Social Interaction, Constructivism and their Application within (CS)CL Theories

Christian Hartmann, Jennifer Charlotte Angersbach and Nikol Rummel
christian.hartmann@rub.de, jennifer.angersbach@rub.de, nikol.rummel@rub.de
Institute of Educational Research, Ruhr-Universität Bochum

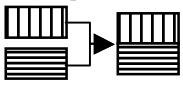
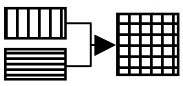
Abstract: We argue that the diversity of theories underlying CSCL research and the dispute concerning the distinction between the terms cooperation and collaboration may be explained (at least in part) by the variability of assumptions concerning the role of social interaction for individual learning. In this paper we identify different roles ascribed to social interaction in theories of learning and attempt to link them to different forms of constructivism in order to categorize theoretical conceptualizations of (CS)CL. This categorization may provide a starting point for developing a framework that enables consolidating various theoretical points of view.

Keywords: cooperation, collaboration, constructivism, social interaction, learning theories, theoretical framework

Introduction

The field of Computer-Supported Collaborative Learning (CSCL) is influenced by several scientific disciplines (e.g. psychology, sociology, philosophy, computer science). Therefore CSCL research builds upon a variety of different theoretical points of view (Stahl, 2013). The phenomena that lie at the heart of CSCL research comprise social interaction and learning in the context of information technology (Ludvigsen & Mørch, 2010). To date, no single, overarching theory or paradigm is able to explain the relationship between those terms (or concepts) comprehensively (Goldbeck & El-Moslimany, 2013). We argue that a potential reason for this may be that there is no clear and universally valid definition of the concepts social interaction and learning. Some approaches appear to be compatible, while others seem incommensurable as they diverge concerning central assumptions concerning the nature of human cognition and social interaction. In this paper, we identify different roles ascribed to social interaction within theories of (CS)CL and attempt to link these roles to different forms of constructivism (see Table 1). We hope that this categorization may facilitate a harmonization of diverging approaches within CSCL; however, we acknowledge that this short paper provides just a starting point for developing a more formal theoretical framework.

Table 1: Theoretical overview

Social Interaction	Constructivism	Product	Exemplary Theory
Contextual: variations of social interaction produce variations in individual learning	*Exogenous*: the source of knowledge is the environment	*no common product (individual)*	*Social Learning Theory (Bandura)*
Enabling: social interaction enables individual learning	*Endogenous*: the source of knowledge construction are individual processes	*additive (cooperative)* 	*Social Interdependence (Deutsch)*
Constitutive: social interaction is a part of the process that produces individual learning	*Dialectical*: the source of knowledge construction is a synthesis of both	*synergistic (collaborative)* 	*Distributed Cognition (Hutchins)*

Theoretical conceptualizations of (Computer-Supported) Collaborative Learning

Theoretical conceptualizations of (CS)CL include three major constituent parts: social interaction, individual learning, and the affordances information technology can bring to these. Due to space constraints, we focus on the first two parts. We argue that the theoretical diversity within CSCL research might be explained – at least in part – by the role ascribed to social interaction for learning. Social interaction is a complex construct and no common definition of the term exists. This also could explain the controversial issue emphasized by Lipponen (2002) concerning the distinction between the terms collaboration and cooperation within research on CSCL. There is some evidence that the term cooperation relates to a different role of social interaction within learning processes, than collaboration does. Therefore we also address this aspect in our conclusion. Social interaction broadly defined entails the exchange of information between at least two individuals. According to Jaegher, Di Paolo and Gallagher (2010), social interaction can relate to individual learning in three ways: it can be (1) a contextual, (2) an enabling, or (3) a constitutive factor for individual cognitive phenomena. We will explain these concepts below. Theories of CSCL also include several forms of constructivism (Goldbeck & El-Moslimany, 2013). Moshman (1982) distinguishes between exogenous, endogenous, and dialectical directions of constructivism. As will be detailed below, we argue that the three roles of social interaction and the three forms of constructivism can be linked to each other (see Table 1). This then allows categorizing assumptions about the nature of learning that underlie theories of CSCL.

