

Toward a dialectic relation between the results in CSCL: Three critical methodological aspects of content analysis schemes

4
5
6

Marc Clarà · Teresa Mauri

7

Received: 30 June 2009 / Accepted: 2 December 2009

8

© International Society of the Learning Sciences, Inc.; Springer Science+Business Media, LLC 2009

9

Abstract The research field of Computer-Supported Collaborative Learning (CSCL) includes a large variety of approaches which present significant theoretical and methodological differences. This diversity complicates the articulation of the knowledge that is produced within this investigative framework. The paper addresses this problem from a dialectic view. We propose that the main reason for this problem is not the theoretical and methodological diversity itself, but rather the difficulty of situating one specific result within this diversity in a way that makes dialectic relations between results visible and mutual transformation of the approaches possible. In the present paper, we propose a set of indicators, applicable to content analysis approaches, aimed to facilitate this reciprocal positioning of the results in the field. These indicators come from what we term “critical methodological aspects”: those aspects of the methodological infrastructure that are directly related to theoretical positions. We consider three critical methodological aspects in content analysis schemes: the units of analysis, the relations to be established, and the dimensions of analysis. Indicators regarding these aspects are proposed and defined, and their use for facilitating dialectical relations between results is exemplified by means of the examination of five specific approaches.

10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

Keywords CSCL · Content analysis · Critical methodological decisions · Dialectics

27
28

Introduction

29

This paper addresses the problem of the articulation of results in CSCL research. This field is characterized by a wide theoretical and methodological diversity between the various approaches. This diversity, we propose, is an intrinsic feature of the field; it arises from the

30
31
32

M. Clarà (✉) · T. Mauri

Department of Developmental and Educational Psychology, University of Barcelona,
Passeig de la Vall d'Hebron, 171, 08035 Barcelona, Spain
e-mail: marc.clara@ub.edu

T. Mauri

e-mail: teresamauri@ub.edu

Q1

very genesis and nature of the field itself. The field of CSCL refers to a set of theoretical, methodological and empirical approaches to the situations of teaching and learning which involve some type of collaborative use of the information and communication technology (ICT). Therefore, what defines the field is the object of study—a specific use of ICT in teaching and learning situations—not the theoretical view of this object, or the way of analysing it. That is why the approaches to this object can be theoretically and methodologically very diverse.

Theoretically, it can be stated that the epistemological position of most approaches to CSCL is constructivist (Redmond and Lock 2006; Schellens and Valcke 2006), and that they conceive social interaction as a key element of learning (Stahl et al. 2006). Beyond these two statements, however, there are important differences between the theoretical premises of the approaches (Schellens and Valcke 2006; Stahl 2005; Woo and Reeves 2007). Recent literature has identified the need to create a clear and articulated theoretical basis for the field (Naidu and Järvelä 2006; Resta and Laferrière 2007). Methodologically, it seems clear that the majority of the approaches analyze, in one way or another, the interaction between participants. For this purpose, content analysis is widely used in the CSCL field (Strijbos and Stahl 2007). According to Krippendorff (1980, p. 21), content analysis is “a research technique for making replicable and valid inferences from data to their context.” This technique permits the transformation of qualitative aspects of text or communication into manipulable codes that can be treated by quantitative procedures. This specificity, which is the main potentiality of the technique, situates content analysis in between pure quantitative and qualitative approaches to social sciences (Woodrum 1984). Between these two poles is a large spectrum of approaches that use content analysis in very different ways. This is the case also in the CSCL field, and as a consequence, the content analysis schemes used in the field present major differences (Resta and Laferrière 2007).

Furthermore, the recent literature has highlighted deficiencies in the validity of the content analysis instruments used in CSCL (Rourke and Anderson 2004). For the purpose of the present paper, the deficiencies in what can be called *construct validity* (in more quantitative approaches) or *content validity* (in more qualitative approaches) are especially important. By construct/content validity, we mean the coherence between the analytical infrastructure of an approach and the theoretical constructs or phenomenon that this infrastructure tries to describe (Rourke and Anderson 2004; Krippendorff 1980). The lack of construct/content validity makes the articulation of knowledge in a scientific field especially difficult. The deficiencies in this type of validity lead to the mislocation of results in relation to the theoretical elaboration of the field, because the empirical answers of an approach may not correspond to its theoretical questions. These deficiencies have been identified in CSCL by several authors (e.g., Rourke and Anderson 2004; Weinberger and Fischer 2006). After a review of content analysis schemes in CSCL research, De Wever et al. (2006, p. 23) concluded that:

Although elements of the theoretical background are mentioned in all cases, not all studies present a clear link between the theory and the instruments. In this respect, the importance of systematic coherence is to be stressed. Some instruments elaborate the operational definition of theoretical concepts, while this is missing in other instruments. From the overview it is also clear that a number of researchers build on earlier work, but at the empirical level, links are hardly made between the new and previous analysis approaches.

