Changing face-to-face communication

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4 Group Discussions: Learning as Co-Construction

> Without other people with whom we share responses to a mutual environment, there is no answer to the question what is in the world to which we are responding
>
> *Donald Davidson*[1]

Collaborative learning makes specific epistemological claims about the nature of knowledge and learning. In this thesis, collaborative learning is viewed from a social-constructivist perspective that stresses the "interdependence of social and individual processes in the co-construction of knowledge" (Palincsar, 1998). Social constructivism acknowledges that the construction of knowledge emerges on the social level without denying the constitutive role of the individual. It enhances the role of inter-action with others rather than actions themselves (Dillenbourg, Baker, Blaye & O'Malley, 1996).

Social-constructivist epistemology contains a clear view of how collaborative learning should proceed in practice. Several studies within this tradition examined what kind of communication contributes to the co-construction of knowledge. These studies make clear that the quality of interaction has implications for learning (Barron, 2003). In this chapter, we further elaborate on the term "quality" and identify some communication patterns that can be associated with the co-construction of knowledge. We present a set of criteria for a constructive dialogue. These criteria serve as communication demands that indicate how well a group carries out a problem-solving discussion aimed at achieving an increased understanding.

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[1] Davidson, D. (1999). The emergence of thought. *Erkenntnis*, 51, 7-17.

4.1 Constructivist Views towards Learning

Constructivist views of knowledge and learning mark a shift in focus from the object of experience or the known towards the subject of experience or the knower (Campbell, 2002). These views state that knowledge is constructed internally by the individual *or* socially during interactions with others. Constructivist theories come in many shapes like cognitive constructivism, radical constructivism, social constructivism, and sociocultural theory. Descriptions of these theories are open to divergent interpretations and the use of concepts varies. It is not easy to make a clear distinction between the various theoretical directions that fall back on the constructivist epistemology. The readers of constructivist literature are usually left to figure out for themselves which epistemological direction is being pursued (Phillips, 1995). One could argue that this is inherent to the position of these theories because they state that knowledge is constructed through "subjective or even intersubjective experience" (Campbell, 2002). Still, it is important to make clear which position will be adopted in this thesis because it has strong implications for research.

Subject-centered versus Social Accounts of Constructivism

Constructivist theories can be positioned on a continuum with subject-centered accounts at the one end and social accounts at the other (Davis & Sumara, 2002). The distinction has to do with the different epistemological claims about the nature of knowledge. *Subject-centered accounts* stress that individuals construct their own understanding; they include accounts such as cognitive theories and radical constructivism. *Social accounts* of constructivism situate the process of learning in the social domain and consider knowledge as something that emerges out of social interaction *or* social activity. Learning from this perspective is viewed as inherently social; people construct "shared versions of knowledge" (Burr, 2003) when they try to make sense of their mutual experiences. Social accounts include theoretical positions like social constructivism and sociocultural theory.

Subject-centered Constructivism

Subject-centered constructivism states that the mind does not passively accept sensory impressions; rather the mind actively imposes an interpretive framework on sense data. Reality, in other words, is constructed (Driscoll, 1994). Virtually all *cognitive theories,* which are inherently subject-centered, entail some form of constructivism to the extent

that the cognitive structures are typically viewed as individually constructed in a process of interpreting experiences in particular contexts (Palincsar, 1998). These cognitive theories take up a *realist position*; they see the internal representations that are the result of individual constructions as more or less correct representations of an external world. The challenge of teaching, from that point of view, is to present the learning material so that it allows for effective and accurate constructions of internal representations. It means that the teacher introduces the subject matter in an accessible manner that closely matches the cognitive abilities of the individual student, taking into account how people acquire and organize information cognitively. The teacher presents the knowledge in parts that are easily understood, points out connections and explains what is difficult to understand. Reiteration, multiple representations and referring to existing knowledge are seen as effective strategies for knowledge acquisition.

