

Chapter 2

Analyzing the Contextual Nature of Collaborative Activity

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Abstract This chapter discusses a methodology designed to explore the contextual nature of collaborative activity. The methods that can be generally considered to be based on ‘*socio-cultural*’ *discourse analysis* are discussed as a means to explore how different aspects of a situation mediate students’ shared meaning-making. First, an analysis is demonstrated, illustrating how different immediate and mediated contexts are embedded in students’ discourse as they are engaged in face-to-face collaborative activity in a computer-mediated context. Second, a multidimensional coding scheme is presented for analyzing the contextualized process of collaborative knowledge construction in an asynchronous web-based discussion. The strengths and weaknesses of the methods are also discussed.

2.1 Taking into Account the Context of Activity in Research on Collaboration: Theoretical Considerations

In the area of Computer-Supported Collaborative Learning (CSCL) research, interest has increasingly shifted from the outcomes and products of collaborative work towards the analysis of the processes of collaboration. This shift shows an attempt to gain understanding about the nature of productive joint activity and to identify interactional features that are important for collaborative learning. There is, for example, a wide field of research on studying the features of argumentative interaction and how it can be best supported in different learning contexts (e.g., Baker et al. 2007). The studies focusing on productive discussion have approached the processes of collaboration mostly from a cognitive and social perspective. The quality of collaboration has been studied by examining the amount and types of

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productive talk that occur. Typically, the categories of talk are defined at the level of utterance, for example by analyzing communicative or strategic functions of utterances (e.g., Fischer et al. 2002), or at the level of meaningful sequences of utterances, for example, by analyzing the cognitive level of episodes (e.g., van Boxtel et al. 2000). However, the weakness of the studies focusing just on the functions or the cognitive level of interaction is that they reveal little about the process of collaboration, as this kind of analysis discards the content and nature of knowledge construction that takes place in interaction between collaborators as well as the context of their activity (Stahl 2002; Crook 1999).

According to Wertsch (1991), however, it is not possible to study thinking and cognition independently from the social, cultural, and historical settings in which they occur. Cognition is a social process embedded within a historically shaped material world, in the sense that it relies on conceptual and material tools that originate from the culture (Bliss and Säljö 1999). To understand collaborative activity and learning, we need to make sense of the discourse students engage in and the tools that mediate their learning (Hmelo-Silver 2003). This means that in order to analyze collaborative learning, we need to go beyond analyzing structures of talk separated from their contexts to also explore how physical and socio-cultural aspects are manifested in students' discursive activity (Black 2007).

The theoretical background of the methodology presented in this chapter leans on the socio-cultural approach to learning (Vygotsky 1978; Wertsch 1991). Even though this theoretical perspective provides an understanding of how learning is socio-culturally situated and how tools - both physical and psychological - mediate learning, we need specified analytical tools for evaluating collaborative activity and learning embedded in specific contexts. The overall analytical approach presented in this chapter can be regarded as based on 'socio-cultural' discourse analysis, as the methods aim to explore how different cultural tools mediate shared meaning-making and, thus, how discourse is embedded in its specific context (Mercer et al. 2009). Gee and Green's (1998) discourse analysis and Linell's (1998) dialogical approach to communication offer valuable conceptual and analytical tools for researching collaborative activity from the socio-cultural perspective. These approaches target attention on the dynamic and interpretive nature of participants' actions and discourse, and how through these actions and discourse the participants both construct and reflect the context of their activity (Gee and Green 1998). Thus, the methodology presented in this chapter builds on the notion of contexts and situations as being socially constructed (Erickson and Shultz 1981; Linell 1998). According to this view, a context is not a predefined or objective environment (Linell 1998), but only includes those contextual dimensions which are or become relevant to the participants in the activity (Erickson and Shultz 1981; Linell 1998). In this way, the participants themselves create the context through discourse by reflecting and relying on the relevant contextual resources (Linell 1998) or aspects of the situation (Gee and Green 1998) in their joint activity (Goodwin and Duranti 1992; Linell 1998).

Linell's (1998) notion of contextual resources and Gee and Green's (1998) notion of aspects of situation can be seen as possible resources that participants use

in their shared meaning-making and interpretation process in discourse and activity. *Immediate and concrete resources or material aspects of situation* refer to the immediate (perceptual) environment which includes, for example, physical spaces, persons, objects and artifacts that are present (potential resources) or referred to (relevant resources) during interaction (Linell 1998). Another immediate resource is Linell's (1998) notion of co-text, which comprises the participants' previous actions and discourse that is actively used in the "new act of sense making" (p. 132). *Mediated and abstract resources or aspects of situation* are reflected and constructed through participants' discursive activity. These include personal, social and cultural knowledge (Gee and Green 1998), such as prior knowledge, experiences, assumptions or beliefs about the things discussed in the discourse in question or about other persons involved in the discourse (Linell 1998). These also include identities which refer to norms and expectations, roles and relationships, and rights and obligations that are relevant in the situation (Gee and Green 1998). Mediated resources also consist of a specific institutional context with its norms, values, regulations and hierarchies as well as an abstract situation definition or the framework of "what is going on" in the actual situation (Gee and Green 1998; Linell 1998). Additionally, Gee's and Green's (1998) semiotic aspect of a situation refers to sign systems such as speech, writing, reading, images and gestures. The context constructed involves these immediate and mediated resources or aspects of the physical, social, cognitive and cultural environments that actualize as relevant through the participants' activity and discourse.

In this chapter I will firstly explore the notion of context through a discourse analysis of collaborative activity in computer-mediated, face-to-face settings. This discursive approach to interaction (Gee and Green 1998) demonstrates how through language and discourse, meaning is carried through time, and how past, present and future contexts are constructed and reflected in the interaction between students as they are engaged in shared activity. Secondly, I will present a multidimensional coding scheme developed for analyzing the contextualized process of collaborative knowledge construction during an asynchronous web-based discussion. This analysis combines the discursive approach with the thematic and functional analysis of discussion and shows how multilevel analysis can be helpful in understanding the reasons behind different collaborative activities. I will also discuss the strengths and weaknesses of the methodology presented.