From the perspective of empiricism, knowledge exists within the empirical or ”external world”, and can be experienced and processed by an individual (Goldbeck & El-Moslimany, 2013). According to this point of view, social interaction is a contextual factor for individual learning (Jaegher, Di Paolo & Gallagher, 2010). Variations of individual learning or behavior can be explained by variations within the social environment. Within social learning theory (Bandura, 1977) and corresponding instructional approaches, social interaction is also a contextual factor. According to Moshman (1982), the construction of knowledge is exogenous and can be explained on the basis of external input (cf. exogenous constructivism). Expanding behaviorist views, these approaches particularly focus on social interaction and the environment as a contextual factor, which serve as an input for cognitive outcomes (Moshman, 1982).

According to a rationalist point of view, and also with reference to cooperation, the nature of knowledge is described by organizational processes “imposed by the human mind” (Goldbeck & El-Moslimany, 2013, p. 43). The ideas of Piaget (1977) can be subsumed under this theoretical direction. Learning is not solely a passive reaction, but it is the process of internal knowledge construction, due to the equilibrium of cognitive structures. Moshman (1982) therefore localizes Piagets' theory within endogenous constructivism. Social interaction is not regarded anymore as merely a contextual factor for individual cognition, but it plays an enabling role in individual learning (Jaegher, Di Paolo & Gallagher, 2010). Against the background of folk theories, Marx argues, that for cooperation “a large number of workers are brought together in one place for purpose of production” (as cited in Morrison, 1995, p. 86). Further, “the effect of combined labor could not have been produced by the isolated worker and […] the combined effect creates a form of cooperation which increases the productive power of the individual” (as cited in Morrison, 1995, p. 86). This definition emphasizes the enabling character of cooperation. Translating this to educational research, cooperation is regarded as a form of social interaction that enables individual cognition. Early research on cooperative learning particularly stressed the benefits of cooperation in comparison to individual learning (Johnson & Johnson, 2002). In summary, social interaction has an enabling character within cooperation, which causes individual cognitive processes. This thought parallels the ideas of endogenous constructivism.

Further, Slavin (1995) distinguishes between motivational and cognitive theories of cooperative learning. Both threads have in common that they expect social interaction to enable cognitive development. While cognitive approaches focus on explanation-giving or socio-cognitive conflicts as an enabling factor for individual development (see Mugny & Doise, 1978), motivational approaches focus on the conditions of social interactions which foster the motivation to cooperate. Deutsch (1949) highlights the need for social interdependence, therefore social interaction becomes an enabling factor for motivation and thus for individual cognition. Social interdependence as an enabling factor illustrates the main characteristic of cooperation, the division of labor and unshared information. According to Dillenbourg (1999), the division of labor is a central aspect when attempting to distinguish cooperation from collaboration. Most concepts of cooperation comprise the idea that splitting the responsibility for the task product facilitates beneficial social interaction (Damon & Phelps, 1989). Dividing up unshared information can enable individual cognition because of explanations that arise from the interdependence of the interacting individuals (Aronson, Blaney, Stepan, Sikes & Snapp, 1978). Stahl (2004) agrees with this notion, claiming that in contrast to collaborative learning where ”the work is done by the group as a whole” (p.63), in “cooperative or coordinated work, tasks are often divided up so that

individuals actually work and build knowledge on an individual basis and then attempt to share the results" (Stahl, 2004, p.63). Thus, one can trace back each individual part of the common, and thereby additive, product. In contrast, the concept of collaboration emphasizes a more creative meaning of working together (Kvan, 2000), where the common product is more synergistic, and thus the different contributions of each member cannot clearly be ascribed to just one individual effort. This attribute of collaboration lead us to an understanding of social interaction and constructivism which differs from the enabling, endogenous characterization.