Radical constructivism can also be positioned at the subject-centered end of the continuum. However, radical constructivism takes up an *idealist position* towards the nature of knowledge. It denies that knowledge could be treated as internal representations of the external world. Radical constructivism breaks with the traditional theory of knowledge that asserts that our cognitive efforts result in a more or less objective representation of the world as it exists apart from us and our experiences (von Glasersfeld, 1991). Radical constructivism does not deny an objective world but this world is not accessible for the individual mind. Radical constructivism refers to the work of Piaget who sees learning as a process of adapting one's internal believe system triggered by individual experiences. The constructivist epistemology of Piaget's work refers to a process in which the individual reflects on and organizes experiences to create order in and adapt to the environment (De Lisi and Golbeck, 1999). Von Glasersfeld (1996) followed Piaget and stated that:

> *Knowledge, for [Piaget], arises from actions and the agent's reflection on them. The actions take place in an environment and are grounded in and directed at objects that constitute the organism's experiental world, not things in themselves that have an independent existence (von Glasersfeld, 1996, p. 4).*

Social Accounts of Constructivism

Social accounts of constructivism also consider experiences rather than an objective source outside these experiences as the reference for knowledge construction. However,

social accounts do not set the individual apart from the social world as radical constructivism does. The subjectivity of the individual and the objectivity of the surrounding social and cultural context exist in relation to one another (Davis & Sumara, 2002). Properties of social collectives like language constitute to the construction of knowledge. Social accounts of constructivism include theoretical positions like social constructivism and sociocultural theory.

Social constructivism covers a range of learning theories that share an antireductionist stance towards the nature of knowledge. Human learning is not a solitary activity by individuals who make sense of their world. Knowledge is temporary, developmental, non-objective, internally constructed and socially and culturally mediated (Twomey Fosnot, 1996). Social constructivism stresses the social dimension of cognition and the role that language production plays in promoting learning (Palincsar, 1998).

Two terms with more or less similar connotation appear in the literature: social constructivism and social constructionism. The former term is more frequently used in educational sciences. Social constructivism refers to the idea that knowledge can be situated on the social plane. The latter term is more widely used in psychology to indicate a tradition that can be contrasted with the reductionist tradition in psychology. Social constructionism places the social prior to the individual and acknowledges the constructive power of language (Gergen, 1995, Burr, 2003). We use the term social constructivism because our research takes place in an education setting. *Social constructivism* assumes that sense making is a social process of people who interpret mutual experiences. The units of analysis to study learning are: the social activity, the mutual environment that shapes thinking, the interactions between people, or a combination of these units. Some analyses concentrate on micro descriptions of human interaction, while others focus on the cultural and historical origins of knowledge.

Sociocultural theory sees human learning through the manner in which the social and cultural world codetermine the way in which people approach learning in various settings, inside and outside formal institutions (Bliss and Säljö, 1999). Thinking is culturally mediated by artifacts such as signs and tools, it is founded in purposive activity, and it develops historically (Scribner, 1997; Packer & Goicoechea, 2000). The defining concepts of sociocultural theory – human action, the use of tools and mediation – can be traced back to the work of Vygotsky. All activities contain different artifacts, and these artifacts or tools embody a certain history and culture (Vygotsky,

1986). Artifacts play an essential role in shaping action; they mediate human action (Wertsch, del Rio & Alvarez, 1995). Every mediating system has distinct features that characterize the nature of communication and learning that takes place in that system. It means that human experience is shaped by the artifacts that they use (Nardi, 1996).

Taking Up a Position

We follow a social-constructivist perspective that assumes that learners construct knowledge through social interaction and that the nature of these interactions affects collaboration and learning.

Social-constructivist theories can be positioned on both sides of the realist-idealist continuum, most theories however firmly lean towards the idealist end. Idealist accounts state that learners cannot know reality in itself, only in so far as it is given in consciousness, experience, language, or practice (Collier, 1998). However, some social-constructivist theories maintain some concept of reality that exists outside the discourse (Burr, 2003). Zuriff (1998) made a distinction between empirical and metaphysical social constructivism. These two positions can be situated at the two ends of the Realist-Idealist continuum. Empirical social constructivism distinguishes the natural world from the constructed world and admits that constructions are descriptions of the natural world. Metaphysical social constructivism rejects the view that the natural world consists of an external objective reality, independent of the human mind (Zuriff, 1998).