2.2 Evaluating Collaborative Activity in Its Context

2.2.1 *Discursive Approach to Studying Context in Students' Collaborative Activity: The Case of Face-To-Face Activity*

In this section, I will draw on data examples reported in the work of Arvaja (2008). The focus of the study was, by means of discourse analysis (Gee and Green 1998),

to identify different aspects of the immediate and mediated contexts that were reflected in a student pair's discourse while they were participating in a collaborative task in a higher education context. The subjects of the study were two higher education students studying in a course of educational psychology entitled "Learning Environments and Educational Technology". The pair worked on a project work assignment which concerned the making of an evaluative questionnaire for users (teachers and students) of a web-based learning environment in use at their university. This chapter concentrates on presenting the analyzed extracts from one of the lessons spent on this project work and draws on empirical examples from the classroom discourse. The task in this particular lesson was to revise and continue the development of the questionnaire, which was drafted beforehand, outside the lessons. The students worked in front of a laptop, where they had access to the drafted questionnaire and the web-based learning environment to be evaluated. Transcribed video and audio data were analyzed through an ethnographically grounded approach to discourse analysis (Gee and Green 1998). According to this approach, language is seen as a socio-cultural practice and social resource of groups, and the focus of analysis is more on what participants accomplish through their discourse rather than on what the form or function of the language is, as such. This perspective on language and discourse sees them as simultaneously reflecting and constructing the situation in which they are used. A particular area of interest was in analyzing which aspects of situation (Gee and Green 1998) and contextual resources (Linell 1998) were reflected in the discourse and, thus, what contexts were considered relevant and built into the shared activity.

2.2.1.1 Different Contexts in Meaning-Making

In the lesson analyzed, the particular focus of interest was on the task context of the students' activity and the aspects of situation and resources that were relevant from that perspective. Three different general contexts characterized the data:

- *Immediate and concrete (perceptual) context* consists of any explicit verbal or nonverbal reference to artifact or current discussion that is used in the new act of sense-making (co-text). In this study it also includes semiotic aspects of a situation, such as gesturing, writing and reading.
- *Socio-cultural context* includes references to prior knowledge manifested, for example, in conceptualizations and ideas in planning the questionnaire. Also institutional norms and identities reflected in the situation are part of this context.
- *Local context* includes the immediate 'task frame' that guides students' activity (making a questionnaire) in the moment-to-moment interaction as well as references to past and future activities concerning that activity. Local context creates continuity from lesson to lesson and thus forms the local history (Mercer 2008) of the task.

These contexts and their specific aspects (Gee and Green 1998) and resources (Linell 1998) are now demonstrated through empirical examples and their

interpretation through discourse analysis. On the laptop monitor, the drafted questionnaire and the on-line environment to be evaluated were the most important concrete resources that mediated student discourse and activity. The following example (Excerpt 2.1) demonstrates how the drafted questionnaire served as a

Excerpt 2.1 Different contexts in discourse

1. Katrin: Ok. <i>How often do you use the environment</i> (reads, whispering, from the screen)?	Immediate context – written text as co-text, reading
Maybe, then, we should start with <i>this one; which tools are you actually using</i> (gestures at the screen and reads)	Immediate context – written text as co-text, gesturing, reading
2. Eva: Yhy	–
3. Katrin: And <i>which ones are you not using</i> (reads from the screen)?	Immediate context – written text as co-text, reading
4. Eva: <i>This one</i> (points to the screen)	Immediate context – written text as co-text, gesturing
5. Katrin: Yeah. I think we should ask may be <i>both</i>	Immediate context – previous discussion and written text as co-text
6. Eva: Yeah, yeah. How about <i>this one? What are the difficulties</i> (reads from the screen)?	Immediate context – written text as co-text, reading
7. Katrin: Maybe we should leave an <i>open-ended question</i> rather to the end	Immediate context – written text and previous discussion as co-text, referring to the question, “What are the difficulties?”, Socio-cultural context – knowledge on questionnaire methodology
8. Eva: But we. How are we going to <i>rate these ones?</i>	Immediate context – written text as co-text, Socio-cultural context – knowledge on questionnaire methodology
9. Katrin: <i>Rate?</i>	Immediate context – previous discussion as co-text
10. Eva: Yeah	–
11. Katrin: You mean <i>the last one?</i>	Immediate context – previous discussion and written text as co-text
12. Eva: No, no <i>the questionnaire</i> , are they <i>open-ended</i> or...?	Immediate context – written text and discussion as co-text, Socio-cultural context – knowledge on questionnaire methodology
13. Katrin: No, we should make <i>categories</i>	Immediate context – discussion as co-text, Socio-cultural context – knowledge on questionnaire methodology
14. Eva: Yhy	–
15. Katrin: Maybe we should. I don’t know	–
16. Eva: <i>Easy, not easy, stuff like that</i>	Immediate context – discussion as co-text, Socio-cultural context – rules of categorization
17. Katrin: Yeah. Our <i>first question: how often do you use it</i> (reads from the screen)?	Immediate context – written text as co-text, reading

(continued)

Excerpt 2.1 (continued)