With this state of affairs, several authors have stressed the difficulty of building knowledge in the field of CSCL (Resta and Laferrière 2007; Suthers 2006). In the present

paper, we will try to address this difficulty from a dialectic approach. Our main argument is that the diverse approaches to the field must be related dialectically, since they share the same object of study. From this perspective, we propose that the problem of the articulation of the results in the CSCL field does not lie in the diversity of the field itself, but in the difficulty of reciprocally positioning the results in a way that identifies their theoretical and methodological tensions clearly and reliably, and permits the dialectic development of the approaches to the field. The aim of this paper is to offer a set of indicators which facilitate this reciprocal positioning of the results and, thus, the dialectic development of the field. These indicators are applicable to results from approaches that use content analysis to study the interaction.

The paper is in six sections (including this introduction). In the next section, we briefly present our epistemological understanding of the development of knowledge in a scientific field and define more exactly the aim of the paper. In the third and fourth sections, we propose a set of indicators, applicable to results from content analysis techniques, as a tool for locating results within the CSCL field and facilitating its dialectic development. In the fifth section, we offer an example of how these indicators can facilitate the reciprocal positioning of the results and contribute to the dialectic development of the approaches. Finally, we highlight the main ideas and limitations of our proposal.

A dialectic approach to the problem of construction of knowledge in CSCL

We understand dialectics in a Hegelian sense, as a tension between *different* entities which are inseparable and in constant mutual transformation. The crucial point of this view is that these tensions, or contradictions, are not external to things, but are internal to them and constitute the very essence of their existence: “a thing is anything ‘in itself’ only because it is something for other things, by acting or appearing in connection with something else” (Dietzgen, cited in Tolman 1981, p. 37). Thus, from a dialectic view, everything is inherently contradictory, and these internal tensions are the essence of the existence of the thing, of its motion, and of its development. Development is understood as “movement that is *self-movement*, i.e., movement originating in the contradictions (struggle of opposites) inherent in the developing entity” (Tolman 1981, p. 39). That is why from a dialectic perspective, synthesis is not the overcoming of tension, nor is it the reconciliation of opposites, but the constant relation and mutual transformation of opposites: It is the opposites in tension as an inseparable unity, as the essence of the existence of the thing (Tolman 1981, p. 43).

For the purpose of the present paper, the “thing” is the scientific field of CSCL. Our view of how dialectics can be used for understanding the development of a scientific field is strongly based on Vygotsky’s foundational work on this issue: *The Historical Meaning of the Crisis in Psychology: A Methodological Investigation* (Vygotsky 1997). An in-depth epistemological discussion about the development of the CSCL field is beyond the scope of this paper. For our purposes, however, we aim to stress here three main points that underlie our epistemological view. The first point is the necessity of the existence of theoretical tensions in the field as the essence of its existence. This idea argues against the dominance of one simple theoretical approach over the others in such a way that the theoretical tensions disappear. Vygotsky (1997, pp. 245–246), referring to psychoanalysis, behaviorism, Gestalt, and personalism in the psychology of the 1930s, wrote:

Each of these four ideas is extremely rich, full of meaning and sense, full of value and fruitful in its own place. But elevated to the rank of universal laws, they are worthy of

each other, they are absolutely equal to each other, like round and empty zeros. 129
 Stern's personality is a complex of reflexes according to Bekhterev, a Gestalt 130
 according to Wertheimer, sexuality according to Freud. [...] After all, to try and 131
 explain everything means to explain nothing. 132
 133

The second point to stress is that the results of different theoretical and methodological 134
 approaches cannot be directly and simply integrated. This claim is based upon the idea that 135
 results are not pure facts, but rather approaches to facts: 136

Any fact which is expressed in each of these three systems [psychoanalysis, 138
 behaviorism and subjective psychology] will, in turn, acquire three completely 139
 different forms. To be more precise, there will be three different forms of a single fact. 140
 To be even more precise, there will be three different facts. (Vygotsky 1997, p. 238) 141
 142

Therefore, a direct and simple integration of results from different approaches would 143
 lead to an eclectic theory, sustainable on the surface but inconsistent at its base. 144

The third important point is that different approaches are dialectically related because of 145
 the existence of colliding facts between them. The presence of a colliding fact does not 146
 permit the integration of results from different approaches, but it implies a dialectic tension 147
 between such results: 148

