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► **To cite this version:**

Kati Mäkitalo, Piritta Salo, Päivi Häkkinen, Sanna Järvelä. Analysing the mechanisms of common ground in collaborative web-based interaction. Pierre Dillenbourg, Anneke Eurelings, Kai Hakkarainen. European Conference on Computer-Supported Collaborative Learning Euro-CSCL 2001, 2001, Maastricht, Netherlands. pp.445-453, 2001. <hal-00190696>

**HAL Id: hal-00190696**

**<https://telearn.archives-ouvertes.fr/hal-00190696>**

Submitted on 23 Nov 2007

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## **ANALYSING THE MECHANISM OF COMMON GROUND IN COLLABORATIVE WEB-BASED INTERACTION**

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**Abstract** The ideas presented in this paper are challenged especially by the certain critical questions concerning web-based interaction and the qualitative analysis of such interaction and learning. The question arises whether the students from different contexts and countries are able to reach such interaction that would lead them to educationally relevant higher-level discussion and learning in web-based environments. Furthermore, as this field of study is fairly novel, there is a shortage of established methodologies for analysing computer-mediated communication and the complex phenomena it encompasses. In this presentation, we attempt to find new approaches to discover how people establish and maintain a common ground in interaction, particularly in situations where students are working collaboratively in a web-based environment. In order to construct the common ground, students share mutual understanding, knowledge, beliefs, assumptions and pre-suppositions. The common ground can be constructed and maintained during the interactive process called grounding. The study described in this paper is a part of the Finnish research project SHAPE (Sharing and Making Perspectives in Virtual Interaction).

**Keywords** common ground, grounding, collaborative web-based interaction, electronic discussion

### **Introduction**

Positive effects of social interaction for individual learning have been established in many studies (e.g. Crook, 1999; Dillenbourg, 1999). According to several recent researchers, social interaction and collaborative learning supported by instructional technology are seen as a setting that can potentially lead to deeper understanding and new knowledge creation. Computer Supported Collaborative Learning (CSCL) seems to be one of these promising innovations to improve teaching and learning with the advanced communication technology (Järvelä, Hakkarainen, Lipponen & Lehtinen, 2000). CSCL could offer some supportive elements to collaborative learning, and moreover, it also enables the researchers to study productive peer interactions (Crook, 1999; Dillenbourg, 1999).

According to most optimistic views, any possible network-based interaction is educationally valuable. But also more pessimistic views about the quality of web-based learning have been presented (Järvelä & Häkkinen, 2001b; Schlagel, Fusco & Schank, 2000). There are several difficulties for using today's web facilities as a medium for productive interaction. According to Roschelle and Pea (1999), on the web, interactive communication is very much dependent on text. Thus, it is much easier to passively read and view information than to actively create it. Collaborative processes are overemphasised, generalised, and their web-specific features are not explicated. Roschelle and Pea (1999) also assume that asynchronous communication is very different than face-to-face communication. There is a need to pay more attention to interactive processes on the web. Some of the most important processes in human

communication like creation of mutual understanding or shared values and goals are hard to reproduce in web environment. The absence of visual information (e.g. missing facial expressions and non-verbal cues) increases the social distance among the participants (Häkkinen & Järvelä, 1999; Järvelä & Häkkinen, 2001a).

The ideas presented in this paper are especially challenged by certain critical questions concerning web-based interaction. The arguments of this presentation arise from a university course involving groups of students from different contexts and countries, who had not previously worked with each other, but were now brought together electronically to work on a common task. The question arises whether the students would be able to reach such interaction that could lead them to educationally relevant higher-level discussion and learning in virtual environments. Building a learning community, which would optimally support the joint study project, is one of the main goals in this particular teacher education course. The main function of the grounding process is to ensure effective communication in terms of shared understanding of different kind of signs and signals used in interaction. This study focuses on the mechanisms for establishing and maintaining a common ground in interaction, particularly in situation where the students are working collaboratively in a web-based environment. The study described in this paper is a part of the Finnish research project SHAPE (Sharing and Making Perspectives in Virtual Interaction: Järvelä & Häkkinen, 2001b; Saarenkunnas, Järvelä, Häkkinen, Kuure, Taalas & Kunelius, 2000).

