Students’ communication and learning in computer supported dialogues

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Introduction

In this paper four different analyses of the same data are presented. The data is gathered in the research project Accessibility and Learning in Higher Education (ALHE). The research is done at Malmö University, School of Teacher Education. It is supported by the KK foundation. Two senior researchers and three doctorate students are involved in the project.

The overriding aim of the project is to facilitate university studies for students with what might be called an ‘unacademic’ background as well as with language difficulties and visual impairment. This is done by the use of computer supported dialogues in small groups. A central assumption is that accessibility will increase by Knowledge Building processes in small groups using asynchronous net-based dialogues. This directs our focus to the social functioning of the groups and to the quality and variation of the contributions to the dialogue. A central issue of knowledge building processes is what resources are fed into the dialogue and what use is made of these resources. Another central issue is the distribution of contributions and responses among the group members. The following analysis will mainly deal with these two issues. Theoretic assumptions and pedagogic-technique tools are described in more detail elsewhere (Svingby & Malmberg, 2003).

Research data

The research data is gathered in ‘natural’ settings, as part of an ordinary course, taken by teacher students in Mathematics and Science during their first year. Data from 138 students in 23 groups (with four to seven participants in each group) working 10 weeks are gathered. About sixty percent of the students were women and half of the students had a non-academic background. Fifteen of the students did not speak Swedish at home.

The data includes
- processdata, that is all contributions to the group dialogues and the chat sent during the period, including contributions made by individual students in the dialogues and as part of role play and opinion polls
- products produced by the groups
- individual data on
  - background data: ethnicity, parents’ level of education, gender,
  - result on the examination of the course,
  - result on a pre-test on certain science concepts,
- result on a self assessment test on computer literacy, attitude towards working in groups, self perception in academic situations, study strategy and knowledge theory,
- students’ evaluation of the course and of her/his own contributions to the course on workload, technical functionality, the significance of the course and the experience of working in a small group.

This paper presents part of the data. Results will be published in other papers and articles. (See Jacobsson, Malmberg & Svingby, 2003). The focus of the first three parts of the paper lies on the social interaction that emerges in the groups during the process.

Part four tries to reveal the resources brought into the dialogues by students referring to voices/texts that they have listened to, taken in and are now responding to. We are working with questions of the contexts of voices thus listened and responded to and with questions of the effect on the process of knowledge building of the voices. The analysis of the data is being done with different methods.

**Part 1. Social interaction in small net based groups**

Knowledge building in asynchronous distributed learning groups depends largely on the social interaction that takes place in the groups. Social interaction is a prerequisite for shared understanding amongst group members, allows the social construction of knowledge and supports the acquisition of competencies.

Social interaction is not only important for cognitive processes, but is equally important for the socio-emotional processes acting during group forming, in the establishment of group structures (including norms, rules and roles) and in promoting group dynamics. These qualities determine the existence of a sound social space, which is essential for reinforcing and sustaining social interaction both for social-emotional and cognitive processes (Krischner, Kreijns & Jochems, 2003).

In collaborative groups each member’s contribution is a source for the sharing and development of meaning. To be a resource to the group, each the individual thinking and learning has to be made explicit. A prerequisite of shared knowledge building is that all participants contribute as even as possible. By contributing to the dialogue, the participants can introduce voices/texts that they have listened to outside the group. The contributions introduce resources that can be used by the group to develop knowledge building and learning. Not until a participant formulates his or her thinking in the dialogue can it become part of the knowledge building process and accessible to the group members. To contribute might, however, be a risky thing. In a way you have to show yourself. This may require a certain amount of self-confidence and trust in the group. If you get a response you will probably feel supported. Our analysis seeks to reveal relationships between activity of this kind and relevant background data.

Many studies show, that for initially leaderless groups a stable hierarchy emerges and persists after a period of initial instability (Beck, Fitzgerald & Pauksztat, 2003). Group members will either belong to a maximally connected central “core” or to a “periphery” that does not communicate with itself and very little with the core. This may be a threshold for the development of Knowledge Building and learning in Computer Supported Collaborative Learning (CSCL) environments.
Social network analysis

One way to look at what is happening in a computer supported collaborative learning discourse, is to use the log data that the computer environment automatically store about user activities. There are often huge amounts of event data that cannot be analysed without quantitative tools. These tools may give valuable information to tutors and teachers on the status and ongoing activity in learning groups. To identify communication processes (cognitive and socio-emotional), we used Social Network Analysis (SNA) (Borgatti, Everett & Freeman, 2002). Social network analysis seeks to define categories and variables in terms of similarities of the pattern of relations among actors. These patterns of relations are investigated to discern the nature, direction and ties among actors in a network. The nature of the resource exchanged refers to the content of the contribution (e.g. knowledge) while direction differentiates between sending and receiving these resources. Strength is the amount of contributions between two participants (Beck, Fitzgerald & Pauksztat, 2003). For both individuals and groups, ties can be consequential. Individuals may send ties and receive ties. The numbers and kinds of ties are keys to determining the range of opportunities, influence and power of a participant (Hanneman, 2001). In a typical group situation, some actors have lots of ties while others have fewer.

