Social Aspects of Collaborative Learning in Virtual Learning Environments

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ABSTRACT

This paper gives an overview on new practical approaches in e-learning focussing on collaborative learning and therefore also on social components of learning. Collaborative learning which presently mainly takes place in physical meetings is described closer by figuring out advantages and critical points. In addition social aspects of learning with a special focus on communication/interaction are described. Thus, collaborative learning is a theoretical background of learning communities a brief overview on virtual learning communities and basic community requirements is given. Examples from progressing projects and research are showing how we try to implement collaborative virtual learning environments by taking into consideration social factors of e-learning.

Keywords

e-learning, collaborative learning, social aspects of learning, learning communities, community platforms

INTRODUCTION

New information and communication technologies (ICT) get an increasing influence in learning. The e-learning market is growing rapidly with yearly growth rates of more than 50%. This growth is based on economic needs of more flexibility, the need for live long learning and the intend to use the advantages of new ICT in educational contexts. Research and development of new, more communicative and collaborative ways of e-learning are supported not only for economical but also political reason (i.g. key action lines in EC programs).

We presently identify the first steps for a paradigm change in e-learning. In the past the development of e-learning systems was nearly only technology-centred but currently we are on the way to more human-centred concepts of using new technologies for business, learning and communication.

Past and present e-learning technologies are mainly resource based with the mayor focus on the interaction between human and computers. The approach is on the one hand to provide media rich resources on the other hand to bring "traditional documents" in the Web. Thus mainly individual learning is supported. This has several advantages such as flexibility (in time and place) and the possibility to give feedback through interactive media. Also structured evaluation processes can be developed easily and it is quite cheap to distribute traditional learning material (scanned documents, texts, ...) to a big amount of people electronically. But also disadvantages have been identified such as a lack of peer contact and interaction, high initial costs for preparing multimedia content and for maintaining and updating this content as well as the need for flexible tutorial support. In general present e-learning solutions are lacking social interaction and cohesion.

Some recent approaches on the e-learning market are taking into account these open questions and disadvantages of today's learning platforms, concentrating on the need for collaborative learning and its advantages in traditional sessions. These platforms can be called 3rd generation learning platforms (Laister, J.; Koubek, A. 2001). These approaches try to focus on social and individual aspects of learning as well as on providing learning content in a way that makes sense. Special requirements to virtual learning platforms come from pedagogical and social research as well as from the technical side. One starting point are virtual learning communities supported by community platforms which enable the learner to communicate on a horizontal level.

Collaborative learning

In pedagogical theory the analysis of interaction between learners has a long history. A number of current approaches shows, that collaborative work is very successful in traditional learning settings.

Collaborative learning in general is defined as any kind of group learning in which there are some meaningful learning interactions between learners. We speak of virtual collaborative e-learning if these interactions take place in virtual environments (Goren-Bar, D., Koubek, A. 2001).

To discuss collaborative learning we start with the question why collaborative learning is seen as successful way to learn? We can find different answers on practical or/and theoretical level. Following five basic answers will be shown:

> Daily Practice: Daily observations show scenarios reaching from groups of children which are trying collaboratively to solve a problem to write research papers together with colleagues. Collaborative Learning can be identified and should be encouraged when there is need for some people to learn together – sometimes it can be seen simply as an outcome of daily organisational practice. (Dillenbourg, P. 1999). Thereby working and learning together in collaborative scenarios is not necessarily intended regarding to any pedagogical or organisational theory or ideology.

> Organisational: It is common practice to achieve goals by bringing together experts, multidisciplinary teams etc. The challenge in these settings is to motivate each member to bring in his expertise in order to get the group to learn and work together. In the longer term collaborative learning enhances the employee's ability to acquire collaborative and decision making skills within the organisation. These skills may help individuals to perform and co-operate better with others (other employees, peers, managers etc.) in the work place. Thus collaborative learning has important influences on the Learning Organisation approach and of Senge's organisational theory (Senge, P. 1990).

> Learning-Theory: There are established theoretical reasons to believe that models of collaborative learning are very effective as means of learning. Here also we can find the division between short-term effectiveness, regarding learning the subject-matter which is the object of a certain collaborative learning setting (Cooper et al, 1990), and long-term effectiveness by the (alleged) enhancement by collaborative learning of cognitive skills (Vygotzky, L.S. 1978; Bossert, C.R. 1990), self-esteem (Johnson D.W.; Johnson R.T. 1991; Slavin, R.E. 1995) and other soft skills that are considered by various theoreticians as conditions that are necessary for long-term successful learning.