18. Eva: <i>Very often, often, stuff like that</i>	Immediate context – discussion as co-text, Socio-cultural context – rules of categorization
19. Katrin: Yeah, but maybe we should <i>specify it. Like each day, twice a week, once a week, once a month or something</i>	Immediate context – discussion as co-text, Socio-cultural context – rules of categorization
20. Eva: So I put <i>this</i> (starts to revise the questionnaire)	Immediate context – written text as co-text, writing
21. Katrin: Maybe we should put <i>categories</i> already in brackets, if we know them (follows Eva's writing)	Immediate context – discussion and written text as co-text
Maybe. I don't know; shall we agree <i>five categories</i> always?	Immediate context – discussion as co-text, Socio-cultural context – rules of categorization

mediating tool and reference point, enabling the student pair to make progress in the task. Since the nature of the written text is that of a permanent artifact, it gives the students a chance to review and revise the questionnaire through dialogue and other semiotic means and consequently, simultaneously, affects the nature of the dialogue being mediated by the artifact. The example also reflects the socio-cultural context in the form of prior knowledge:

The above excerpt demonstrates how the written text – the drafted questionnaire – simultaneously provides a focus for discourse and reasoning for the task (Turns 1–19), and also embodies the progress made (Turns 20–21). Thus, the questionnaire serves as an ‘improvable object’ for the students (Wells 1999). It is also used as a shared (concrete) reference object which mediates student discourse. The written text that is explicitly and implicitly referred to in the discourse serves as a co-text for the students, and is actively used in the “new act of sense making” (Linell 1998, p. 132) (Turns 1–8). The discussion itself is also used as a co-text – that is, the previous discussion serves as a co-text for further discussion on the subject at hand. This becomes evident when students start to think about the possible categories and develop their ideas based on one another's suggestions (Turns 9–19). Thus, they are not using the written text as a reference here, but instead are building their ideas on each other's (verbal) suggestions. Co-text (Linell 1998) is a relevant indicator of a shared immediate context being built, and also its prerequisite. In their activity, the students build a shared (immediate) context through different semiotic aspects (Gee and Green 1998). In addition to dialogue, reading and writing, as well as gestures towards the monitor, all are semiotic means that serve in creating the shared context and content-base in the students' collaborative task.

The above excerpt clearly demonstrates the *dynamic nature* of discourse (Mercer 2008). It shows not only how the immediate context is constructed through verbal and nonverbal communication (Linell 1998; Gee and Green 1998), but also how discourse emerges and how speakers' contributions are contingent on what the other speakers say or do (Mercer 2008). The excerpt also embodies a *historical element* (Mercer 2008). Excerpt 2.1 demonstrates how the students draw on prior knowledge

Excerpt 2.2 Different contexts in discourse

1. Katrin: Yeah. I would, I would also put <i>it</i> in categories, because <i>it's easier for us to do the statistics</i>	Immediate context – written text as co-text, Socio-cultural context – knowledge on doing research
2. Eva: Yhy. Yeah. But how can we do <i>this why-part</i> ?	Immediate context – referring to the questionnaire in the screen, written text as co-text
3. Katrin: <i>Why?</i> I think <i>we have to categorize it afterwards, like qualitative</i>	Immediate context – discussion as co-text, Socio-cultural context – knowledge on doing research

on ‘questionnaire methodology’ in their discourse. Their prior knowledge both implicitly and explicitly stated during the discussion indicates that in evaluative questionnaires one should prefer categories instead of open questions (Excerpt 2.1, Turns 8–13). ‘Rules of categorization’ are implicitly referred to (Excerpt 2.1, Turns 16, 18, 19) and explicitly stated, such as “Shall we agree five categories always?” (Excerpt 2.1, Turn 21), thus implicitly referring to a Likert-type scale. The students also use their prior procedural knowledge on ‘doing research’ in their discourse and activity (Excerpt 2.2):

In Excerpt 2.2, Katrin differentiates between quantitative (implicit reference, Excerpt 2.2, Turn 1) and qualitative methods (explicit reference, Excerpt 2.2, Turn 3), referring to her knowledge on research activity. This framework, consisting of rules for making a questionnaire and procedural knowledge about doing research, can also be seen as a previously constructed and learned *cultural model* (Gee and Green 1998) that the students draw on to guide their discourse and activity in the current situation. Cultural models are like theories of action situated in social and cultural experiences (Black 2007), or general ground rules for organizing shared activities (Linehan and McCarthy 2001). Thus, certain implicit rules which are made explicit through discourse guide the students’ activity and enable progress in the discussion (see Excerpts 2.1 and 2.2). This is seen, for example, in the progress the students make during their discussion on developing the categories and specifying them (Excerpt 2.1, Turns 13–21). According to Stahl (2004) the building of shared understanding involves making tacit knowledge explicit, which can then become a context for a new object of discussion and its understanding. For example, in Excerpt 2.1, students’ prior knowledge of questionnaire methodology is tacit knowledge that is made explicit through the application of the rules it constitutes, and this creates a context for discussion and for developing the object (content) of discussion further.

In addition to prior knowledge, the next excerpt (Excerpt 2.3) shows how also identity, another socio-cultural context, is mediated through student discourse. Also local context in a form of implicit references to past task-related activities is demonstrated:

Excerpt 2.3 Different contexts in discourse

1. Katrin: Then <i>he is really interested</i>	Local context – past discussion with the professor
<i>that one, that what could be improved</i>	Immediate context – written text as co-text
[...]	–
5. Katrin: Maybe, I mean we shouldn't do too many questions, I would say like one...	–
6. Eva: Yeah	–
7. Katrin: ...one page, maybe we should leave it away and just ask <i>what could be improved</i>	Immediate context – previous discussion as co-text, referring to question “Do you have difficulties (it) and What could be improved?”
8. Eva: Oh, okay	–
9. Katrin: I don't know	–
10. Eva: Yeah, no problem	–
11. Katrin: I mean, oh what is more important, we have to use <i>this one</i> , ‘cause <i>I think aa, professor is really interested in that one</i> (points to the screen)	Immediate context – referring to the question “What could be improved?” (this one – that one), written text as co-text, gesturing, Local context – past discussion with the professor, Socio-cultural context – student identity