Some hypothesis could be made. Groups with highly and evenly connected actors may be better able to mobilise their resources and to bring diverse perspectives to solve problems. Highly connected individuals probably are more influential. They may even be more influenced by the process.

Sociogram
The patterns of communication among participants in the groups are represented through sociograms. Each node represents a participant and each line represents communication. The thickness of the line represents the strength of communication. Different patterns reveal different relationships between the participants in the group. In Figure 1, in the first sociogram, up left, all participants are equally connected to each other. The second, up right, reveals a hierarchical pattern with one participant in the top, two in between and four participants in the bottom. The third sociogram, down left, shows one central person and six persons in the periphery.
Density
Another measure used in this study is density. The density is defined as the proportion of all ties that could be present, that actually are present. In any network there are $k^2 - k$ possible ties, where $k$ is the number of participants. In a fully saturated network the density has the strength of 1. The lower density, the less connected actors in a network. In fully saturated networks all possible ties are present as in Figure 1, top left. The size of the network is critical for the development of different patterns of social relations. As a group gets bigger, density normally will fall, and the more likely it is that subgroups will emerge.

Degree of centrality – power
Social Network Analysis has contributed to insights into the distribution of power. The SNA approach emphasises that power is relational. Power is a consequence of patterns of relations and communication. The location of individuals in terms of how close they are to the “centre” of the group is thus an indication of power\(^1\). People working with SNA are, however, more likely to describe their approaches as description of centrality than of power.

The analysis uses Freeman’s degree of centrality measures (Hanneman, 2001) to describe the number of sent and received ties.

Core – periphery structure
Core – periphery models can be utilised to describe actors’ position in a network. In an ideal core – periphery structure members in the core exchange frequent communication with each other and are maximally connected to each other. Members in the periphery do not communicate with each other and may or may not communicate with the core (Beck, Fitzgerald & Pauksztat, 2003).

One might expect significant differences between participants of high centrality (i.e. members of the core) and participants of low centrality. Core members would be expected to send messages that are longer and of higher quality or take initiatives to start discussions and of early submission of their contributions (Beck, Fitzgerald & Pauksztat, 2003).

Group dialogue – an example
A typical dialogue is presented below by a quotation of a sequence of contributions and visually in Figure 2. The dialogue deals with the dilemma of allowing or not allowing animals in medical research. The students are very focused. The dialogue continues over six days and

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results in a group product consisting of a statement that is underpinned by five pages. One sequence of the dialogue is presented here.

J: Does it matter what kind of animal one uses for experiments?
M: From an ethical view I have to admit that I don’t mind experiments on insects.
But…they do also suffer. Of course, they shouldn’t be exposed to unnecessary experiments.
E: The more I can interact with the animal, the more I am against the use of it in experiments. It might not be right to think that way?
M: No, I don’t think it’s OK to think that way. The suffering is the same, despite the kind of animal. But I react in the same way. The more intelligent animal is, the more I react when they suffer.
J: I believe that the smaller the animal, the less we care. It’s easy to ignore it as a living creature. But I also think that more intelligent animals understand more and hence suffer more. Practically, is it easier to use small animals. It’s easier to create good living conditions for them.
E: Do you really believe that intelligence and suffering is a function of each other? Do less intelligent people suffer less than genius?=========
J: It depends on if you look upon physical or mental suffering. Does the individual understand what’s happening? For a small insect living condition in a jar is as good as they are outdoors, as long as it has food and water.
M: Animals used for experiments are not mismanaged. Your reasoning is not logic. It matters of course what kind of experiment the animal is used for. Genexperiments, i.e. when one shift bodyparts on a fly (wings were the legs used to be etceteras) may not be harmful for the fly. One just sees if the experiment succeeds and kills the fly. Make the same experiment on a monkey. It’s absurd! (I must admit that it’s rather absurd on a fly as well…) Maybe you are right in that the monkey understands more that something is wrong, and suffers mentally. But let’s use a mouse…? I believe the mouse suffers less than the monkey.
C: An interesting comment…I agree!

Figure 2 shows how the dialogue develops from an initial contribution by J., which is to by all five participants but with different frequency and time delay. The contributions follow in a threaded pattern. Some contributions create a lot of responses, some do not create any responses at all. Some contributions create parallel responses.

J starts a thread day one. This message creates three responses, two by M (day 2) and one by E (day 5). The first response by M creates a chain of responses, the upper line, with a lot of branches. The response by E creates two parallel responses, one by C (day 5) and one by D (day 6). The observation can be made that C gives five separate responses addressing all other members, but she receives no responses.
Figure 2. The figure shows how five students (C, D, E, J and M) communicate in an asynchronous discussion during a period of six days.