With regard to our position we keep away from a relativist position that suggests that essential properties of an object of the world are relative to their description (Moser, 1993). We do acknowledge that human action is based on a belief system that is socially constructed. This does not mean, however, that there is no reality outside these experiences. Although the perceptions and sensations of people do not mirror reality, they do refer to the real world in some way; they are not independent of it, produced entirely through symbolic systems such as language (Burr, 2003). Experience is always an encounter with what exist before the experience and is to a degree known to us as a result of the experience (Collier, 1998). This observation makes it possible to come up with a *deliberate* design that aims to change an existing practice. The design interventions are based on insights of the practice but it also incorporates knowledge in a broader sense.

4.2 Collaborative Learning in the Classroom

So far, we have discussed social constructivism at a rather abstract level. In this paragraph, we turn to a more practical elaboration. We discuss the implications of social constructivism by focusing on the human-activity system – i.e. small groups of interacting students who learn collaboratively – that is the object of the research. Collaborative learning has been implemented as a problem-solving discussion between a limited number of students. Collaborative problem solving can be seen as the interplay between a problem-solving task and those who have to solve that task. It is defined by the interaction between task characteristics on the one hand and person and group characteristics on the other (see for example Frensch & Funke, 1995). In this paragraph, we further elaborate on the relationship between the two. We introduce the notion of "*problem space*" to conceptualize the relationship between the group and the learning task. The concept has its origin in the cognitive analysis of human problem solving where it is associated with an information-processing approach. It has also been applied to describe problem solving from a social-constructivist perspective (Roschelle & Teasley, 1995; Greeno, 1998).

Information Processing: A Search for the Right Answer

The information-processing perspective focuses on distinguishable aspects of human problem solving. The complexity of human problem solving is decomposed into identifiable processes that are carefully studied by manipulating various conditions within the environment. Research topics include knowledge and its representation, inferential processes and perception. Explanations are primary in the form of models of processes of constructing, storing, retrieving and modifying representations of information (Greeno, 1998).

Problem solving from an information-processing perspective is seen as a *search* for the appropriate response within a set of internal representations that comprise the individual's problem space. A problem space is defined as a person's internal representation of the task environment (Newell & Simon, 1972). It captures essential aspects of the problem as it is presented to the person. The problem space includes general knowledge associated with the problem and strategies, plans and rules for solving that problem.

The Pooling of Information

The information-processing perspective conceptualizes collaborative problem solving as a *joint search* in the problem space for the right means to solve the problem. Groups from this perspective are viewed as information-processing units, analogous to how cognitive psychology views individuals (Brauner & Scholl, 2000). Group members share information so that they are able to build a more accurate description of the problem. They deal with a lack of understanding by constructing a shared representation of the problem. The essence of collaborative problem solving is that group members pool information to represent the problem space. The group from this perspective needs to gather all the information needed to solve a problem and it uses the collected information to develop solutions (Hasenbein, Kopp, Mandl, 2008). Group problem solving, just like individual problem solving, is a *search* for the right answer within the pool of collective information. According to this view, groups outperform individuals because they have potentially more information available, are more likely to recognize valid information, and are capable to process more information than an individual (Propp, 1999).

Information Processing and the Design of Group Support Systems

Electronic meeting systems (EMS) seem to reflect an information-processing perspective towards collaborative problem solving. These systems are used in professional settings to support groups who have to solve problems or make decisions. They are employed in face-to-face settings where people gather at the same time and same place (Fjermestad, 2004). A group uses an EMS to construct a shared representation of a problem by exchanging, organizing and assessing information that is available among the group members. In general, such meetings can be characterized by a distinct communication sequence of 1) the generation of ideas, 2) the organization of these ideas into meaningful categories, and 3) the evaluation of these ideas (Stefik, Foster, Bobrow, Kahn, Lanning & Suchman, 1987).

Conclusion

The added value of groups from the information-processing perspective is their ability to better process information. This notion seems too narrow for our situation. Complex learning does not only capitalize on the pooling of information. Complex learning such as solving ill-structured problems calls for the construction of new

knowledge (King, 1999).

