to understand and to evaluate what computers can and cannot do" (Duchâteau, 1992). Despite constant advances in technology products, they never seem to contain "*all the information necessary to help one use them appropriately"* (Proulx, 1999) and not all users are able to navigate the online help sections present in the graphic interfaces of the operating environments. Adoption of an IT culture born in the 1980s with personal computers is still going on today, with machines that are still not totally user-friendly, any more than are the software environments. Furthermore, the context has broadened with the generalisation of computerised communication networks. A "digital culture" has appeared that can be defined as "*familiarity with knowledge and know-how concerning computerised electronic communication"* (Proulx, 1999).

The computer is certainly no more than a tool, but "*this neither prevents IT from occupying a very special place in our society, nor some people from defining it as the driving force behind a real revolution, or as the centre of a new technological culture*" (Breton, 1996). For anyone to become and remain an actor in a society as deeply imbued with technology, information and knowledge as ours, these skills have become indispensable. The biggest problems are not so much technical as organisational and it is important to clarify certain rules and operating procedures based on clearly-defined economic and legal models. In this context, adopting a necessary technology can be defined as "*acquiring cognitive and technical mastery of the minimum amount of knowledge and skill necessary for the individual or the society to integrate the technology significantly and creatively"* (Proulx, 2001). Bearing in mind that not everyone is used to the idea or practice of group work in a digital context, the adoption process needs to be studied in a wider framework than that of the individual.

6.2 The forms of change: from the disadvantages of ICTs to the creation of meeting places

6.2.1 Negative aspects and interactive solitude

Several researchers have underlined the informational and communicational aspects of ICTs, while reserving judgement about any positive aspects concerning the extension of their use. Dominique Wolton (2000)[14] remains on the whole sceptical in his analyses of the Internet. Although he recognises that ICTs provide an open space allowing creativity and favourable to change, he concludes that the ideal of the Internet as a channel for democratic communication is a Utopian illusion.

Like Dominique Wolton, Philippe Breton considers that grandiloquent justifications for ICTs are the expression of a desire by politicians to forge a consensus. The cult of the Internet is seen as a way of driving society towards a new ideology, as it represents social and cultural globalisation. Breton defends the thesis according to which techniques should be used by society as tools and not seen as ends in themselves. As is made clear by the subtitle of one of his books[15], the Internet is a threat to social cohesion.

It would therefore seem that the digital enlightenment welcomed by some could turn out to be no more than a delusion in many organisational contexts, with the obligation to be competitive nationally and internationally and relying on ever-more-complex technical structures. This notion of cohesion or 'linkage' is an intrinsic ingredient of ICTs: hypertext on the one hand and the physical connection of hardware and networks on the other are obviously considerable advantages. The social dimension, however, requires further ingredients. In the organisational context of the workplace, the pressure of a system in which ICTs are both symbols of openness and vectors of rationalisation can lead to real ambivalence. To quote Patrice Flichy, we are in an era of "*connected individualism*" (Flichy, 2004), where we are essentially alone, even when we are 'connected' to others.

When the professional sphere comes under the influence of ICTs it does not escape this effect. While an intranet can usefully link up the active components of the organisation irrespective of geographical distance, it paradoxically isolates those components at the same time. Email and the floods of messages it carries, multiple and sometimes contradictory instructions, pre-suppositions concerning network policy, the omnipresence of ICTs in our

[14] Dominique Wolton. Internet et après - Une théorie critique des nouveaux médias. Paris: Flammarion, 2000, p. 68.

[15] Philippe Breton. Le Culte de l'Internet. Une menace pour le lien social. Paris: La Découverte, 2000, 125p.

activities, the tacit and increasingly insistent requirement to be technologically competent – all this tends to weave a net whose mesh becomes more and more constricting. The digital divide, or more precisely, digital fragmentation, can henceforth become an integral part of the organisational fabric itself.

6.2.2 Integration in an identified social space

The equation for solving the digital divide has to be expressed in complex terms with some unavoidable differentiating factors. "*The availability of infrastructures, the acquisition of minimum skills and the building up of a stable repertoire of usage habits should not be taken as explicit signs that the digital divide has been crossed. It is not defined solely by exclusion, non-usage or poor-quality use but also includes 'mal-inclusion'* (unsatisfactory integration)*, by which I mean the development of usage which may seem sophisticated at a purely manipulative level but which still does not empower the user to negotiate a rewarding social position within the social universe he or she frequents"* (Granjon, 2005). Seen from this critical perspective, the digital divide reveals a third aspect, beyond questions of infrastructure and the acquisition of a basic IT culture, concerning the integration of individual users in an identified social space.