After all, we remember that the foreign principle penetrated into our science via a 149
bridge of facts, via really existing analogues. Nobody has denied this. [...] ...the 151
 critique of these facts, the critique of the principle itself, draws still other new facts 152
 into the scope of the science. The matter is not confined to the facts: the critique must 153
 provide an explanation for the colliding facts. The theories assimilate each other and 154
 on this basis the *regeneration* of a new principle takes place. (Vygotsky 1997, p. 280, 155
 original emphasis) 156
 157

So the dialectic tensions between results are the engine of the development (as self- 158
 movement) of the scientific field, the inherent internal contradictions that lead to its 159
 movement. We propose that in CSCL, these dialectic tensions are not visible enough, and 160
 this hinders the development of the field. In other words, it is not easy to see how a specific 161
 result has implications for specific results from different approaches. These implications can 162
 only be seen if the different results are reciprocally positioned in a clear and reliable way. 163

If we consider the results from CSCL approaches using content analysis, this reciprocal 164
 positioning cannot be done by means of their explicit theoretical postulates because of the 165
 lack of construct/content validity of some of the instruments used. Nor can the results be 166
 located from an exclusively methodological point of view—that is, reliability, sampling, 167
 validity, and so forth—because this does not permit a theoretical positioning. Our proposal 168
 is that there are certain aspects of the methodological infrastructure of analysis that are 169
 theoretically critical: There are certain methodological decisions that are a direct 170
 consequence of a specific theoretical position, be it explicit or not. These decisions, 171
 therefore, can be used as indicators for reciprocally locating the results of the field, by 172
 overcoming the problem of construct/content validity. 173

Three critical methodological aspects 174

In this section and the next one, we will propose a set of indicators aimed to facilitate the 175
 reciprocal location of the results from approaches that use content analysis in the CSCL 176
 field and, thus, the dialectic development of these approaches. Although our view of the 177

construction of knowledge in the field of CSCL is not limited to results from content analysis, the tool—the set of indicators—that we propose in the present paper is only applicable to results of this kind. This set of indicators is proposed based on the idea that the decisions about certain methodological aspects of an approach are directly related to specific theoretical postures. Thus, the specific decisions of an approach to these critical methodological aspects tell us a great deal about the (actual) theoretical postulates of the approach. Because a result comes directly from the application of the methodological infrastructure, this result responds theoretically to the postulates embodied in this infrastructure. In the present section, we will propose three critical methodological aspects of content analysis schemes. These aspects are not our indicators; the indicators are the specific decisions about these aspects. In this section, we will argue why the specific decisions about these aspects can tell us a great deal about the theoretical position of approaches, and what information we can obtain from the examination of these decisions. In the next section, we will offer a set of possible specific decisions (indicators) regarding these aspects.

As we have said, the theoretical perspectives in the field of CSCL are many and varied. In fact, to some extent, they are incompatible. Broadly speaking, one can distinguish two major positions regarding the “theoretical level” in which learning is understood (Suthers 2006; Stahl 2005): theoretical perspectives that understand learning as an individual phenomenon, and theoretical perspectives that consider the group, the inter-mental activity, as the main agent of learning. According to Stahl (2005, p. 83), these two extremes constitute a continuum along which different perspectives can be located:

At one extreme of the spectrum, collaboration is only valued to the extent that it results in learning outcomes for individual minds. At the other extreme, collaborative learning can benefit a whole community of practice by developing cultural artefacts like theories. Intermediate positions may acknowledge that benefits accrue at group and individual levels in parallel, through reciprocal influences.

In addition to different positions regarding the nature of individual-group learning, in the field of CSCL there are also different positions with regard to the context in which learning takes place. On the one hand, there are different positions regarding the role given to the context in the learning process, which expand the continuum to individual-group-context. On the other hand, there are different positions on the conception of “context” itself. In this respect, Cole (1996) differentiates between two possible conceptualizations of the “context”: first, *the context as that which surrounds*, allowing a differentiation of levels of context that are more or less macro; and second, *“context” as that which intertwines*. In this last conceptualization of the “context,” emphasis is put on the dialectic relation between the “context” and the primary focus of analysis: The focus of analysis and the context are not separated but entwined, so that one is based on the other. These two conceptualizations can also be seen as two extremes of a continuum on which different approaches can be situated. At one extreme we find, in the field of CSCL, the approaches that address the technological design of the environment as an independent variable that influences learning. At the other extreme, we find those approaches that consider the context as intrinsic and constituent of the learning process.