Ill-structured problems give rise to confusion: for example, the exact nature of the problem and possible solutions are unclear because information can be interpreted in different ways. These differences serve as the mechanism for learning. Students can only resolve ill-structured problems by extensive reasoning during which the students address their differences in thinking. Students should be encouraged to critically address each other's belief system and discuss underlying reasons, assumptions, and perspectives. They have to engage in a constructive dialogue that marks a rather *subtle* shift from the pooling of information and the search for the right answer towards interaction and the joint construction of meaning. It emphasizes that collective thinking is much more than the pooling of knowledge (Barron, 2003).

Social Constructivism: The Emergence of Understanding

Social constructivism considers collaborative problem solving as the *intelligent social* practice of a group of students who collaborate on a common task. The denomination 'intelligent' refers to the ability of the group to alter their thinking in response to additional information, growing experience or increased insight. This ability cannot be traced back solely to individual cognition but emerges during group interaction when the group constructs a shared representation of the *problem space* that exceeds their prior individual understanding. Shared understanding cannot be established at the beginning; rather it evolves when the group jointly addresses the demands set by the task.

Shared Understanding

A shared problem space expresses how the group understands the problem. Aspects of the problem situation that are shared may include a representation of the situation, the main goal, operators for changing the situation, and strategies, plans and knowledge of general properties and relations in the domain (Greeno, 1998). A shared problem space supports problem-solving activity by *integrating* goals, descriptions of the current problem state, awareness of available problem solving actions, and associations that relate goals, features of the current problem state and available actions (Roschelle & Teasley, 1995).

A shared problem space emerges as individuals find and align themselves with other members who have comparable cognitive models of the situation (Massey &

Wallace, 1996). Significant features of the problem space arise during group interaction. This alignment of cognitive models becomes *more* apparent for ill-structured problems that are open to multiple interpretations. The group can be considered as a means to gain access to alternative viewpoints. Groups do not only have more resources available to generate new ideas. There are also more viewpoints from which to evaluate critically those ideas (Fisher, 1980). Multiple viewpoints serve the same role as multiple examples or cases in supporting the induction of abstractions (Gick and Holyoak, 1983). Through a process of extensive reasoning group members integrate their perspectives into a more abstract, and a more accurate representation of the problem space (Schwartz 1995). Roschelle (1992) speaks in this respect of convergence that is achieved through cycles of displaying, confirming and repairing shared meanings. Individual and shared cognitive representations recursively co-evolve into a shared problem space that reflects shared knowledge and conceivably new knowledge (Massey & Wallace, 1996).

Occasions for Collaborative Problem Solving

According to Weick (1995) two aspects of the problem-solving task – uncertainty and ambiguity – determine the kind of communication that is needed to solve a problem. *Uncertainty* refers to those situations where the problem solvers lack sufficient knowledge and information to form a *valid* representation of the problem. Uncertainty comes from an ignorance or imprecision of an interpretation of the problem and possible solutions. To remove ignorance, more information is required (Weick, 1995).

Ambiguity, in contrast, refers to those situations where people are confronted with *multiple* viewpoints. The problem with ambiguity is that people are unsure what questions to ask and whether there even exist a problem they have to solve (Weick, 1995). People do not need new information to address ambiguity but they have to enter into a process of reasoning, argumentation and negotiation. Schrage (1990) made a similar remark when he states that the essence of collaborative problem solving is not just more communication but rather a different quality of interactions. Schrage (1990) identified two kinds of groups, those who are oriented at communication and those that are oriented at collaboration. The traditional model of communication states that listening carefully and talking clearly are essential for understanding. Groups caught up in the communication paradigm believe that *more communication* can compensate for a lack of understanding. Collaboration, on the other hand, assumes a different kind of

orientation; what is needed is not more communication but rather a different quality of interaction. Students should be less interested in displaying information rather than in creating a *shared space* that enables them to play collectively with their knowledge, concepts and beliefs (Schrage, 1990).

4.3 A Constructive Dialogue

The collaborative learning practices that are the object of the research exploit ambiguity as an opportunity for learning. The ambiguity associated with the learning task leads to a constructive dialogue during which the students address their differences in thinking. A constructive dialogue is concerned with the knowledge and the concepts that underlie the problem solving (De Vries, Lund, Baker, 2002). It uses inquiry to explore one another's assumptions and thinking with the intent of learning about them more deeply (Barge, 2002).