This, of course, brings us back to the notion of "social cohesion" which is especially relevant when analysing the problem of the digital divide. We can place social cohesion, which must be constructed at both individual and social levels, at the intersection of four main dimensions: social, professional, political and territorial (Vodoz, Pfister Giauque, 2005). It therefore develops simultaneously in both the public and private spheres and is influenced by all the different environments to which the individual is connected (whether by ICTs or not).

Consequently, as we spend more and more time every day handling this tool, there is a real danger that we may progressively lose contact with the social circle on whose help we depend to improve our technical mastery. In many different contexts it seems to be true that belonging to micro- or macro-communities, and the leveraging effect of human mediation on the learning process, all help to reduce the digital divide and support the notion of ICTs contributing to social cohesion (Vieira & Pinède, 2004).

ICTs are multiple and multidimensional tools, opening up many new possibilities, whether in terms of connectivity, access or computing power. It is true that Jacques Ellul warned of the need to "*be aware of just how radical the changes are into which, whether we like it or not, we are drawn by the ultra-rapid growth of these technologies"* (Ellul, 1983). We are clearly not obliged to pay too much heed to the siren song of technological determinism:

all this technical potential is neither self-sufficient nor does it automatically prescribe the ways in which it will be used. ICTs are only meaningful and operational in a mediated communication process and when incorporated in a complex social fabric. "*We need to restore these technical devices to their true role, making them mediators and not mere instruments or, in the words of Simondon, what might be described as a stable mixture of human, natural, social and hardware aspects; we need to show how the technology and its social and natural environment are interdependent […]"* (Akrich, 1993).

Some even speak of a "double mediation": Josiane Joüet states that the mediation "*is both technical, because the tool itself determines the way it is used, and social, because the motivation, the forms of use and the meaning attributed to the practice take their source from the social setting"* (Jouët, in Beaud et al., 1997). The technical and social spheres thus permanently interact and interrelate. We can follow Bernard Miège in accepting that "*the undeniable progress made by ICTs proceeds less by leaps forward, ruptures and innovations than by the pursuit of complex processes, which started a long time ago"* (Miège, 2007). This is why he prefers to express the role of ICTs as "*social anchoring*" rather than "*social insertion*", as this better illustrates the mediations and strategies underlying the junction between the technical and social spheres.

6.2.3 Territories and virtual communities

With the help of these technologies, virtual communities spring up to enable dialogue and sharing in the digital world, communicating via a variety of software applications. Pierre Lévy writes that *"as an example, a virtual community can be organised by mutual affinity using telematics communication systems"* (Lévy, 1995). The technological context can enable people to form groups with a common interest irrespective of their geographical location and even, sometimes, of their language. "*The culture of virtual communities adds a social dimension to the way technology is shared: it makes the Internet an instrument for selected interaction and for symbolically belonging"* (Castells, 2001). We may not know where the other members of the community are located, geographically, but does it matter? Pierre Lévy (1995) speaks of the "*de-territorialisation*" that results from the impact of new technologies on time and distance accompanied by greater mobility in various fields. Based on these two observations, we consider that the virtual community composed of the actors in a given administrative area together with those who work with it (institutional partners, businesses etc.) could contribute to what we might call *"re-territorialisation".*

In addition, we should not underestimate the role of confidence which is "*a decisive factor in collective performance, particularly in the case of virtual communities and/or of*

teams working on mostly abstract products" (Prax, 2001). It is easier to contribute to a joint work of creation if we know what we are likely to get in return, and the fact of participating helps strengthen our perception of territorial identity.

6.2.4 Interaction, human mediation and knowledge transfer

The elements for understanding ICTs that we have discussed here obviously also apply to ICTEs (Information and Communication Technologies in Education). The use of the acronym 'ICTE' indicates the use of ICTs in an educational environment. In practical terms, ICTEs may be thought of as "*any IT application used in the course of training, or in the transmission and sharing of knowledge*." This includes "*IT services and applications using Internet network technology for teaching purposes*" as well as "integrated systems (known as platforms or teaching environments) available from *servers"* giving access to such services as videoconferences, audio conferences, online chatting, or the production, publication and storage of teaching information, as well as the inevitable email (Bouillon & Bourdin, 2005).

Since the act of teaching is the principal function occurring in these training environments and ideally takes the form of the Teacher-Learner relationship, it is inevitably identified with a cultural, social and organisational dynamic. Consequently, the use of ICTEs in learning situations is clearly not devoid of significance: many diverse and indeed contrasting situations arise, due to the constant interaction of these factors.

Let us consider the example of group work mediated by ICTEs. The cooperative or even collaborative aspect is a key indication of the way these activities are reshaped around network-based digital techniques. "*Nowadays, information and communication technologies enable teachers to control this group work more precisely, whether this involves discussions and coordinating learners at a distance or in a bricks-&-mortar classroom"* (Peyrelong & Follet, 2006). However, a number of studies[16] have shown how difficult it can be to base the joint construction of a "collective intelligence" on a set of tools. Even if the "task synchronisation and time management" dimensions can generally be coordinated quite easily, the same cannot be said for collaborative work, seeking a negotiated, progressive and collective outcome in the context of a task-oriented project. This is a clear illustration of the process of reciprocal adjustments between 1) a social microcosm, 2) a task to be carried out and 3) a mediation relying mainly on tools (with all their possibilities and limitations).