Patterns of communication

Using the SNA analysis we can provide a picture of the communication pattern used by this specific group. The analysis of all 23 groups revealed three different patterns, which are represented by the three groups, A, B and C as sociograms in Figure 3. The measures of communication density for the actual groups are also expressed in the figure.

Group A represents the nine groups, of totally 23 in the study, in which all members communicate with each other. The arrows in the figure are two-way. The density of the group is 1.

Group B exemplifies three groups, of the 23, with very low density. It has a star-shaped communication pattern. For group B one student, Karl, is in the centre. The arrows are one-way and in four out of five cases directed towards Karl. The density of Group B is 0.25, which means that only 25% of the possible communication ties are used.

Group C represents eleven groups with an average level of density. One student, Hjalmar, distinguishes himself by being less involved in the group dialogue than other group members. He sends messages to Hans and receives messages from Hans and Mia. Hans is the only participant sending and receiving messages from all the group members.
By showing the *intensity* of the communication additional information is provided. Figure 4 not only illustrates who is communicating with whom. It also shows the intensity of the communication. In group A, Dan receives or sends fewer messages than the others. There is a drift towards a subgroup consisting of Eva, Jan and Malin. Cecilia is interacting more intensely with the other two women in the group than with the men.

In group B, all communication is directed towards Karl, who is the focal point of the group. Frans contributes the least. The other three members make roughly the same amount of contributions. Karl’s contributions, not shown in the figure, either entail replying to his own contributions or initiating discussions (See Table 1).

The pattern of group C reveals a subgroup of four participants (Rolf, Hans, Mia, Fia) exchanging frequent communication.

The participant Hans tends to be the focal point, although we cannot see whether the contributions are directed towards or from Hans. Anne and Hjalmar demonstrate low activity and are the periphery of the group activity.
The average density of all 23 groups in the study is 0.83. This implies that 83% of all possible ties have been used. Three of the groups show a density less than 0.3. The communication for nine of the groups is saturated, with a density of 1.0. The density for the remaining eleven groups is above 0.65.

There is a significant correlation between group size and density. The smaller the group, the higher the density.

Some interesting questions have arisen as a result of the above analysis. As we can see, in many of the groups there are participants who do not contribute to the dialogues. Why do they not contribute? What happens to them when they do not contribute? What happens to the group?

From the perspective of joint building of knowledge, silent group members do not contribute. Their knowledge remains their own and is not shared by the group. Not contributing thus is negative for the group. It may also be negative for the person her-/himself. The individual learning is hidden from other group members, but also from the person her-/himself. It is certainly true that learning also takes place by imitation, hidden processing, and peripheral participation (Hoel, 1995, p. 330). This kind of participation is also of value. But if you accept the assumption of writing as a possibility of verbalising your knowledge and thus of opening it for reflection, the lack of contributions is negative not only for Knowledge Building but also for developing your own learning.

**Responding**

We will proceed the analysis of groups A, B and C. The overall activity of the three groups differs substantially. The participants of group A make 697 contributions; group B makes 84 and group C 100 contributions. In Table 1 are these specific groups communication analysed using Freeman’s degree of centrality measures.

In the table is the number of sent and received contributions as well as initiated discussions by members of Groups A, B and C shown. The pattern of sending, receiving and initiating varies substantially between the three groups, adding to the understanding of the social interaction and the process of Knowledge Building in the group.

In group A, two students, Eva and Malin, primarily initiate the discussions. They also distinguish themselves from the others by receiving most responses. The group’s standard
deviation is greater for contributions received than made. Cecilia makes more than three times
the amount of contributions than she receives. The opposite applies to Eva who receives the
double amount of contributions compared to what she makes. Dan is characterised by the
small number of contributions he makes compared to others.

Group B is exceptional due to one member, Karl, who in principle receives all contributions.
Karl is also the one that initiates most group discussions. His own involvement is either to
respond to his own contributions or to initiate new discussions.

Group C is characterised by three subgroups. Hans and Fia make considerably more
contributions than the other group members do. They also initiate most of the discussions.
Hans differentiates from Fia in that he receives more contributions than he sends. Mia and
Rolf are similar in view of received and sent contributions as well as initiated discussions.
Neither Anne nor Hjalmar initiate any discussions and make very few contributions.