In Excerpt 2.3, Katrin puts great emphasis on the professor's preferences concerning the questionnaire: “Then *he is really interested*” (Excerpt 2.3, Turn 1) and “What is more important, we have to use *this one*, ‘cause *I think aa, professor is really interested in that one*” (Excerpt 2.3, Turn 11). Thus, when they negotiate what questions to include and what to exclude, Katrin feels that the professor's preferences should override the ones they have (“more important”). This signals certain norms, expectations and obligations in the student-teacher relationship and thus reflects socially valued ways of thinking and acting in the present context (Wells 1999). It implies status differences where the professor has strong authority over the students and their preferences. This is also a good example of how, through discourse, Katrin not only reflects but also re-produces institutional norms and values of the community wherein she acts. Hence, this example also reflects identity applied in the situation (Gee and Green 1998). Katrin's discourse reflects that she identifies with her assumed place in the student-teacher community. According to Wells (2007), identity construction is ongoing and occurs in the situated actions and discourses in which participants engage. In new situations one might apply multiple identities originating from various communities of practice whose values and scripts define our identities. In this case, the student identity is supported by the institutional context wherein the students act. It therefore reflects the previous experiences, attitudes and meanings the students have attached to the activity through their extended participation in this relevant (learning) community (Arvaja 2007a; Crook 1999).

Excerpts 2.2 and 2.3, described above, demonstrate also how the local context provides continuity between different contexts. This means that in the shared task

context, the references to past and future discourse or activities concerning the task are relevant in order for one to proceed and understand the task at hand. The local context can be seen as a task frame guiding the activity in the immediate moment-to-moment interaction and influencing the goals and choices made in the immediate context. For example, Katrin suggests creating subcategories for one of the questions because “it’s easier for us to do the statistics” (Excerpt 2.2, Turn 1). Thus, she is referring to future activity concerning the task at hand, which influences the decision-making in the immediate context. In Excerpt 2.3, students are reviewing the questions in the drafted questionnaire and negotiating what should be excluded. Katrin suggests excluding the last question, “Do you have difficulties?”, and suggests including the question “What could be improved?” (Turn 7). She justifies this suggestion by referring to a past discussion she had with the professor teaching the course (Turns 1, 11). In the analyzed lesson the references to the past and future activities are typical justifications for decision-making and negotiation in the moment-to-moment interaction. This demonstrates how the participants’ task frame crosses time and events outside the immediate perceptual context (Mercer 2008).

From the point of view of collaboration, the focus of the presented analysis was both on the historical as well as the dynamic aspect of discourse (Mercer 2008). The historical dimension of the discourse was apparent in that the interaction was located within a particular institutional and cultural context. In the analyzed examples, it was demonstrated how students drew on some past experience or prior knowledge that was used as a resource for building understanding in the present situation and how they applied ‘a cultural model’ (Gee and Green 1998) of doing research in their activity. Discourse also reflected certain norms, expectations and obligations that were socially valued in the present context (Wells 1999). The dynamic aspect of discourse became evident from the way in which the written text, previous discussion or speech turn served as a co-text in student meaning-making, as a ground for building on one another’s suggestions, and reasoning further the subject at hand. The notion of intertextuality provides another conceptualization for understanding how different moments in time were tied together and how the students drew on past texts to construct present texts and implicate future ones (Gee and Green 1998; Pappas et al. 2002; Staarman et al. 2004). Furthermore, Grossen’s (2009) notion of “dialogicality”, with its spatial and temporal dimensions, provides another tool for understanding how every situation has a “here-and-now” (spatial) and a “there-and-then” (temporal) dimension. Often the analysis of collaborative interaction, e.g., in the socio-cognitive research tradition, is interested in analyzing the “here-and-now” situation, leaving out the historical and temporal nature of discourse (Grossen 2009; Mercer 2008).

Even though the analysis presented above was able to demonstrate the embeddedness of different contexts in students’ activity, the analysis was not, as a whole, temporally (Mercer 2008) or chronologically (Hmelo-Silver et al. 2008) ordered. Thus, even though the analysis showed how through discourse different historical timeframes or layers (past, present, future) were present in the immediate context of activity through intertextual referencing, the analysis did not focus on analyzing the temporal history of the whole data. What the students actually learned through participating in extended dialogue with each other and the teacher during the course

cannot be discussed based on the short data excerpts presented here. Temporal analysis of the whole discourse would have helped to identify how students' ideas developed and changed through the extended process of interaction in the group, and how possibly new concepts, ways of thinking and solving problems were appropriated (Mercer 2008).

2.2.2 Contextual Process of Collaborative Knowledge Construction: The Case of Asynchronous Web-Based Discussion

Even though the analysis presented above clearly demonstrated how students' collaborative activity was embedded in the immediate and mediated contexts where the collaboration took place, and therefore warned against analyzing (collaborative) activity out of its context, it provided few tools for evaluating the *collaborative* aspect of interaction and knowledge construction. Next, I will illustrate a methodology developed for studying students' collaborative knowledge construction activity in an asynchronous discussion forum, not forgetting the contextual nature of interaction and shared meaning-making. The analysis and results reported in Arvaja (2007b) will be used as a basis for demonstrating and discussing the methodology.

The subjects of the study consisted of two small groups of teacher education students studying the pedagogy of pre-school and primary education in a web-based learning environment. The students were set a so-called 'open problem', meaning that they had to create and solve a problem relating to the theme "Differentiation in teaching reading". The students' task was to discuss in an asynchronous discussion forum the problem they had created and finally to prepare a lesson plan for teaching reading. The two groups were chosen for detailed analysis and comparison from among seven groups engaged in the same basic task, because they had created the same problem: "How to differentiate teaching reading in a classroom where pupils are on different levels as regards reading ability".