> Empirical: Research shows that collaborative learning compared to individual and competitive learning scenarios brings students to a higher achievement level, raises their problem solving- abilities, offers cognitive advantages to learners and also has positive influences in enhancing the development of personality traits that are beneficial for future learning or future autonomous or co-operative learning and working (Tozer S. E. et.al. 1995; Webb, N. 1984; Bargh, J.A.; Schul, Y. 1980).

> Ethical: Collaborative learning empowers the individual and enables people to live a more autonomous but also co-operative and satisfying life in the future. This answer, referring both to children and adults, has emerged mainly from radical views such as critical pedagogy (Freire, P. 1987; Giroux, H. 1988) and other radical criticisms of prevailing educational structures.

Critical points connected to Collaborative learning can be detected because of structural conditions (view 1 and 2 below; i.e. attempt to implement an open learning model in basically closed organisational settings) and in disadvantages stemming from its essential group-based nature (view 3 and 4 below):

The teachers' classic role (hierarchy, vertical communication structure, ...) is incongruent to the requirements to teachers in collaborative learning situations. Teachers may feel that they are loosing control over the learning process and that therefore their effectiveness and contribution to the learning process are being diminished (Kimber, D. 1994).

There are difficulties in evaluating collaborative learning progress with traditional individual evaluation criteria, especially when it comes to higher cognitive skills, which are emphasised in open and reflective collaborative learning models (Sheridan, J. 1989).

There may occur pressure on the more introvert among the participants in collaborative learning sessions and on those who have difficulties in interacting in groups in general. This is often followed by falling contribution to the collaborative learning processes - and even more gravely by a decreasing level of self-esteem and readiness and capacity for further learning (either collaborative or individual).

There are dangers of opportunism and groupthink stemming from the proved human tendency to conform with authoritative leaders or with group pressure (Janis, I.L. 1982).

This brief overview shows that collaborative learning is a very efficient daily practiced paradigm of working and learning together and also points out some theoretical approaches in this field. The above mentioned critical points refer mainly to structures, roles and individual learning types and show that institutions, tutors and learners have to learn to deal with the collaborative learning approach. Furthermore they show the importance of mediation of collaborative learning groups. Even the role of the "teacher" changes to the role of a "tutor" or "guide" mediation is important as it will be shown below by discussing virtual communities.

Since collaborative learning is associated with interacting closely in groups questions regarding social aspects of learning arise. The following can only provide an overview on some important social factors of learning which are mainly connected to the communication process and feeling as a group member.

social Aspects of learning

Social learning is mentioned in different contexts and meanings which range from learning social content (e.g. learning how to behave in social situations or learning to be a social learner – for example learning when to ask questions) to social interactions in learning processes (Salmon, G.; Perkins D.N. 1998). Our focus on social aspects of learning in virtual environments are interaction processes in collaborative learning scenarios. Thereby we primarily refer to increasing important factors of social presence by transmitting various features of real-world environments also in virtual learning environments. By having the possibility to represent users and enable various ways of communication, social and cognitive orientation can considerably be relieved. To enable social presence in virtual environments the interactions in virtual rooms should be sensed equally by all group members at the same time by means of giving the possibility of social-emotional feedback. Knoll and Jarvenpaa observed in their studies individual and collective requirements for efficient virtual group work which are summarised in the following three categories of skills (Knoll, K.; Jarvenpaa, S. L. 1995):

virtual socialisation skills: social-emotive information such as lively self-description, small talks etc.

virtual collaboration skills: definition of behavioural rules, evaluation of sub-results (feedback among each other), separation of public and private communication etc.