<table>
<thead>
<tr>
<th>Group A</th>
<th>Sent Contributions</th>
<th>Received Contributions</th>
<th>Initiated discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecilia</td>
<td>136</td>
<td>42</td>
<td>1</td>
</tr>
<tr>
<td>Malin</td>
<td>223</td>
<td>221</td>
<td>12</td>
</tr>
<tr>
<td>Jan</td>
<td>147</td>
<td>156</td>
<td>2</td>
</tr>
<tr>
<td>Eva</td>
<td>139</td>
<td>242</td>
<td>14</td>
</tr>
<tr>
<td>Dan</td>
<td>52</td>
<td>36</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group B</th>
<th>Sent contributions</th>
<th>Received contributions</th>
<th>Initiated discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fanny</td>
<td>15</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Karl</td>
<td>36</td>
<td>82</td>
<td>4</td>
</tr>
<tr>
<td>Caroline</td>
<td>13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Frans</td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Dennis</td>
<td>11</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group C</th>
<th>Sent Contributions</th>
<th>Received Contributions</th>
<th>Initiated discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hans</td>
<td>35</td>
<td>44</td>
<td>6</td>
</tr>
<tr>
<td>Fia</td>
<td>27</td>
<td>22</td>
<td>5</td>
</tr>
<tr>
<td>Mia</td>
<td>16</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>Rolf</td>
<td>14</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>Anne</td>
<td>5</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Hjalmar</td>
<td>3</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1. The tables show the number of sent and received contributions as well as initiated discussions by members of Groups A, B and C.

The tables above illustrate activity differences between the students. A few students in each
group receive significantly more contributions than they make. Consequently, their
contributions generate more responses than those of other group members do. Participants
receiving numerous responses are generally enjoying a higher status, attracting the attention
of other members and adding to their importance. (Hanneman, 2001).

Core – Periphery

The social network analysis uses a model of Core – Periphery to establish whether empirical
data corresponds with the communication hierarchy. The ideal model for a core – periphery
structure consists of a core that is completely in alliance with itself, i.e. where the core
members constantly communicate with each other and the members in the periphery
communicate with each other to some extent but also communicate with the core (Beck et al.,
2003).
When analysing Groups A and C, a clear core - periphery structure becomes apparent. Both
groups have developed a core in which the members are communicating extensively and a
periphery with an insignificant degree of communication.
In addition, the groups are characterised by the periphery communicating more with the core
than vice-versa. Table 2 shows level of fitness to the core – periphery model (values vary
between 0 and 1).

<table>
<thead>
<tr>
<th>Group</th>
<th>Core</th>
<th>Average core to core</th>
<th>Average core to periphery</th>
<th>Periphery</th>
<th>Average periphery to periphery</th>
<th>Average periphery to core</th>
<th>Fitness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>2 (Eva, Malin)</td>
<td>66.0</td>
<td>25.2</td>
<td>3 (Jan, Dan, Cecilia)</td>
<td>11.7</td>
<td>42.0</td>
<td>0.93</td>
</tr>
<tr>
<td>C</td>
<td>3 (Fia, Hans, Ralf)</td>
<td>8.7</td>
<td>1.6</td>
<td>3 (Hjalmar, Mia, Anne)</td>
<td>0.5</td>
<td>2.3</td>
<td>0.81</td>
</tr>
</tbody>
</table>

Table 2. Core and periphery structure of Groups A and B.

Fifteen of the 23 groups in the entire study have a similar core – periphery structure as groups
A and B.

The core-periphery structure developed in many of the groups will have influenced on the
process of Knowledge Building. If we accept the assumption of the dialogue as a means for
the joint construction of meaning, a certain level of equality in contributions is presupposed.
An amount of co-operation is needed for a dialogue to sustain. A dialogue is interplay
between two or more partners. An ambition of all partners to understand and contribute is
needed. A central element in the dialogue is that the partners by their contributions
supplement each other. To respond is to make such supplementing. The partners listen to and
reflect on the contributions of the others and by responding they create something that they
had not been able to create alone. The dialogue thus creates joint meaning. If you do not
respond or do not react on the texts sent, the dialogue will come to an end. Dialogue partners
create meaning both as producers and as listeners. One presents her/his thinking. The other
listens and responds by creating thoughts that meet the text of the first. The result is
knowledge to which both partners have contributed. The dialogue, thus, is a collective product
and not the sum of the single communicative acts. (Hoel, 1995, s 181).

Part 2. No response – a matter of timing?

The question of why some contributions elicit many responses and other do not elicit any at
all, is dealt with in this part of the paper. We use group A as unit of analysis. The following
quotation is taken from the six day long dialogue on the issue of using animals in medical
research. The response quoted from Cecilia is made on the fifth day. She gets no responses.

Jan (initiates): Is a human life worth more than that of an animal?

Dan, Eva and Cecilia respond in parallel:

**Dan**: I definitely believe that to be the case.

**Eva**: If I had to choose whether to save the life of a human or the life of an animal.

**Cecilia**: I have been thinking about that question for some time now. Seriously – I am not
animal, I would choose the human. In so doing, I suppose I value human life more than animal life. However, it does not give us right to exterminate or inflict pain on animals.

sure, but I do know that I value many animals more than humans. An animal that has been close to you is worth more than the life of a stranger in a foreign country who might also be cruel to animals. I have had animals in the past that I could have done anything for to prevent them from dying, which they of course did anyway as a result of age. On the other hand, I eat different types of meat so I cannot really say that the life of an animal is worth more than that of human, as I could never imagine eating a human. But I can say one thing. Humans who deserve similar treatment torment many innocent animals to death. However, the only punishment they get is a couple of months in prison. Is the life and suffering of an animal not worth more..?