The study concentrated on examining the asynchronous web-based discussion that each of the groups had. One focus of the framework developed for the analysis was on the functional analysis of communication, which shed light on the purpose of the discussion. The communicative functions were adapted from the framework for analyzing language functions developed by Kumpulainen and Mutanen (1999). However, these language functions were not used as predefined categories; rather, the specific context of the data was taken into account in interpreting the function of communication. Thus, the communicative functions were contextual in nature, depending on the topic of the discussion and the interpretations made by the participants involved in these discussions. The functional analysis of the web-based messages focused on the purposes for which language was used in the given context. The communicative functions were identified by their content and form and by their effect on and relation to the discourse of which they were part. From the data, 11 functions of communication were found; *interrogative, responsive, judgmental,*

evaluative, suggestive, informative, exemplary, elaborative, justificational, reasoning and summarizing functions (Arvaja 2007b).

However, the functional analysis, as such, does not tell much about the content and nature of knowledge construction (Crook 1999; Stahl 2002). Thus, in order to truly evaluate the *shared knowledge construction*, we actually have to examine both the kind of knowledge that is constructed as well as whether the knowledge is mutually constructed. Therefore, the method developed focused also on the matic content of the discussion as well as on the contextual resources (Linell 1998) used for knowledge construction. *Content analysis* of the messages was conducted to explore the thematic network of the messages: What knowledge or information was dealt with in each message? How were the messages thematically related to each other? Thus, the unit of analysis was the thematic meaning unit rather than the message, paragraph or sentence as such (e.g., Rourke et al. 2001). After reading the messages through a number of times, two broader themes were identified in the discussions of both the groups: “Methods for teaching reading” and “Differentiating activities in teaching reading”. Thematic content analysis was also conducted at the utterance/several utterances level to identify the main (sub) themes of discussion within the two broader discussion themes. The notion of contextual resources (Linell 1998, see Sect. 2.1) was used as an analytical tool in studying what aspects of the potential context the students made relevant in the process of shared meaning-making. Relevant resources were those referred or oriented to in the discourse. From the data, five broader categories of resources were found (Arvaja 2007b):

- *Course material*: In discourse, students refer directly, for example, to lectures or articles which serve as theoretical background material for the task, or the discussion may be identified as being based on the course material.
- *Own idea*: In discourse, students use their own ideas, which are mostly manifested in *action* and *activity descriptions*. Own ideas are usually based on common knowledge about school practices.
- *Own conception*: In discourse, students use their own conceptions of either practical or more abstract issues or knowledge manifested in *interpretations* of issues or knowledge (e.g., the consequences of a practical suggestion or the conceptualization of theoretical knowledge). In discourse this shows in reasoning and justifying.
- *Own experience*: In discourse, students refer to their own teaching experiences manifested mainly in *case descriptions* or *examples*. References to own teaching practices also reflect the *identity* (Gee and Green 1998) applied in the situation.
- *Co-text*: Co-text refers to the fact that students build their thoughts on other students’ thoughts. In discourse, students directly or indirectly refer to *interpretations, case and activity descriptions or examples presented by others* by developing them further.

Thus, to analyze collaborative knowledge construction, a multidimensional coding scheme was developed. The analysis of the communicative functions and contextual resources was limited to students’ content-based activity. In another study, the whole data was coded and new categories of communicative functions and contextual

resources were found, such as the social and organizational functions and a document base as a resource to refer to (see Arvaja and Hämäläinen 2008). However, this new analysis did not affect the categories developed for content-based activity presented in this paper. In addition to the analysis of the functions, resources and themes of discussion, for the purposes of this paper, the discursive features (Gee and Green 1998) of the discussions of the two groups were analyzed to deepen the interpretations made based on the coding category.

2.2.2.1 Analyzing Collaborative Knowledge Construction in Its Specific Context

To exemplify the multidimensional coding scheme and to give a contextualized interpretation of the students' activity (Hicks 1996), a detailed analysis is demonstrated in the next table (Table 2.1) based on the discussion of Group A.

In first three of the messages (Messages 7, 8 and 11), the students are wondering how they should differentiate the teaching to fit pupils' abilities (theme: Differentiating activities in teaching reading). From the thematic content and functions of communication we can see that Iina first suggests dividing the pupils into ability groups, but also reasons that they ought to have some joint lessons as well (Message 7). Otto elaborates this further by suggesting peer teaching in mixed groups (Message 8). In the messages the students also negotiate how the pupils should be taught in "ability" groups. Iina suggests using a school assistant (Message 7) and Alisa agrees (Message 11). Alisa elaborates further on differentiation by suggesting the use of a special teacher for dyslexic and remedial instruction for weaker pupils (Message 11). In the three messages the students mostly elaborate one another's ideas and justify their own and others' suggestions. They also ask for confirmation for their own ideas (Interrogative; Messages 7, 11). In messages 20 and 21, the students are discussing the method that would be best for pupils who have difficulties. This becomes a real problem-solving situation for them. Alisa asks for clarification on the KÄTS method while at the same time elaborating on its features (Message 20). Iina replies by confirming and justifying the selection by describing the features supporting the selection of that particular method (Message 21).

From the contextual resources we can see that in the 'differentiation' theme the students build their discussion mostly on one another's (co-text) and their own ideas and conceptions. In the 'methods' theme the students draw also on course material. The notion of co-text is particularly important from the point of view of collaboration, because it shows whether the students build their thoughts and discussion on other students' thoughts and discussion (Arvaja 2007b). Thus, it shows whether the theme/s under discussion is co-constructed. This means that in discourse, students directly or indirectly refer to descriptions, interpretations, or examples presented by others by developing them further. It is important to note that although the elaborative function of communication indicates that students develop previously offered knowledge further, the concept of co-text additionally indicates whether some other functions, such as asking and answering questions, justifications and reasoning, are built on one

Table 2.1 Empirical example of the analysis of Group A discussion by using a multi-dimensional coding scheme