technical skills: usage and care of the system

These results clearly indicate that not only the formal structure such as task-relatedness must be considered as a factor for the quality of virtual group work in collaborative e-learning scenarios. Successful virtual collaborative learning and working generally depends on the combination of formal, social, and technical skills. For developing a virtual identity, a broad communication and information structure must be realised that allows interaction on various behavioural levels. On the level of virtual socialisation skills, for example, informal small talks can be performed or private information can be exchanged which increase the community feeling and counteract social isolation in Web-based scenarios. The group can also focus on the normative effects by developing a set of rules for collaborative work, the so-called virtual collaboration skills. For example, somebody visualises a question in order to signal that he or she has difficulties in understanding something and that he or she needs support from the other group members in order to take part in the common knowledge construction. Audio and text-based information and communication can thereby strongly be supported by the possibility to visualise nonverbal stimuli. Besides verbal and para-verbal communication (which can also in virtual environments transmitted by audio channels) nonverbal communication is an important functionality in virtual learning environments for collaborative learning. The major functions of non verbal cues are transmission, repetition, replacement, emphasis, contradiction and regulation (Chen, G.M.; Starosta, W.J. 1998). Face, head and hands are the main source of bodily nonverbal messages. In learning situations head and hand gestures serve mainly functions like expressing agreement or disagreement, pointing at things or other group members, to get attention (without interrupting verbally the speech of another person) and to express more clearly what was said verbally. Especially in small interactive learning groups where every participant visually can see and be seen by the others individually nonverbal communication is important for the interaction process.

Each of the functions of nonverbal communication are, for the most part, missing generally by using the internet as a communication tool. In "standard" e-mail and chat-discussion- or learning- rooms non of the above mentioned components of nonverbal communication with their subsystems are supported. On the one hand important information transported in face-to-face meetings via nonverbal communication gets lost, on the other hand studies show that the communication structure and participation is more equally (Kling, R. 1996) what is very important for collaborative learning. A system for synchronous e-learning can support learning and communication processes over distance best taking in account the importance of verbal communication and the transfer of the main nonverbal meanings because gestures and facial expressions are very important for communication processes. The expression of positive and negative feedback, emotions and feelings (e.g. if somebody is very interested, feels bored, etc.), expressing agreement and disagreement and to interrupt the speaker nonverbally (to ask questions, give statements etc.) are very important in collaborative learning situations and serve a major function in getting a feeling of social presence.

To sum up, it can be sustained that collaborative e-learning requires solutions for social and cognitive orientation. The system should enable its users to get a feeling of social presence by supporting a variety of interaction stimuli. Each participant should be informed who is present in the session, how the group is composed, and who is participating actively or passively. Nonverbal communication processes can be implemented by visualisation of signs and symbols (e.g. facial expressions, signs for commitment or having questions) but also tools for synchronous communication (like audio and text chat) which are most important for collaborative learning sessions should be supported by visual aids (e.g. to see who is speaking currently).

This overview outlined briefly some social factors of learning whereby mainly communication processes – verbally as well as non verbally – were discussed. One approach to deal with e-learning groups and interaction between participating people are virtual learning communities. There is a wide range of applications connected to this term reaching from discussion-groups to 3D community platforms. Following we focus on learning communities as a key approach in the discussion on collaborative e-learning.

Learning communities

The term "virtual communities" is one of the major buzz-words in the Internet literature in the last years. Following this term and associated software products, also the concept of learning communities has been born. We want to show briefly what learning communities are and make

explicit how they support social interaction in collaborative learning situations.

Virtual Community has been defined in different ways in the multidisciplinary field of people who are researching, developing on or participating in online communities. A broad definition outlines online communities as consisting of (Preece, J. 2000):

people, who interact socially to satisfy needs, perform roles etc.

a shared purpose, that provides a reason for the community.

policies, that guide peoples interaction.

computer systems, to support and mediate social interaction.

The need and shared purpose of an education community is learning. Online communities can offer a lot of opportunities to students which are comparable with face to face meetings and which are essential for collaborative scenarios. For example they can exchange information, work together, share resources, comment the work of others etc. Thereby students can take all advantages of working online (e.g. interaction is not bound on a physical meeting in the same place). Online learning communities can force students to learn together collaboratively and benefit from sharing ideas and resources but in most cases also support for enabling the learning processes is needed. Salmon points out that moderators or mentors are important for learning communities but the primarily function of these people is to guide students to meaningful learning activities rather than to provide knowledge (Salmon, G. 2000).

Also here we can raise questions described above by discussing the social aspects of learning: How can these interaction processes be supported? How can students who are never meet their peers physically get a feeling of belonging or commitment to a community? And therefore which conditions are motivating people to stay and interact in a learning community? How can it be ensured in general that given information is correct?

To discuss these questions firstly we will look at two general and interrelating requirements of successful online communities: *Usability* which focuses on the human-computer interaction and *Sociability* which focuses on the social interaction processes.

Usability focuses on the software design. The basic requirement sounds simple: It should be possible for users to interact and perform their tasks easily and intuitively. Software with good usability supports lower error rates, high productivity, rapid learning and efficient use. Some catchwords for usability are: Navigation, Interaction dialog and possibilities, Feedback, Registration, Support tools and help functions, Archives, Representation of the users, etc.