The three responses to Jan’s question are similar in that they all express a personal view but they differ in many other ways. Dan says that he definitely believes that there is a difference between the value of a human and an animal life. This is different from Eva’s “I suppose” response. Cecilia says “I am not sure” but that she “values many animals more than humans”. Unlike the others, Cecilia refers to her own experiences and leaves her response open with the question “Is the life and suffering of an animal not worth more?” Referring to Häkkinen, Järvelä & Mätikalo (2003), this type of social keys is an important contribution to a response that normally will encourage other group members to participate in the discussion.

A response is not merely based on earlier discussions and written observations but also on future responses. A response is aimed at a certain person and more or less an invitation to continue the dialogue. When comparing the three responses above, it is evident that Dan’s utterance aims to transfer his opinion as effectively as possible. Cecilia invites to a continuous dialogue and her responses focus on generating new meaning. Eva’s response is halfway between the two. When Lotman, while elaborating on Bakhtin’s theories of communication (Dysthe, 2000), speaks of univocal and dialogic response functions he refers to the ability of a text to create a connotation. A univocal text is passive, conveying information between the sender and recipient while a dialogic text is aimed at generating new connotations.

What responses are generated by these assertions? Dan gets three responses, Eva fourteen and Cecilia none. This result gives rise to the questions; To what extent are the students interested
in what the others are saying? Is it possible to explain why some contributions get a larger number of contributions than others?

During this period, the group members made an average of 27 contributions. Cecilia made the most (39) and Dan the least (18) (Table 3). The standard deviation of contributions made is 7. The standard deviation of contributions received is 17. The participants’ level of activity does correspond with the level of activity throughout the entire course (Table 1), the only difference being that Eva receives a considerable smaller amount of contributions as time goes by.

This becomes evident when analysing and comparing the core – periphery structure of the whole course with this section (Table 2 and 4). Jan has now replaced Eva at the core of the group. The group is otherwise an example of a typical core – periphery structure with a significantly higher level of communication from periphery to core than from core to periphery.

Table 3

<table>
<thead>
<tr>
<th></th>
<th>Sent contributions</th>
<th>Received discussions</th>
<th>Initiated discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cecilia</td>
<td>39</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Malin</td>
<td>34</td>
<td>50</td>
<td>3</td>
</tr>
<tr>
<td>Jan</td>
<td>26</td>
<td>45</td>
<td>1</td>
</tr>
<tr>
<td>Eva</td>
<td>23</td>
<td>22</td>
<td>0</td>
</tr>
<tr>
<td>Dan</td>
<td>18</td>
<td>15</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 3 and 4 illustrate the level of activity and core – periphery structure of Group A during a 10-day section of the course.

Table 4

<table>
<thead>
<tr>
<th>Group</th>
<th>Core</th>
<th>Average core to core</th>
<th>Average core to periphery</th>
<th>Periphery</th>
<th>Average periphery to periphery</th>
<th>Average periphery to core</th>
<th>Fitness</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>2 (Jan, Malin)</td>
<td>16.5</td>
<td>3.8</td>
<td>3 (Eva, Dan, Cecilia)</td>
<td>3.0</td>
<td>10.3</td>
<td>0.89</td>
</tr>
</tbody>
</table>

Univocal or dialogic contributions to the dialogue

The dialogue is dynamic when in the first four days of group A is discussing pharmaceutical research, ethics and experiments on animals. The participants have not yet summarised or come to any conclusions in order to draft the report commissioned. During these four days, the participants make in total 70 contributions of which 63 receive a response and 7 do not. These seven contributions are characterised by having a more univocal rather than dialogic function, i.e. not directly relating to the group assignment. A univocal function is a passive communication of information between sender and receiver.

The following quotations are example of the seven contributions not receiving a response. They are mostly social encouragement or closed statements.

- *Eva, I responded almost literally in line with your contribution to the voting.*
- *Can’t agree more. But does it apply to all illnesses? However, this is something that we discuss elsewhere in the forum and perhaps should not discuss here.*
The 63 contributions receiving a response are mostly dialogic, aiming at generating a new connotation. The following are examples of such contributions:

- At the same time, there are those who believe that we could manage just as well as vegetarians. That our diet in ancient times primarily consisted of food from the vegetable kingdom. Based on this argument, would it be just as easy to support the killing of animals. Do we really need to eat meat? Could we manage without?

- Sometimes people do something for many years without realising the dangers (e.g. smoking). It is then proven to be dangerous to our health. Do they then only have themselves to blame? I find this a very difficult question.

- Are we to visualise ourselves as part of nature or not? Should the human intellect be required to take greater responsibility for other lives? When a cat kills a mouse it is a natural process, but when we do the same thing, we feel sorry for the mouse. How does that work?