### **Theoretical background**

In learning and collaborative activities it is essential to reach an adequate level of mutual understanding. The participants need to solve any problems with this respect in order to reach the higher level interaction (Baker, Hansen, Joiner & Traum, 1999; Dillenbourg, 1999; Veerman, 2000). In order to construct the common ground, students share mutual understanding, knowledge, beliefs, assumptions and pre-suppositions. The common ground can be constructed and maintained during the interactive process called grounding, which is becoming increasingly important in computer-mediated communication systems. At the beginning of any interaction, there will already exist some mutual understanding between individuals sharing the same cultural background. But also the participants with the shared culture need to maintain and consolidate their common ground during the interaction itself in order to explore new aspects of mutual understanding. (Baker et al., 1999.)

According to Dillenbourg and Traum (1999), grounding can occur at the linguistic level as well as at the cognitive level. Furthermore, Veerman (2000) proposes that grounding can exist also at the level of understanding thematic information in relation to certain task and learning goals. Through the negotiation processes the participants can reach mutual understanding, but there has to be space for negotiation. For example, the learning tasks should be designed in the way that collaborative learning situation will offer possibilities for disagreements and misunderstandings (e.g. Häkkinen & Arvaja, 1999). During grounding and negotiation processes participants can build a shared solution, which is a central idea in collaborative learning (Dillenbourg, 1999).

Previous studies on grounding show that more insight is needed into the mechanisms that support the students' engagement to the web-based action and discussion (e.g. Hakkarainen, 1995; Baker et al., 1999; Dillenbourg & Traum, 1999; Veerman, 2000). Since it is very difficult to explore human thinking and knowledge construction processes, the special aim of this presentation is to discuss how to examine the complex interaction process of web-based learning.

The purpose of this study is 1) to increase knowledge about web-based interaction and learning by exploring the mechanism of augmenting and maintaining the mutual understanding and 2) to develop methods to analyse web-based interaction and learning.

### **How to research the process of grounding**

Many CSCL studies focus on web-based interaction, but it is assumed that the process of learning is much more than the communication processes in the environment (Crook, 1999). From the situational point of view, learning is seen as an activity in specific context. In the case of the computer-supported collaborative learning, there arises a question of how to examine the complex interaction processes in the two different levels: face-to-face and web-based levels. For example, in the process of grounding, non-verbal signals (e.g. gestures) play an important role in ensuring effective communication. To capture the process of grounding, we should see the concept of learning environment more widely than just as a technically constructed place for communication (Crook, 1999). The participants' mutual discussions in the classroom, for instance, are still common situations to build shared understanding, not to mention the whole cultural setting of learning environment. Since it is very difficult to examine and analyse thinking and knowledge construction, one aim of the study is to develop research methods for valid description of collaborative learning.

To examine collaborative learning through computer-mediated conversations, it is important to answer a number of fundamental questions to start with. For instance, what is the unit of the analysis? How do we approach and study the social construction, and what are the essential features of the conversation from the viewpoint of this particular research? (See, e.g. Reed, Schallert, Benton, Dodson, Lissi & Amador, 1998). In qualitative research, there are many variables, which could affect exploration. To gain reliable information on learning and interaction it is important to develop valid research methods that match with the complex phenomenon of social knowledge construction in the computer-supported learning environment. We need new qualitative methods for analysing the shared processes and understanding in computer-mediated interaction (e.g. Hara, 2000; Hoadley, 2000; Häkkinen & Järvelä, 1999; Järvelä & Häkkinen, 2000, 2001b).

### **Context of the study**

The subjects of the study are pre-service teachers in the USA, University of Indiana (N=67), Great Britain, University of Warwick (N=9) and Finland, Universities of Jyväskylä (N=19) and Oulu (N=21). For all these students, participation in web-based conferencing course is credited as part of their alternative studies in education. All the students had gained experience with field training and had basic knowledge about computers and the Internet. This web-based project lasted for two months. Students used an asynchronous web-based learning environment called ProTo to communicate with each other. The main topics of the discussions were related to teaching and learning. The students constructed case-based descriptions in the areas such as learning context, technology in education and teachers' professional growth. The students' learning task was to maintain their personal case discussion and to summarise the discussion in the middle of the computer-supported learning course period and also at the end of it.