The location of an empirical approach in the theoretical continuum individual-group-context has at least two fundamental impacts on the infrastructure of analysis: the unit of analysis, and the search for relations between these three “theoretical levels.”

The choice of the unit of analysis is a methodological decision that has direct theoretical implications. The consideration of the group as the key agent in learning implies using units

of analysis that include inter-mental activity. That means that the unit, the segment that is categorized, has to be a relation between different participants; it has to include an interaction between different people, and all this interaction has to be considered as a unit. Otherwise, if the unit is an action of a participant, then what is being considered theoretically in learning is the individual. The theoretical consideration of the context implies the use of units that include elements that go beyond the specific individual actions and inter-mental activity in which the analysis of learning process is focused (Arnsent and Ludvigsen 2006).

However, the theoretical discrepancies between different perspectives lie not only in which “theoretical levels” are considered, but also in how they are considered in relation to learning (Stahl 2005; Suthers 2006). Therefore, the relations that are sought between “theoretical levels” are also direct indicators of theoretical positions. If learning is understood as an individual process, the focus has to be on the individual level, but the other levels can be considered for relating them to what is happening in the individual. If, on the other hand, learning is understood as a group process, then the focus has to be on the group level; the individual level could be considered in order to explain what is happening in group learning. If, instead, learning is understood at the same time as an individual and group process, then these two levels have to be considered in an integrated way and bidirectional relations have to be sought.

Beyond the “theoretical levels” and their relations, there are also discrepancies in the conception of learning itself: Different theoretical positions disagree regarding the “theoretical elements” that they consider as crucial in the learning process. The theoretical positioning on this issue has a direct impact on the infrastructure of analysis: the choice of the dimensions of analysis. These dimensions of analysis are an operationalization of the “theoretical elements” that are considered relevant for the explanation of the phenomenon. This operationalization can take place in different ways (Gerbic and Stacey 2005), but the choice of a specific dimension in the analytic infrastructure always indicates a positioning with regard to the relevance of a “theoretical element.”

In summary, we propose that the methodological decisions in the analytic infrastructure about the units of analysis, the search for relations between theoretical levels, and the dimensions of analysis are valid indicators for the theoretical positioning of the empirical approaches to CSCL, and therefore, of their results as well.

Decisions regarding the critical methodological aspects: A set of indicators

As we stated in the previous section, the decisions about the three critical methodological aspects in the analytic infrastructure can be used as indicators for reciprocally locating specific results in the field of CSCL. In this section, we present and define generically some habitual decisions in CSCL analytic infrastructures concerning the unit of analysis, the relations that are sought between theoretical levels, and the dimensions of analysis. In the next section, we will offer an example of how these indicators can be used to facilitate the reciprocal positioning of specific results and permit the dialectical development of the field. The set of indicators based on the critical methodological aspects are offered in Table 1.

Decisions regarding the unit of analysis

As we mentioned in the previous section, the decisions about units of analysis indicate the “theoretical levels” that are considered in the conceptualization of learning processes. We

t1.1	Table 1 Set of indicators based on the three critical methodological aspects			
t1.2	Critical methodological aspects		Common alternatives in the field of CSCL	
t1.3	Units of analysis	Individual level	Posting	
			Conversational turn	t1.4
			Sentence	t1.5
			Unit of meaning	t1.6
			Argumentative move	t1.7
			Illocutionary act	t1.8
			Movement	t1.9
t1.10		Group level	Exchange	
			Discussion	t1.11
t1.12		Context level	Context associated with a posting	
t1.13	Search for relations between theoretical levels ^a	Inter-level	Context → group	
			Individual → group	t1.14
			Context → individual	t1.15
			Group → individual	t1.16
			Group ↔ individual	t1.17
t1.18		Intra-level	Individual → individual	
			Group → group	t1.19
t1.20		Elements regarding the nature of the meanings used by participants	Theme	
			Epistemological source	t1.21
t1.22		Elements regarding the interaction between participants	Negotiation of meanings	
			Perspective taking	t1.23
			Argumentation	t1.24
			Responsivity	t1.25
t1.26	Theoretical elements considered in the dimensions of analysis	Elements regarding the cognition of participants	Cognitive functioning	
			Critical thinking	t1.27
t1.28		Elements regarding the function of participants' actions in the learning process	Epistemic activity	
			Regulation of the learning process	t1.29
			Educational assistance	t1.30
t1.31		Elements regarding the context in which the interaction takes place	Community	
			Contextual resources	t1.32
			Pedagogical and technological design	t1.33

^a The arrows indicate the direction of the relations that are sought between theoretical levels

will establish that a unit of analysis is an indicator of the theoretical consideration of the individual level if it refers to an individual action. Otherwise, a unit of analysis will be an indicator of the theoretical consideration of the group level if it refers to a *relation* between individual actions of different participants. Finally, we will establish that a unit of analysis is an indicator of the theoretical consideration of the context level if the unit refers, not to participants' actions, but to elements of the environment or the situation in which such actions take place.