Sociability is conjunct with planning and developing policies. These should be understandable and acceptable to members and should support the goals of online communities. Examples for such policies are policies for membership, privacy, copyright, security, free speech, roles (moderator, student, …), codes of behaviour, etc.

Thus, usability and sociability and their interrelations, base on communities needs and shall support the communities evolution.

In addition to these basic needs, successful learning communities must support additional needs of students and tutors like resources, guidance, feedback and enjoyment (Preece, J. 2000).

Resources: To communicate with all group members, within small groups, one-to-one, with the instructor; to access resources in the WWW and to search the Web, to collaborate in projects, to share work etc.

Guidance: Teachers/Professors have to guide students effectively, to challenge them

to use the internet creatively and ensure that they are rewarded for their efforts. This includes to filter information and prove the correctness and to view communication flows.

Feedback: Feedback can be given in several forms in the learning process. It can come from the tutor, from peers or from both. Also automatically feedback functions can be implemented in the system.

Enjoyment: Learning is more meaningful when it is fun. Features that encourage sharing, empathy, trust, support and collaboration, as well as discourage aggression, self-centred behaviour etc. help to make learning enjoyable.

The requirement for resources can be seen as part of the more general requirement of openness: It expresses the need of learners to organise themselves the way they work and the resources they would like to access. The requirements of guidance and feedback are related to more general concepts of reflection and supporting different forms of communication. Enjoyment is a very general requirement and focuses on a wide range of needs starting from interaction processes up to usability questions.

So far we have discussed our research work in the field of collaborative learning and some components on social aspects of learning followed by an overview on learning communities in theoretical terms. Now we will present in short two projects which build on these collaborative and social aspects of learning as well as on creating a learning community.

current practical approaches

INVITE Using a 3D environment for collaborative learning

INVITE – Intelligent distributed virtual training environment - is a European project, funded under the 5th framework programme on IST and is running from 2000-2003. The prime idea of *INVITE* is to focus on the support of group learning processes with the means of a tool for collaborative e-learning. *INVITE* is not only a research project as it has the clear objective to develop a commercial product which is a virtual learning platform, specifically for the support of learning groups, which can participate in tutor-centred learning sessions or also learn together synchronously and asynchronously.

The basis of the *INVITE* application is built on a 3D multi-user communication platform, which is already successfully operating in the market of online communities. The main advantage of this platform is that it creates nearness and social presence. These aspects of virtual presence are further enhanced by representing the users through photo-realistic avatars that look like the person they represent and by being able to articulate feelings and nonverbal cues through face expressions and gestures. For synchronous communication an audio channel and the possibility for text chat as well as application sharing are available. In addition various tools will be implemented: tools for monitoring learner actions, for structuring learners into groups as well as for evaluating and reflecting the learning progress in the group and tools for recording sessions and displaying learning material. Besides creating a virtual learning community by using a 3D platform, avatars as well as communication and reflection tools, the system supports international co-operation with its on-line capability of text translation.

Current synchronous e-learning platforms are mostly based on video-conferences, and seem to have been designed to virtually represent the concept of frontal learning. A general problem of these tools is the reduced social presence of the participants that are represented in windows by means of live pictures which mostly are not fluid, occur with time delays, have a low resolution and are quite small. Thus, participants are rather given a feeling of distance than a feeling of nearness and group awareness.

An environment as *INVITE*, where people feel to work as a group in a 3D environment and tend to forget to be in front of a computer as they see the other participants and their actions, can be the

basis for the methodological innovations *INVITE* focuses on: Open, participatory and reflective collaborative e-learning, supported by modern pedagogical paradigms as social constructivism and organisational learning theories.

The demand for an innovative system like *INVITE* is high in the targeted market that are international companies and networks of companies as well as in the future also traditional learning institutions, such as higher education and training. *INVITE* offers to those user groups not only a solution to reduce the travel effort but also a solution for being able to design a more flexible learning process. The addressed users will be able to meet on short notice and integrate learning better into their working place as well as get more continuous support from tutors.

Based on the requirements our end users which are international companies like Lauda Air, AV-List, AXA etc. have mentioned at the beginning of the project a first visual prototype has been developed and evaluated. The general comments of these test users on *INVITE* were rather positive. They liked to use *INVITE* because it is easy to use and the main system functions are all nearly self explaining for people who are used to work with computers. Furthermore they think that navigating in the 3D room is also easy to learn and that the avatars, gestures and mimics are a plus for learning in a group. These general comments as well as the usability testing results will be considered in the ongoing development work of the new prototype version which will be made accessible publicly on the *INVITE* website in the near future (for further information please visit: http://invite.fh-joanneum.at).