### **Results**

#### ***Themes and topics of discussion***

In this project, the students constructed case-based descriptions in the areas (Table 1) such as 1) Authenticity and Context, 2) Fears in Educational Environment, 3) Technology, ICT and Education, 4) School, Home and Society, 5) Dealing with Difficult Situation and Delicate Matters, 6) Learning to Learn, 7) Becoming a Teacher, 8) Creativity and 10) Thinking, Understanding and Knowledge Construction. During the period the participants (students and mentors) produced 477 messages.

Table 1 The amounts of messages and cases by the themes of discussion

<b>Theme</b>	<b>Number of messages (Number of cases)</b>
Authenticity and Context	26 (1)
Fears in Educational Environment	37 (7)
Technology, ICT and Education	48 (5)
School, Home and Society	124 (15)
Dealing with Difficult Situations and Delicate Matters	48 (4)
Learning to Learn	26 (2)
Becoming a Teacher	67 (7)
Developing Learning Communities	30 (4)
Creativity	49 (4)
Thinking, Understanding and Knowledge Construction	22 (2)
<i>Total</i>	477 (51)

There was 51 different cases involving 1 to 26 mailings in each case. There was one case under Authenticity and Context – the theme that included the highest number of mailings (26). The log file data gave some evidence on how students acted in different groups.

#### ***Activity in the web-based learning environment***

Table 2 describes students' activity in the web-based learning environment. 17 of the students were passive readers, they read the incoming mails from others but there were no outgoing mails by their personal name. This is partly explained by the fact that some of the students worked as groups, and the groups used to log onto the web-based environment by using only one member's name. Table 2 shows that the students from Oulu participated actively in the discussion. A great number of messages were sent

by the students from University of Indiana, though the average of their mailings per student proved lower than the respective means in the both Finnish groups.

Table 2 The students' activity in the web-based learning environment

University	Oulu	Jyväskylä	Indiana	Warwick	Total
<b>Students</b>	21	19	67	9	= 116
The number of <b>students</b> who did not sign in the virtual learning environment at all	0	1	27	2	= 30
The number of <b>students</b> , who did sign in, but did not leave any messages	1	6	3	7	= 17
The number of the <b>visits</b> in the virtual learning environment	543	264	266	17	= 1090
<b>Messages</b>	169	97	187	0	= 453*

\*Students' messages only (the messages by the staff not included)

The quantitative data analysis of students' activity does not prove that learning has taken place in this web-based learning environment, and therefore more qualitative investigation is needed. The next step is to take a closer look at one of the case discussions, which will be analysed below as an example. The case involved 21 mailings.

### *Qualitative analysis of discussion*

In this study we approached the discussion data by using two different methods. The first method, which was partially applied here, is based on Häkkinen's and Järvelä's (1999) model of analyzing the type of messages and the level of discussion. This kind of data analysis gives an idea of the level of discussions but to explore the mechanism of establishing a common ground we need a different approach. Still, it is educationally important to know at which level the discussion moves, as it is generally assumed that higher level discussion enhances learning. In addition, this study also gave an opportunity to explore what kind of mechanism of common ground is related to the high-level discussion, and so these two methods of analysis were needed.

At the first stage the aim of the analysis was to examine the type of messages in order to organise the data. The messages were grouped into the following categories: Comment, Suggestion, Experience, New point/Question and Theory (Häkkinen & Järvelä, 1999; Järvelä & Häkkinen, 2001b). At the second stage the messages were examined to find out, for instance, what kind of feedback the participants give to each other: whether they show interest in one another's opinion and experience, and whether they willing to react and respond to the message (attitudinal reaction; Baker et al., 1999). A common form of feedback is a signal that the posting is read and comprehend (Baker et al., 1999). In collaborative action it is important to give open space for misunderstandings and disagreements as Dillenbourg (1999) mentions, but also to give space for participation. This second analysis focused on the feedback, contact and open space for negotiation and participation. Open space for negotiation means that the participants ask for clarification (meanings) or ask other people's opinions about the issue under discussion. On the other hand, open space for participation is like an invitation to joint discussion. In the discussion these two items can be included in the same message. This second stage of the discourse analysis involves many levels: the level of individual messages, interrelationships between two or more messages, and the level of the whole discussion. These second stage analyses are still in progress, but we will shortly introduce some preliminary results in the next session.