Message (number, title, sender)	Function of communication	Contextual resources	Main thematic content	Discursive features
(7. More about the task..., Iina) Would it be good idea to divide the pupils into “ability groups” and for every group think of what method to start with? Could we have, for example, a school assistant in our classroom (could be) so differentiating the pupils would be easier? We still need to think how often we should have these kinds of “ability groups”, I suppose not every lesson, I suppose we should have some joint teaching as well...	Suggestive, interrogative Suggestive, justificational, interrogative Reasoning	Own idea Own idea Own conception	Differentiating by the means of grouping on ability Differentiating by the means of assistant Mixing different ability students	“Ability groups” – “Ability groups” Hesitation common sense
(8. Re: More about the task, Otto) As Iina said, it isn’t necessary to differentiate the pupils in every lesson It is probably good for the dyslexic as well to be with “normal” learners	Judgmental Justificational	– Own conception Co-text	– Mixing different ability students	– Hesitation Common sense “Normal” learners
Those who can already read could read in small groups and those who are still trying to acquire the ability to read would listen and would see the others act This way all could participate on their own level. I believe it also motivates the more skilful pupils. Otherwise they escape the teacher’s attention	Elaborative Justificational	Own idea Co-text Own conception	Peer teaching in mixed groups –	Skilful pupils Common sense
(11. Thoughts, Alisa) –School assistant available –Ability groups in teaching every now and then. [...] Dyslexic children and those who have difficulties in perceiving text and letters will attend a special teacher, I guess	Summarizing Elaborative	– Co-text Own idea	– Differentiating by the means of special teacher	Ability groups Hesitation Common sense

(continued)

Table 2.1 (continued)

Message (number, title, sender)	Function of communication	Contextual resources	Main thematic content	Discursive features
It also occurred to my mind that if a teacher gives remedial instruction to a weaker pupil, one could in advance go through the section etc. to be handled together in the next lesson, already in the remedial session	Elaborative	Co-text Own idea	Differentiating by the means of remedial instruction	Weaker pupil
In this way the weaker pupils could experience feelings of success, as they don't always have to be the slowest ones	Justificational	Own conception	–	Weaker pupils Common sense
(20. Hello, Alisa)				
It's very difficult to decide what to do with those who have difficulties	Judgmental	–	Method for those who have difficulties	–
It is anyway the case that these children have difficulties in many different areas...	Reasoning	Co-text	–	Common sense
I cannot offer any method; the only thing that comes into my mind is that the teacher supports every child and tries to help them forward	Responsive	Own conception Co-text	–	Hesitation (uncertainty)
Was it the case that the KÄTS method was initially developed for children who have difficulties in reading, or is my memory at fault?	Interrogative Elaborative	Own idea Course material Co-text	Specific features of KÄTS method	Common sense Theoretical ground Hesitation (uncertainty)
If it is so, could we apply KÄTS in this group as well?	Suggestive Interrogative	Own idea	–	–
(21. Re: Hello, Ina)				
Yeah, it was the case that KÄTS was initially for those who had difficulties in reading...if I remember correctly	Responsive	Co-text Course material	Specific features of KÄTS method	Hesitation (uncertainty)
Let's start with that method. I can't figure out anything else	Judgmental	–	–	Hesitation (uncertainty)
And KÄTS is a method that deals with these letters and speech sounds and their perception, which I think is important for those with dyslexia	Justificational	Course material Co-text Own conception	Specific features of KÄTS method	Theoretical ground

another's ideas or thoughts, thereby developing the groups' reasoning further, or whether it is more a case of the students sharing knowledge (no co-text) and following their individual paths of reasoning (e.g., Barron 2000). Communicative functions, such as judgmental or evaluative comments, are not considered as co-text, even though the previous discussion is referred to. This is because the previous suggestion, for example, is only acknowledged, but not developed further (Arvaja et al. 2007).

As the activity in this study took place in the virtual environment, the line between immediate and mediated context is more difficult to draw than in the previous case. Roughly, one could say that only co-text is part of the immediate context; other resources are more or less mediated. The only semiotic means (Gee and Green 1998) in the web-based discussion are reading (others' messages) and writing (own messages). Thus, the written text (others' messages) that represents (text-based) discussion serves as a co-text for the students (see Sect. 2.2.1.1 for comparison). Own ideas, conceptions and experiences are usually related to prior knowledge the students have on reading methods and differentiation, and thus represent more the socio-cultural context of an activity. Also conceptualizations made based on the previously read texts or listened lectures (course material) can be considered as mediated resources. However, the students might use the course material also as a concrete resource while working on their computer. Thus, assigning resources into different categories or into immediate or mediated resources is, in some cases, more technical than actual, as resources "overlap considerably" (Linell 1998, p. 132). As is demonstrated in another study based on this data (Arvaja and Hämäläinen 2008), the local context is manifested in the students' 'organizational talk' that ties together the problem-solving discussion and the document writing activity (lesson plan). Task frames (interpretations and goals of the task) "selecting the method" and "means to differentiate" provide another local context that guides the discursive activity throughout the discourse (see Arvaja 2007b).

The discursive features of discussion are examined to interpret deeper meanings and reasons for the students' activity. From the discursive features we can see that the task is challenging for the students and they are uncertain and hesitant in their suggestions. Some discursive features of their communication indicate their hesitation: "I suppose" (Message 7), "It is probably", "I believe" (Message 8), "I guess" (Message 11). Also in messages 20 and 21, students are directly referring to their uncertainty: "or is my memory at fault?", "if I remember correctly", "I can't figure out anything else". The high frequency and also the nature of questions – mostly in the form of requests for confirmation of one's own suggestion – are further evidence of this uncertainty. Under the methods theme, the fact that the students are justifying or reasoning their conceptions theoretically indicates that the methods for teaching reading are something of which the students in this group have no experience. Thus they have to lean on theoretical course material and one another (co-text) in their reasoning. As they do not have experience in applying the methods, the methods become something they try to remember ("if I remember correctly"), not necessarily something they understand. Their discourse resembles a kind of 'in theory' talk. As for the differentiation theme (Messages 7, 8 and 11), in turn, the students are mostly using 'common sense' in their justifications and reasoning the issue: "I believe it

also motivates the more skilful pupils”. It is also present in their discussion on the method theme: “I cannot offer any method; the only thing that comes into my mind is that a teacher supports every child and tries to help them forward” (Message 20, Table 2.1). This discourse could be described as a kind of ‘common sense’ talk in the sense that it helps the students to make inferences about what the other one means, and they rely on the expectation that it makes sense, and thereby also helps them avoid conflicts and disagreements.