Collaboration is more related to dialectical constructivism, and to the assumption that social interaction is a constitutive factor. This perspective can be illustrated by Vygotsky's zone of proximal development (Moshman, 1982). The zone of proximal development bridges between an enabling and constitutive role of social interaction. On the one hand, it emphasizes social interaction as an enabling factor, because it stresses the "gap between what individuals can do by themselves […] and what they can do in collaboration" (Stahl, 2013, p. 78). On the other hand, the zone of proximal development underlines a constitutive role of interaction. Against the background of specific requirements for development inside the learner, individual cognition and the social environment presuppose each other. The individual stage of development influences the structure of the educational environment, while the environment directs "the course that development takes" (Moshman, 1982, p. 375). This interrelation between endogenous and exogenous sources of knowledge is characterized by dialectical constructivism. According to this theoretical viewpoint, social interaction is not just a contextual or an enabling factor, it constitutes individual cognition (Jaegher, Di Paolo and Gallagher, 2010). Social interaction becomes a part of the cognitive process itself. An important view on (CS)CL which goes along with such an interrelated conception of individual learning and social interaction is the approach of distributed cognition (Hutchins, 1995). Along similar lines to group cognition (Stahl, 2006), distributed cognition emphasizes the dialectical and constitutive relation between individual cognition and the social or socio-technical environment (e.g. the speed bug within an airplane). In other words, the group product and particularly cognitive processes cannot be traced back to individual cognitive processes (endogenous) or the social environment itself (exogenous). It is a reciprocal, dialectical composition of both. Therefore the group product cannot be attributed to the actions of the individuals, but must be attributed to the group as a whole. Furthermore, cognitive phenomena cannot be described exhaustively by individual processes, nor solely by social interaction, but must be conceptualized as a complex interplay of both. Most approaches which stress the synergistic and dialectic characterization of social interaction use the term collaboration. According to Beers, Boshuizen, Kirschner and Gijselaers (2005), the enabling characterization of social interaction focuses on the development of common ground and shared knowledge, formed through negotiation and knowledge exchange. In contrast, the product of a constitutive and therefore dialectical process particularly stresses the construction of new knowledge as a result of a synergistic integration. Theoretical approaches like social interdependence theory (Deutsch, 1949) describe social interaction as an enabling factor for individual cognition. In contrast to endogenous constructivism (e.g. Piaget, 1977), approaches as distributed cognition (Hutchins, 1995) are related to dialectical constructivism, and the assumption that social interaction is a constitutive part of the cognitive process itself.

Conclusion

The purpose of this paper was to categorize theoretical accounts of (CS)CL concerning their underlying definitions of social interaction and constructivism. Both aspects are central to understanding 'collaborative learning'. Social interaction can enable or constitute individual cognitive processes. These roles of social interaction are linked to the versions of constructivism identified by Moshman (1982). We stress that theories within CSCL research can be categorized concerning both aspects. This categorization may be the first step towards a framework that allows integrating the diverse theories of (CS)CL. Though this goal of integration cannot be realized in this paper, we were able to point out the two central roles of social interaction concerning cooperative and collaborative learning. In addition we linked these roles to the versions of constructivism suggested by Moshman (1982). In doing so, we found indications for the assumption that the reason for the sometimes controversial usage of the terms cooperation and collaboration could exist because of its controversial relation concerning social interaction. Dillenbourg (1999) for example argues that cooperation relates to the division of labor, while collaboration is related to working together, not individually by solving sub-tasks. He also developed some conditions for collaboration, for example the "symmetry of knowledge". Individuals should have a common ground concerning knowledge in order to collaborate. According to that, we claim that cooperation can be used in order to generate a common ground. The process of cooperation, starting with finding out who knows what, hence resulting in division of labor and finally learning with the additive product, enables a common ground. Cooperation then can be seen as an optional sub-process of collaboration, which takes place if the symmetry of knowledge is not assured. Summed up, social interaction has an enabling role within cooperation: it enables the common ground, by dividing the work and finding out, who knows what.

The knowledge construction though is an individual process, yet the product is additive and gives each individual the ability to again construct knowledge individually in order to generate the common ground needed for collaboration.

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