VirRAD learning community a medical environment as case study

Imagine there is a group of people working in a very specific area, having specific learning needs, problems and questions in their working field. Imagine this group is distributed in different countries all over the world. Presently group members meet for basics training and have to meet for advanced training sessions to learn and work together collaboratively and access expert knowledge. This requires a high effort of resources, because the group has to meet on one place.

VirRAD, a project under the Fifth Framework Programme, IST, of the European Commission which will start at the 1st of March 2002, bases on such pre-conditions. The primarily target group are radiopharmacy post-graduate students and professionals but the widened target group for building a learning community are nuclear medics. The project aims to create a easily accessible virtual environment, where the nuclear medicine community can meet to learn, exchange views, and discuss best practice. Part of this environment will address the particular needs of trainee radiopharmacists, a sub-specialisation of nuclear medicine, through providing distance learning material. This will be an intelligent learning environment with courseware and shall overcome the economic and logistic difficulties in course provision for this specialist community. The development of multimedia learning material will be closely coupled with the pedagogical theory of mindful learning. Collaborative learning and community processes will be supported by a 3D virtual worlds platform.

Thus, the provision of "classical" and multimedia on-line learning material and the provision of community facilities should build a learning environment which meets the requirements of this target group. On the one hand radiopharmacy students can gather basic knowledge and discuss their questions in the community – on the other hand advanced nuclear medics can support them and discuss with students as well as with other advanced nuclear medics.

As group learning processes are highly efficient especially in problem solving, the virtual environment will support collaborative processes.

VirRAD aims at the integration of current RBL concepts with collaborative e-learning strategies. The basic pedagogical aims are the development of

> an instructional design from Mindful-Learning theory (Langer, E.J. 2000);

> a multi-layered meta-cognitive learner model within the context of an intelligent, virtual

reality enhanced, distance learning environment for vocational training;

the embedding of this environment within an enriched learning structure that gathers together learners, practitioners and specialists in a knowledge community, using radiopharmacy as the target learning and knowledge exchange area.

VirRAD will investigate the integration of a personalised, yet social, learning environment; with technologies that explore protocols for communications between virtual reality and the facilitation of communities of learners; and learner modelling and instructional design. It will also satisfy the real needs of the specialised radiopharmacy community.

While in *INVITE* collaborative e-learning of "small groups" (e.g. groups as would participate in a traditional training) is at the centre of attention, VirRAD tries also to integrate these results to support a full community learning process, including asynchronous communication, RBL and synchronous learning. It is expected that both projects will substantially contribute to the research of collaborative e-learning.

Conclusions

Market studies show that an increasing number of European companies – especially big and medium size companies – are getting interested in e-learning. The e-learning market rapidly grows but much of this learning is dedicated to pure computer-based training, with the major application in the field of software training, where world-wide standardized training packages are available. What is missing in these traditional e-learning scenarios is social cohesion, group awareness and the possibility to co-operate and collaborate with other learners.

Collaborative work and also learning is integrated in the daily working process but collaborative e-learning is a concept of which only few have heard off. However, collaborative work is one of the main strengths of the networked economy. Working with people, one has never met, forming dynamical teams over continents in order to solve problems, are common in many globalised or networked companies as well as in multinational project teams. The challenge for collaborative e-learning platforms is to design solutions for distributed networked learning and working teams by providing on the one hand solutions to share learning content and to interactively work on it. On the other hand the concept of collaborative learning also focuses on social aspects of learning which are less implemented in current systems. Not only theoretical models and research work but also the increasing importance of virtual learning communities show that future applications should and will take into account these collaborative and social aspects and enable especially small groups to learn and work together efficiently via computer networks.

To realise and implement collaborative e-learning scenarios in the broad context of life long learning it is not only important to provide technical solutions but it is also a big challenge to establish and support a new learning culture with horizontal communication structures and active participation of the involved people – learners as well as tutors. E-learning communities can only be successful when people are participating actively and provide meaningful discussion inputs as well as when the number of "free-riders" (e.g. people who only gather knowledge but do not bring in knowledge) is low. Also in this context it is very important to take into consideration social aspects of learning and support a feeling of commitment and affiliation to the group.

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