2.2.2.2 Combining Quantitative and Qualitative Analysis

In the next table (Table 2.2), the percentages for the five main functions of communication and contextual resources are presented for both of the themes to demonstrate the overall nature of collaborative activity in both of the groups.

Quantifying the categories of communicative functions and contextual resources serves as a valuable tool for comparing the general differences and similarities between the two groups. However, linking the analysis with qualitative description and interpretation of the messages, which also takes into account the thematic content and discursive features of discussion, enables a deeper understanding of the ways in which the dimensions interact in the situation. From the contextual resources we can see that for the theme ‘methods’, the main resources of Group A were co-text and course material (Table 2.2). As the analysis (Tables 2.1 and 2.2) demonstrates, as far as the methods were concerned, the students faced a real problem-solving task, and needed the course material (31%) and one another (co-text, 37%) in order to solve the problem of “what methods to select”. A thematic analysis showed that the students discussed all the three methods thoroughly (see Arvaja 2007b):

We could use LPP method at least for shared teaching, because the pupils don't need to be able to read at all. This would practise that visual perception and the perception of wholeness, which is important for everyone, no matter what phase of reading they are.

(Message 12, Iina, Group A)

As this example again shows, the students relied on theoretical justifications, ‘in theory’ talk, in their discussion. However, the reliance on theory as ‘something to remember’, as was pointed out earlier, is again confirmed, because the student here is actually talking about the features of the KPL method, not those of the LPP, thus making a misinterpretation. As can be seen from the contextual resources drawn on in Group B, the students relied mostly on their own experience (42%) in choosing the method (Table 2.2). The next example illustrates the nature of their discussion:

I myself have used the KÄTS method, but I have noticed that if you have dyslexia, you have to slide letters close together and then it almost changed the old a-u au t-o to auto [car in Finnish]...

(Message 8, Jaana, Group B)

Whereas Group A discussed all of the methods thoroughly before making the selection, Group B did not discuss any other methods, but chose the KÄTS

Table 2.2 Five main functions of communication and contextual resources in Group A and B discussions (adapted from Arvaja 2007b)

	Methods theme		Differentiation theme	
	Group A (%)	Group B (%)	Group A (%)	Group B (%)
Communicative functions				
Elaborative	16	–	23	14
Exemplary	–	11	–	12
Informative	12	–	–	–
Interrogative	16	17	23	–
Judgmental	–	–	13	14
Justificational	16	22	13	18
Suggestive	12	34	13	17
In total	72	84	85	75
Contextual resources				
Co-text	37	0	38	24
Course material	31	8	3	2
Own conception	13	33	21	22
Own experience	0	42	0	32
Own idea	19	17	38	20
In total	100	100	100	100

method that they all knew, based on their teaching experience. The students used their own experiences in legitimizing the selection of the method instead of a critical comparison of the different methods: “I don’t properly know any other method than KÄTS, but I don’t mind what methods we select for this class...” (Message 17, Jaana, Group B). Thus, whereas Group A students justified the selection of the methods on an ‘in theory’ basis, Group B students based their justifications on an ‘in practice’ basis. The main function of communication in Group B was suggesting (34%), and, as the total lack of co-text (0%) demonstrates, the suggestions made were not related to other students’ suggestions. Thus, they did not regard one another’s contributions as relevant resources in solving the problem at hand.

As regards the ‘differentiation’ theme, the groups were more similar in quantitative comparison (Table 2.2). Of the five main functions of communication, four were the same. Co-text was also among the main contextual resources drawn on in both of the groups. This shows that the knowledge was co-constructed in both of the groups. Lack of theoretical knowledge (3/2%, Arvaja 2007b) and references to one’s own ideas (Group A, 38%) and experiences (Group B, 32%) indicates that the knowledge construction was based on common practical knowledge. In fact, the thematic analysis showed that both of the groups handled exactly the same sub-themes as a means to differentiate teaching (see Arvaja 2007b). This is an indication that all of the students shared cultural knowledge (Gee and Green 1998; Linell 1998) about these school practices, even though the ‘level of this knowledge’ differed, as can be seen by examining the discursive features. As was demonstrated above, Group A students used ‘common sense’ talk in justifying the suggestions made as

regards the means to differentiate the teaching. However, Group B students' discussion had more features of 'realistic' talk.

You can also differentiate pupils according to remedial instruction, but I have noticed that with the existing time frames it is impossible as the only way, as you can give remedial teaching for an hour or two in months.

(Message 6, Mari, Group B)

Both this (Message 6) and the previous example from the method theme (Message 8) show that Group B saw some problems in real-life activity relating to the practices discussed, and they critically evaluated the established practices based on their experience and the reality they had faced in the field. Thus, both groups shared the same common knowledge, but Group B had a deeper understanding of the issues discussed, based on their experience, and this showed in 'realistic' talk as opposed to 'common sense' talk in Group A. Another difference in discursive features was that whereas Group B students used professional terms in their discussion, Group A students used more novice-like terms. Table 2.3 summarizes the differences in discursive features between the groups.