### *The path of discussion*

It is easier to follow the proceeding of a discussion in the form of graphs, which function as researchers' analysing tools. Figure 1 displays some key information about the participants (female/male, students/mentors at which university) as well as the day when the message was sent to the discussion forum and who was answering to whom, and the type of messages.

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 Insert Figure 1 here  
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As figure 1 shows, all the mails were higher level messages, such as messages involving theory, a new point or questions. According to the level of messages, the participants reached high-level discussion. There are allusions to the other messages, but a further content analysis is needed to explore these references. In general, the participants are likely to discover more new points once the mutual understanding has been established (e.g. Häkkinen & Järvelä, 1999). This is only one example of analysing web-based discussion, and the next step is to explore the mechanism of the augmenting and maintaining a mutual understanding.

In BU's case 53 % of the mails included feedback (I agree with you, Really interesting question, "participants' name", hello etc.). Many of the participants giving the feedback also got responses, not only from the feedback recipient but from the other participants, as well. Especially when the feedback was personal, addressed by name, the response was sent immediately. Positive feedback encourages people to participate in discussion and also engages the participants to the group of web-based learning environment.

It seems that second- and third-round messages (Figure 1) have effect on how the discussion is progressing thereafter. It is important that participants show their interest to carry on conversation. Participants can leave the space open for participation or negotiation in their messages by asking questions or using triple points, combinations of question and exclamation marks. As figure 1 shows, the second round messages that included questions led the discussion forward (Appendix 1; messages 4 and 13). By using questions a participant can show her/his interest in the other participant's opinions and experiences, giving space for participation or negotiation and also showing her/his attitudinal position that she/he is willing to react and respond.

In the web-based discussion participants had the power to choose which messages they were going to answer and thus direct the flow of conversation by their own eagerness. They could also pass or avoid issues that they did not feel comfortable with. In BU's case, for example (Appendix 1; messages 12, 13 and 14), the case presenter chose to answer only the question of talent and creativity, ignoring the gender issue, even though he was the first one who actually raised the gender issue in his first message (Appendix 1; message 1). In the web-based discussion it is easier to avoid some uninteresting and unpleasant issues, because there is nobody to demand it from you immediately by asking an explanation, for example.

Participants who have reached common understanding can more readily concentrate on reconstructing their knowledge together. For example, when the participants have found out in the discussion that they agree on something and are thinking along the same lines, they have established a common ground on which to base further discussion with each other (Appendix 1; messages 3, 4 and 7).

## **Conclusion**

In order to design web-based teaching in the future, it is important to explore web-based interaction and learning. Therefore, we need more research to find out what kind of problems and possibilities there will arise for using technologically supported environments to reconstruct learning and teaching methods and to create innovative and highly motivating virtual environments.

The aim of this presentation was to raise question of how to make research on web-based learning. According to most optimistic views any possible network-based interaction is educationally valuable. It seems evident that people acquire knowledge and patterns of reasoning from one another by sharing and negotiating common goals, but it is not obvious, however, that networked interaction guarantees deeper-level understanding. In order to understand collaborative learning more deeply, we need to know more about these interpersonal processes like grounding. Reaching a mutual understanding calls for effective interaction between the participants, and if their discussion is composed of monologues instead of a dialogue, the participants have probably missed the opportunity to negotiate with each other for mutual benefit. Reaching the higher level of interaction and learning is a common problem in computer-mediated communication (Järvelä & Häkkinen, 2000, 2001b).

Furthermore, the main problem of computer-mediated communication studies seems to be how to analyse the complex phenomena. In conclusion, one challenge of research on web-based learning is to progress towards more elaborated research methodology. Therefore, multi-methodological approaches are needed.

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## Appendix 1

BU’s case; Creativity – How to improve creativity?