**Time aspects of the contributions**

Beck et al. (2003) show that the time aspect of the participants’ contributions in a discussion forum is crucial. An analysis of when the members of group A make their contributions shows important differences between the participants. In Diagram 1 we can see that Jan make early submission. He initiates and develops a discussion the first day. On the second day, Malin, Eva and Dan also make contributions. Cecilia does not enter the discussion until the sixth day, when she makes 24 contributions. Jan, Malin and Eva are active during the Saturday and Sunday (the 3rd and 4th day), making a total of 44 contributions.

![Diagram 1](image)

When questioned about the reasons of the distribution of their contributions, the students give different answers. Cecilia makes the following comment:

*Prior to entering into the discussion, I tried to come to my own conclusion on which to base my contributions. I did this by reading certain literature and web-...*
sites concerning various aspects of animal experiments... It is important to consider other aspects before making your own contribution. It is the only way in which to form a fair judgement... I generally learn a lot by talking to people. However, I need to do quite a lot of research before I enter into a discussion.

Cecilia’s observations are different from Jan’s:

*Debating a matter with various individuals forces you to reassessment...*

Malin reasons:

*When being provoked, I simply have to respond if the discussion in which I am involved totally goes against my own beliefs... Sometimes it keeps me awake all night. I learn a lot from reading other people’s contributions.*

Malin is a relentless participant making contributions eight days in a row. This means that she never stops participating in the discussion. This is evident from Table 3 showing that she made 34 and received 50 contributions.

**Part 3. Social position in the group related to other variables**

The result of the SNA analysis gives rise to questions about the relationship between the social position in the group and other variables such as students’ personal characteristics, contributions to the dialogues, academic achievement and experiences of the situation. The project has gathered a lot of data of this kind. In all 53 variables are studied (see page 1). We have analysed the variables in order to find correlation between process variables and individual variables (SPSS for Windows, Version11.0.0). Some relevant results are presented in the following.

**Many contributions means passing the examination**

The dialogues were part of a course, which included an individual examination. Eighty percent of the students passed the examination. There is a significant correlation between passing the examination and variables relating to the students’ activity in the dialogues. Students passing the examination have made more contributions to the dialogue and initiated discussions more often than other participants. The students being most active in discussion forums have, in addition to passing their exam, initiated more discussions and attained a higher response level than others. The quality of the contributions is still to be analysed as is the contexts of the responses.

The result of the experiment group was compared to a group of students who took the course the “normal” way that is with no computer-based dialogues. The students following the net-based course performed significantly better on the examination.

**Core position – positive attitude and hard work**

Students who have made many contributions and belong to the core express a positive attitude towards the setting and towards the course. They like the group work, but feel that they themselves have worked harder than other group members have. This approach has worked well and they would willingly take up another network-based course. These students
appreciate the freedom of choice of time and place and think that a net-based study can replace face-to-face meetings.

Two comments from positive students are typical:
- I normally learn more from working in a group. I get more involved and make better progress primarily because I continually have to question my own views. This leads to further questions to which I then try to find an answer.
- You are more alert when working with others.

So are the comments from a student negative to the net-based group work:
- When working alone, I work at my own pace. When working in a group, another person may work slightly faster, which adds to the level of stress since you feel that you must make a contribution. The work consequently becomes less detailed than if you had continued working at your own pace.

Initiative goes with core position – responding does not
The students initiating most discussions have obtained a higher level of responses from the group members than have other participants. The contributions of these students thus are highly influential on the resources that are brought to the dialogue. Their contributions add to the knowledge building process. Analysis shows that there is no significant correlation between numbers of contributions and core position.

Non-academic background – positive attitude and core position
Participants with a positive attitude towards working over the Internet are more often women than men and have a non-academic background. They have made many contributions, have initiated discussions and thus more often belong to the core than to the periphery. They see themselves as good students but do not feel at home in a traditional academic environment. They think that working with the course has changed their view on learning.

Small group – many contributions
The correlation between group size and level of contributions is significant. Small groups (4-5 participants) have a significantly higher level of contributions than have bigger groups (6 to 7 participants).

Part 4. Responded listening- an analysis of voices
The dialogues mirror the social context in which the students are embedded as well as the situations and voices they have met earlier. Their words are filled with other voices stemming from other contexts. The contributions thus contain layers of meaning. This understanding is based on Bakhtin’s theory (1984) of the dialogue as a reflection of many underlying voices and of speech, oral and written, as permeated of other people’s words. According to the theory, there are no words or utterances that are not populated with other people’s voices. We use them more or less consciously. The voices carry different perspectives, but we may think that they are our own. We are either not aware of the voices embedded, or we are aware of the authoritative quality of some words, thus using them to reinforce what we say. This means that every contribution made in the net dialogue, according to Bakhtin, involves a row of other voices. It has a voice of its own, but is also filled by voices from other dialogues. There
are a manifold of voices outside the ones manifest in the dialogue. In every text there is an explicit or implicit presence of other texts (Fairclough, 1996).