Combining the three dimensions of the analysis – the theme and function of communication and the source of knowledge – enabled an evaluation of what kind of knowledge was constructed, how it was constructed, what resources were used for it and whether the knowledge was co-constructed. Even though the analysis of communicative functions and contextual resources was performed at the utterance level and hence represented quite a static kind of analysis (Grossen 2009), it was still able to some extent to capture the dynamic nature of interaction (Mercer 2008). Most of the communicative functions, such as elaboration, answering, summarizing, evaluating and judgment, imply the connection to the content and function of the previous message(s). In addition, the contextual resource co-text indicated whether the content of the previous message was used as grounds for thinking and developing the knowledge further (co-construction), and not just for acknowledging the previous thoughts presented. Quantifying the analysis of communicative functions and resources offered valuable direct knowledge on the general similarities and differences between different groups. Contextual resources indicated whether the knowledge discussed was based on practical or theoretical knowledge, that is, on one's own experiences as a teacher, ideas based on common knowledge, or on course material. Communicative functions, in turn, allowed interpretations to be made of the quality and purpose of discussions in the two groups. Thus, the quantitative analysis

Table 2.3 Discursive features of discussion in Group A and B

Group A	Group B
Hesitation/uncertainty	Confidence
'In theory' talk	'In practice' talk
'Common sense' talk (unproblematizing)	'Realistic' talk (problematizing)
Novice terms: e.g., "ability groups", weaker, "normal", skilful and advanced pupils	Professional terms: e.g., reading groups, challenging pupils and fluent readers

was able to give general knowledge on the nature and ‘level’ of collaborative knowledge construction in the two groups.

However, only a detailed qualitative analysis of the relations among specific thematic content, communicative functions and contextual resources as well as the discursive features of discussion made it possible to gain a deeper understanding of the reasons behind these similarities and differences. This interpretative analysis was able to open up the “dialogicality” of the situation (Grossen 2009): how the meaning of the here-and-now situation (e.g., interpretation of the present task) was understood with respect to there-and-then situations, such as other activities that the students had been involved in (e.g., teaching experiences) or had some representation of (e.g., theoretical conceptualization based on course material), and in what kind of activity and knowledge formation this resulted. Interpretation of all the aspects taken into account in the analysis as intertwined showed, for example, how in Group B the selection of the reading method (the problem at hand) was suggested and justified based on one’s own and shared teaching experience manifested in ‘realistic’ and ‘in practice’ talk, and regarded as sufficient justification. Thus, Group B students were able to pass the task by relying on their former experiences as teachers, rather than relying on one another’s contributions (no co-text) or theoretical material in completing the task. They regarded their own teaching experience as relevant and sufficient (context) for accomplishing the task. Furthermore, the interpretative analysis showed how in Group A an emergent understanding of reading methods, manifesting itself in ‘common sense’ and ‘in theory’ talk, was expressed as hesitation in the situation and led the students to seek confirmation (interrogative) from other students, and consequently led to shared problem-solving (e.g., responsive, co-text) in the situation (see Table 2.1). Thus, being novices, they seemingly needed one another and theoretical course material in completing the task. The qualitative analysis and interpretation of the here-and-now and there-and-then situation illuminated how the students interpreted the task at hand and what resources were realized as relevant, and why (/not). Thus, the analysis was able to provide contextualized interpretations of why certain activities occurred.

2.3 Discussion

One focus of this book is to present different methodologies for studying interaction in various CSCL contexts. If I reflect on the methodology presented in this particular chapter, what was actually sought through the analyses was dialogicality (Grossen 2009; Linell 1998) in situation, rather than interaction in situation. Firstly, in both of the empirical cases, building the shared immediate here-and-now situation or the shared ‘content and activity space’ through co-textual referencing was shown to be a prerequisite for collaborative activity. In such a situation, the students’ activity was coordinated (Barron 2000) and the activity was organized around joint problem-solving efforts manifested in co-construction of solutions and referring to and expanding one another’s ideas. Secondly, the studies also demonstrated how collaborative

activity was rooted in the mediated there-and-then situation; in the socio-cultural context and in the history of the students and their activities.

One weakness of the presented methodology is that it, as such, captured more the 'visible' analyst's perspective. Additional data in the form of interviews or diaries, for example, would have shed more light on (other) resources relevant from the students' perspective (e.g., Arvaja 2007a). Another limitation of the methodology as presented here relates to its use of the group as the unit of analysis. However, the study of Arvaja and Hämäläinen (2008) used an individual level of analysis based on the multidimensional coding scheme and demonstrated how the individual students in the group adopted different functional roles and resources in different tasks (e.g., knowledge provider, knowledge elaborator, social supporter). Also, another study (see Arvaja et al. 2007) combined the individual self-report data (questionnaire) with the group-level discourse data to give knowledge on the subjective meanings the students attached to the group's learning activities. The self-report data was able to validate the findings of the discourse data. It is thus obvious that the data from multiple sources as well as individual and group-level perspectives are needed to fully understand the contextual nature of collaborative learning.

Empirical examples illuminated how it is pedagogically important to see that original task designs are always re-interpreted by the learners themselves and the actual realisations may radically differ from what might have been planned by the task designers. For example, in the second case, whereas the task was a real problem-solving task for Group A, the students in Group B faced no challenges as such and merely reproduced their commonly shared knowledge. The task and its structuring in the web-based learning environment were apparently unresponsive to the different resource needs of the groups. The notion of contextual resources (Linell 1998) can thus be used as a tool in evaluating the success of designed collaboration activities by revealing, on the one hand, how students interpret and make use of available resources, and on the other hand, how the resources used (e.g., conceptual, social, material, technological) support students' collaboration. This, in turn, helps to identify critical points for designing learning and teaching activities in flexible ways, both before and during the ongoing activity. From the teacher, this requires appropriate scaffolding (Rasku-Puttonen et al. 2003) and flexible structuring of students' activities, for example, by offering new resources that become relevant for students' activity (Dillenbourg and Tchounikine 2007).

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