Collaborative learning as a constructive dialogue puts some demands on the kind of communication that the group has to display. A constructive dialogue requires the *active* involvement of the learners' believe system, while better understanding is acquired when learners collaboratively reflect on their mutual experiences. Learners should align their comparable cognitive models to construct a meaningful representation of the problem space. Then, the emphasis lies on communication that creates *meaning* while *coherence* is the primary vehicle through which learning occurs (Allen & Plax, 2002).

Box 4.1 gives an overview of the communication demands that are associated with a constructive dialogue. *First,* the communication should be oriented at effective task performance because learning achievement is associated with task-related interactions. Task-related interactions stimulate the elaboration of conceptual knowledge (van Boxtel, van der Linden & Kanselaar, 2000).

A *second criterion* for the success of the groups is that the members maintain acceptable levels of participation. All the group members must be able to share their knowledge with the group. Equal participation of the group members is a fundamental element of well-performing student groups (Lindblom-Ylänne, Pihlajamäki & Kotkas, 2003).

Thirdly, the group members must organize their individual talk into a coherent

Box 4.1: Communication patterns of a constructive dialogue.

- Communication is oriented at the *learning task*.
- Communication displays an equal pattern of *participation* and the *free exchange* of ideas.
- Communication is *coherent*. The successive communicative exchanges of various students should be organized in an orderly and meaningful way.
- Students go beyond the given and address their group member's assumptions, judgment and reasoning strategies. Such a group discussion can be characterized by a process of *elaboration* on the knowledge that is shared by the group members. Elaborative communication patterns can be characterized by a critical assessment of the knowledge that is shared by the group members.

whole. If a contribution is to be used, someone must, sooner or later, relate it to the other contributions (Harnack, Fest & Schindler Jones, 1977). Barron (2003) studied the interaction patterns of groups who communicated orally in a face-to-face setting. The groups consisted of three students who participated in a problem-solving discussion. She found that more successful groups compared to less successful ones differed in how they respond to correct proposals. Successful groups carried out a productive discussion that is oriented at the exploration of ideas. These groups discussed or accepted correct proposals, whereas less successful groups showed a tendency to ignore or to reject them. Students from successful groups also showed a better transfer of their learning to an individual achievement task. Differences in level of knowledge of individual group members did not account for how successful the groups were. Barron found that the performance differences had to do with the interaction patterns. Successful groups carried out a *more coherent discussion* during which they directly linked proposals to the prior conversation. This observation is confirmed by a study of Kneser & Ploetzner (2001) who conclude that the successful groups produced more coherent dialogues.

Finally, successful groups can be characterized by frequent knowledge *elaborations* that are organized in an orderly and meaningful manner (Barron, 2003; Kneser & Ploetzner, 2001). Hogan, Nastasi and Pressley (2000), for example, identified three patterns of interaction to characterize the essence and flow of a discussion: 1) consensual, 2) responsive, and 3) elaborative. During *consensual* sequences, only one speaker makes substantive statements. Another speaker assents or acquiesces with what

has been said. Within *responsive* sequences, at least two speakers contribute substantively to the discussion. These sequences usually have a question-response pattern that contains a few turns in length. *Elaborative* sequences resemble coherent sequences in the sense that several speakers contribute substantive statements to the discussion. The speaker in elaborative sequences makes multiple contributions that build on or clarify another's prior statement. Hogan, Nastasi & Pressley (2000) observed that performance differences could be traced back to the kind of interactions that emerged during the discussion. In general, the elaborative sequence was most frequently associated with a productive dialogue.

A medium-neutral description

In the next chapter, where we discuss the problem analyses and the tool design whereby we take the four criteria of Box 4.1 as the point of reference. These criteria – task orientation, equal participation, coherence and knowledge elaboration – have been described in *medium-neutral* terms. The criteria relate the group communication with learning achievement. They will be used to analyze the existing verbal, face-to-face communication but the criteria also serve as the reference for the design of the collaborative tools. The aim of the collaborative tools is to create patterns of communication that closely match with the criteria for a constructive dialogue.