Responding is a prerequisite of the dialogue. Every contribution is meant for someone. The dialogue erases the sharp border between text and context as the text also directs back to its own context. (Adelmann, 2002, p.120). As Bahktin sees it, life is by its nature dialogic.

The single adequate form for verbally expressing authentic human life is the open-ended dialogue. Life is by its very nature dialogic. To live means to participate in dialogue: to ask questions, to heed, to respond, to agree, and so forth (Bahktin 1984, p. 293).

Aims
The aim of this analysis is to describe patterns of resources that emerge in the dialogues. Our intention is to describe the contextual resources, the voices that the students activate by their contributions and to study which functions these voices have in the dialogue. The aim releases questions like: Which voices have the students listened to and are they responding to by their contributions? Which contextual resources are introduced in the dialogue? Which other texts are present in the texts?

By the contributions to the dialogue the students make explicit or implicit references to other voices. The analysis tries to detect these voices as indications of the resources that students offer to the knowledge building process. The analysis makes explicit the range of voices outside the group and the status of voices inside the group. Using concepts from ‘Women’s ways of Knowing’, the amount of ‘listening to my inner voice’ as well as the listening and responding to ‘authoritarian voices’ can be traced (Belenky et. al., 1986). The data indicates the contextual resources that are accessible to the group for Knowledge Building.

Sample and method of analysis
We have chosen to study one of four groups, which were working for two weeks with the dilemma of deciding to allow researchers or not allow them to use mice in order to develop a cure towards ‘the metabolic syndrome’. The dilemma was worked out as a sort of role-play. The group acted as an ethical committee, which took the decision and gave a rational for the decision. The task held information given by the researcher on the necessity of the research, the law, statistics about research using animals and links to organisations against and pro the use of animals in medical research. To solve the task, you are required to take into account relevant factual information pro and con the two alternatives, but the dilemma also involves emotional and values dimensions.

Before starting the group task, the students individually took a test, in which they answered questions on their attitudes towards animal research in a medical setting. The group had five participants. Three of them were positive and two were negative towards using animals for such reasons.

All contributions, were registered, sorted and printed. In all 197 contributions were made, varying in length from a sentence of four worlds to 1 ½ pages. The analysis focused on direct or indirect reference to other voices, in the contributions. Such voices were situated in different contexts. In a similar study of group dialogues Adelmann categorised the responses in three dimensions (2002, p. 163). We used the same categorisation: The Situation Dimension, The Teaching Dimension and the Culture and Society Dimension.
Results
The three dimensions are described as contextual resources by the specific references made in each of them.

In the Situation Dimension, students referred to all other participants in the group, which means they did not only refer to actual contributions, but to all contributions made in the group and to her-/himself.

In the Education Dimension, students referred to the written instruction given to the group, to the specific course-material and to the lectures.

In the Culture and Society Dimension, students referred to specialists, to public knowledge/experience, and to her/his own experience.

Table 5  Distribution of contributions on three contextual dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Situation Dimension</td>
<td>50</td>
<td>26</td>
</tr>
<tr>
<td>The Teaching Dimension</td>
<td>32</td>
<td>16</td>
</tr>
<tr>
<td>The Culture and Society Dimension</td>
<td>115</td>
<td>58</td>
</tr>
<tr>
<td>Total</td>
<td>197</td>
<td></td>
</tr>
</tbody>
</table>

Table 6  Numbers of References to the Situation Dimension

<table>
<thead>
<tr>
<th>Contribution</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Contribution to specific participant of the group</td>
<td>46</td>
</tr>
<tr>
<td>Contribution of the group as a whole</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
</tr>
</tbody>
</table>

Table 7  Numbers of References to the Teaching Dimension

<table>
<thead>
<tr>
<th>Course Material</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Course material</td>
<td>21</td>
</tr>
<tr>
<td>Course instruction</td>
<td>8</td>
</tr>
<tr>
<td>Lectures</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 8  Numbers of References to the Culture and Society Dimension

<table>
<thead>
<tr>
<th>Knowledge Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Own knowledge/ value statement</td>
<td>71</td>
</tr>
<tr>
<td>Own/family experiences</td>
<td>7</td>
</tr>
<tr>
<td>Public knowledge</td>
<td>32</td>
</tr>
<tr>
<td>Specified knowledge</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
</tr>
</tbody>
</table>
The tables show that on the whole, as in Adelmann’s study, the students make a lot of references to texts and discourses outside the group. In this way the contributions bring external resources to the group dialogue.