*1. How to improve creativity? - BU - 10:01 15-Mar-2000*

It is said that every people is someway creative. Of course there are many different ways how creativity appears. Someone is creative in music and arts other in science, technology and so on. We can say that everyone is individual in this field of life.

Often teaching in schools is mainly similar to every pupil and does not take into account differences between them. It is claimed that this is the main reason to kill pupils creativity during school time.

How to improve school teaching so that pupils creativity can grow and develop?

What is your opinion about these:

There is a difference in creativity between girls and boys.  
Pupils who have high grades in school are more creative than lower grade pupils.

### *3. creativity differences - ST - 14:53 15-Mar-2000*

I wouldn't want to see a definite difference between the creativity of girls and boys. I think that every girl and boy is an individual with his/her strengths and weaknesses. Talking about differences concerning talents and abilities between the sexes does not, in my opinion, attribute to the noticing of individual needs, but creates differentiating categories between boys and girls. I still agree with you in that fostering learner needs is important and a goal which teachers should aim at. When talking about creativity and pupils with high and low grades, I must say that I believe that all pupils can be creative – to differing degrees, maybe. What I want to say is that I don't see school performance as the only indicator of a child's creativity, people can be e.g. great violinists but poor at maths.

### *4. What is the role of backgrounds? – BU - 18:51 27-Mar-2000*

I can see about your text that you probably think nearly same way about creativity than me. My questions were a bit provocative but your answer is very similar with other comments in this case area. Some comments dealing with our roles here. You wrote that: "I don't see school performance..." I would like to make a one extra question: Is a great violinist a "product" of school teaching or how you see the role of backgrounds like parents...?

### *7. talents and background – ST - 16:01 28-Mar-2000*

You posed a hard question! It might be so that school education fosters more cognitive skills than those that are more "artistic", although such division of skills might seem a bit artificial. So, it could well be so that the influence of background is more prominent in the development of certain skills. But I don't think that anyone could become a great violinist just based on e.g. home upbringing, there has to be also the talent. Then again, I don't think most people can develop their talents to the full without support from home or school. This came out a bit unclear, but what I wanted to say is that, yes, background does matter in the sense that it sometimes makes possible the full development of a talent.

### *12. In-progress report - BU - 20:51 3-Apr-2000*

There was one main question in my case:

How to improve school teaching so that pupils creativity can grow and develop?

Those who participated in this case had clearly the same idea about human creativity. Everyone have something...but it is much more difficult to measure the amount of it. Teachers role was basically seen as a tutor who supports different kinds of learners and gives opportunities to personal curricula. It is also easy to notice that there isn't any patent "medicine" to increase pupils creativity. However also teachers have to aim toward better teaching by taking account pupils differences in this area.

Questions how gender effects on creativity or is school achievements and creativity connected were also relatively clear. It was seen that gender and creativity isn't connected to each other. Creativity can help to achieve higher grades in the school for example in music and arts, but high achievement in the school isn't any kind of measuring instrument if we are thinking the amount of the creativity.

Theoretical background of creativity

Creativity is very wide concept which contains many many different aspects how to deal it. One of the main questions is how to measure creativity? After a some process which has seen creative has come a need to define what creative process includes. Many times creativity and problem solving is connected. Also models about problem solving process and creative process have seen very similar. For more information and basic references about creativity see: <http://www.gwu.edu/~tip/create.html>

### *13. Creativity and talent – Mentor D - 08:33 19-Apr-2000*

Some thoughts taht occurrec to me:

Is a good violin player creative?

What is the difference between being talented and being creative?



What is the relationship between knowledge and creativity? Can answers to these questions give ideas on how to foster creativity?

*14. Talented or creative? – BU - 13:16 1-May-2000*

One way to define creativity is that creativity appears in capability to create a new solution in a problem or for example in a different ever seen 'style' to do something.

I think that talented person could be a person who can easy learn to do something or a person who has for example a ideal body for a sprinter. A person can be physically, mentally, musically, intellectually...talented.

A traditional example of a talented and creative person is Newton who developed a new theory about why apple drop always straight down. We can say that Newton was talented, he has theoretical knowledge, technological 'know how' and creative new idea.