While it seems indispensable that the learner should be fairly familiar with IT resources before confronting specialised applications, as well as being able to elaborate and use information and communication strategies, this is clearly not enough. The human

[16] See for example http://ec.europa.eu/education/programmes/elearning/studies_en.html (consulted on 27.09.2007).

mediation personified by the role of the tutor or trainer is a way of “socialising” the technical tools, of contributing to this articulation between the technical framework and the context of use and, finally, of accompanying change, particularly concerning the systems for sharing and transferring knowledge.

For the current project it is necessary to evaluate the possible value added by ICTs to information and training systems that are efficient and accessible to users (Vieira, Rouissi, Pinède, 2007). The learners, for their part, whether in initial education or professional training, hope to acquire skills that will increase their efficiency in their professional activities and consequently to realise their full potential in socio-economic development. Giving them workable tools to facilitate their acquisition of ICTs can help them identify their own needs and contexts, increase their capacity to address today’s socio-professional challenges and, in the longer term, facilitate successful (re-)insertion through employment. If this is not done, ICTs can prove to be a hindrance: insufficient adoption, or even rejection, of these technologies is likely to aggravate the user’s handicap and exacerbate the digital divide.

6.3 Conclusion

Innovation is generally associated with concepts such as progress, movement, novelty and creativity, leading to ideas of transformation and evolution, consequently evoking a positive image. But it can also give an ambiguous impression, as in the first instance the innovator must transgress the accepted norms making him temporarily “abnormal” because his behaviour can be seen as not only unconventional but somehow improper. All civilisations are founded on a respect for common rules: rules of law, customs and values. It is only possible to live in society because social relationships are predictable and backed up by law. At a later stage the opposite occurs and it is the behaviour of the innovator (or of whoever adopts the innovation) that becomes "normal" or conventional through diffusion. This is correctly stressed by Norbert Alter (2003)[17] in his book *L'innovation ordinaire*: “Innovation depends on the simultaneous development of the forces of destruction and creation”, it “destroys the social rules whose stability makes common practices meaningful, ensuring socialisation and allowing individuals to forge an identity.” (p. 278).

To what extent can deconstruction, “abnormality”, lead to evolution and reconstruction, thus contributing to the optimisation of procedures for the acquisition of knowledge, particularly where electronic learning systems are concerned?

[17] Norbert Alter. L’innovation ordinaire. Paris: Editions PUF, 2003. 278 p (Collection Quadrige).

7 Conclusion

E-learning today is characterized by the incessant creation of tools, artifacts and courses that often replicate the "traditional" model of one-way knowledge transmission from teacher to students.

How may we apply and employ the recent findings on the beneficial effects of social interaction on learning, and incorporate them into e-learning contexts? How can "powerful learning environments" be designed?

The present work started from these questions, with the purpose of providing ICT-practitioners with good practices and guidelines drawn from empirical research in psychology of education and from significant examples of e-learning courses (applying a sort of "knowledge transfer" approach).

Drawing on research evidence concerning the complex relationships between social interaction and cognitive activities, we basically aimed at detecting, describing, and suggesting educational practices and technological artefacts, which may foster the beneficial effects of social interaction on knowledge construction. As a matter of fact, e-learning is a powerful context that encourages collaboration, and social interaction may be considered as the "royal road" to knowledge acquisition.

Nonetheless, supporting online collaboration is a very complex and challenging task indeed. For this reason, several aspects involved in the design of e-learning courses, which are considered fundamental to the realization of successful e-learning courses, based on effective online collaboration, have been explored.

In conclusion, interesting guidelines and examples of good practices have been detected and described for each dimension that was investigated (i.e., input, process, outcome).

Although further studies are needed to verify the actual effectiveness and feasibility of these guidelines, the results described in this handbook may be considered as a step forward on the way to *"a better understanding by teachers, learners, decision-makers and the public at large of the implications of ODL and ICT for education, to ensure that pedagogical considerations are given proper weight in the development of ICT and multimedia-based educational products and services; and by promoting access to improved methods and educational resources in this field"* (see European Commission, Minerva Action: http://ec.europa.eu/education/programmes/socrates/minerva/index_en.html).

Moreover, if we consider e-learning as a powerful instrument in implementing the Lisbon strategy, these results may be considered as a step forward towards the adoption of distance learning systems at national level aimed at providing flexible, high-quality, and cost-effective higher education to adults.

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