The external resources brought to the dialogue are mainly found in the *Culture and society Dimension*. 115 contributions of a total of 197 contributions (58%) come from this dimension. It can be compared to Adelmann’s study, where only 12 % came from this dimension. The result can be understood as if the students in our study brought a variety of external voices to the dialogues. This understanding is modified by the notion that a major part of the responses (71) take the form of vague value statements, which are difficult to trace. The texts in the text are hidden. It is difficult to understand which resources are called upon. The contributions may be responses to what students have listened to on the public scene. They seem to carry voices from the public debate, from books or newspapers or from other parts of the media. They are written as personal statements with expressions like “I mean, I feel, I know…” They are examples of layers of words listened to and responded to by the students, who now act as the words were their own. Participants to a much lesser extent (7) refer to explicit own experiences, which means experiences from their family life. These contributions, however, are much longer and richer. An example is given here.

Fatness…? There is only one solution and it is not medicine…(This is a very long contribution, excuse me).

I am as divided as you, Dal are. But as you I do not believe in a medical solution, in the long run anyhow. I have a daughter who is fat and can with relatively certainty say that it is genetic. Her grandmother, grandmothers sister and grandmothers mother are all stout women weighing of three figures. My other children, who eat the same food and move as much as she does, have normal weight. Still I think that the solution is more exercise and better food. Better food, we have already introduced. More exercise is a bigger problem. It is not easy to motivate a clodhopper to move. She feels still clumsier. Here I would perhaps have wanted that the recourses to be used instead of allocating lots of many on producing medicine. Money to the schools so that they will have recourses to arrange sports that could suit everybody, it is like often those who most are in need of doing sports are the best to find excuses not to do it, which is not difficult to understand. Personally, I have about the same feeling for ball sports as a sea gull and suffered all the sports lessons that involved ball sports. Instead, I am very agile and alert and took jazz dance during my teenage period. When we had a teacher who had a lot of gymnastics and agility exercises I felt like a fish in water. But then other children suffered. I do not want to say that those who suffer from fatness are to blame, but I know how much sweat and tears it may cost, but medicine is no solution. There is only one solution and it is not economically profitable, more than possible to the sports clubs...

Rich personal contributions like the one cited usually elicit a lot of responses.

The responded listening manifested by the contribution show, however as a rule, that the resources introduced by the participants are much more unspecific. When the students do not refer to themselves as the origin of knowledge, they refer to ‘public knowledge’. There are few instances where specific voices are introduced as resources to the knowledge building dialogue. Some of these refer to authoritarian voices. An example of this kind of contribution is given here.
My answer to the question if a human’s life has more worth than an animal is intuitively, yes. My answer can be described as an example of natural selection and can be explained as a natural law, which means that in nature there is only a fight for survival, everybody in war with everybody. I am a human and it is natural that I fight for my species. Charles Darwin, English scientist, describes the principle of a law of Nature in his great work ‘The origin of the species’ (1859). He means that the struggle for existence always is harder inside a species than between species, as relatives of the same species demand the same environment, while individuals of different species in an easier manner can live side by side (The Swedish National Encyclopaedia). I link this to the cohabitation between men and animals. Our possibility of communication and ability to think has led to our big knowledge about animals. It leads to that the animals are involved in all human activity. One of these is medical research, which includes research on animals in order to produce new medical treatments.

The contribution involves a value statement that is supported by a direct quotation from the Swedish National Encyclopaedia. Contributions of this kind ought to elicit a lot of responses, but they do not. We can conclude, that ‘Listening to my inner voice’ is highly represented by the value statements, but the idea of giving priority to own experiences is not often articulated by the students. Authoritarian voices take a specific place in the dialogue. They do not elicit many responses. A statement representing an authoritarian voice is accepted as a truth, that is not to be commented on, just accepted.

The responded listening of the Teaching dimension is dominated by references to the specific material prepared for the course. This material is mainly authoritarian, referring to acknowledge researchers or introducing judicial text. No explicit value statements are presented.

The contributions in the Situation Dimension show that the group members to a large extent listen to and respond to each other. Many contributions explicitly address specific persons by saying for instance ‘That was a good comment, Jane’ or ‘I think that what Mike said about x was very relevant, but I do not understand what is meant by …’

The analysis done so far, show that the students are important resources to each other’s learning and that the group is an important resource for learning. The dialogue reveals contextual resources existing in an individual student’s texts and found by other participants of the group. The individual participant thereby gets access to resources, which she/he might not have found herself. Knowledge building is taking place. More analysis is needed to understand the knowledge building process and the relationship between this process and the development of the participants.

The variation between the resources presented by the individuals and the resources used by the group will also be studied. Such information can be used by students and by teachers to expand the resources of an individual student and to expand the competence of the group to use the resources introduced to it.

We intend to take the analysis further analysing the contributions of specific students in order to trace their repertoire of responded listening and to relate this to the responses elicited and the use their contributions are made of by the group. The analysis will thus further trace the building of knowledge by analysing the content and the critical incidents in the process.
References


Hanneman R.A., 2001. *Introduction to Social Network Analysis*, Department of Sociology, University of California