We offer below a compilation of ten units of analysis that are usual in the field of CSCL. Seven of these units are indicators of the individual level, two of them indicate the theoretical consideration of the group level, and one of them indicates the consideration of the context level. Because the designations of the same unit may vary in different approaches, we will adopt designations that we consider generic.

Units of analysis that indicate the theoretical consideration of the individual level

- 1) The *posting* is a unit of a technological nature. We define it as the entry of a text in an asynchronous written communication environment. Many approaches call this unit the “message” (see, e.g., De Wever et al. 2006; Rourke et al. 2001). However, we prefer “posting,” in order to avoid possible terminological confusions with other units of a semantic nature, or pragmatic nature, which some approaches also label as “message” (e.g., Coll et al. 1995). The use of “posting” as a unit of analysis is widespread in CSCL.
- 2) The *conversational turn*, unlike a posting, is a unit of analysis of a conversational nature. In a conversational interaction, the change of “conversational turn” is determined by the change, or the sign of a possible change, in the participants producing the discourse. Some authors consider the conversational turn and the posting as equivalent units (e.g., Vaughan and Garrison 2005). This unit is used, for example, by Beers et al. (2007b), or by Schrire (2006).
- 3) The *sentence* is a unit of analysis of a syntactic nature. Strijbos et al. (2006, p. 37) define the unit as “a sentence or part of a compound sentence that can be regarded as meaningful in itself, regardless of meaning of the coding categories.”
- 4) The *unit of meaning* is a unit of analysis of a semantic nature. It can be defined as the minimum unit in which a consistent “theme” or “idea” can be identified (De Wever et al. 2006, p. 9). This unit is used, for example, by De Laat et al. (2007).
- 5) The *argumentative move* is a unit of analysis of argumentative nature. It can be defined as the minimal unit that constitutes an argumentative claim. We can find an example in Weinberger and Fischer (2006).
- 6) The *illocutionary act* is a unit of analysis of a pragmatic nature. It is defined by Rourke et al. (2001) as the minimum unit with a defined purpose: A change in purpose sets the parameters for the unit. Some of the approaches that use this unit are Arvaja et al. (2007), or Pata et al. (2005).
- 7) The *movement* is a unit of analysis of a pragmatic nature. Following Wells (1999), it can be defined as the minimum unit with a complete interactive sense. It is the minimal unit of discourse by a locator that deserves a response from the interlocutor. This unit is used in the CSCL field by, for example, Schrire (2006).

Units of analysis that indicate theoretical consideration of the group level

- 8) The *exchange between conversational turns (or other individual actions)* is a unit of analysis of a conversational nature. It is defined as the set of conversational turns (or other individual actions) that respond to each other. This unit is used in CSCL, for example, by Schrire (2006), by Zemel et al. (2007), or by Zumbach, Reimann, and Koch (2006).
- 9) The *discussion* is a unit of analysis of a thematic nature. We define it as the interaction carried out by the different participants and which revolves around an element of the task. This unit is used by Häkkinen and Järvelä (2006), Stein et al. (2007), and Pata et al. (2005), among others.

<i>Units of analysis that indicate theoretical consideration of the context level</i>	327
10) The <i>context associated with a posting</i> is used as the unit of analysis by Arvaja et al. (2007). It can be defined as the characteristics of the environment which allow the comprehension of a participant's specific individual action.	328 329 330 331
Decisions regarding the search of relations between theoretical levels	332
As we have pointed out, another of the theoretical discrepancies in the field of CSCL is the kind of relations that are sought between "theoretical levels" in the analysis. With regard to this issue, we have divided the options into two groups: approaches that search for relations between different theoretical levels; and approaches that search for relations in the frame of one and the same theoretical level.	333 334 335 336 337 338
<i>Search for relations between different theoretical levels</i>	339
1) <i>Context level</i> → <i>Group level</i> . The search for relations of this kind implies understanding the learning process, at least in part, as a group process. This search indicates that theoretically it is considered that some aspects of the context level have a direct influence on learning, which takes place at the group level. We can find some examples in the approaches of Häkkinen and Järvelä (2006), Lai and Law (2006), or Zumbach et al. (2006).	340 341 342 343 344
2) <i>Individual level</i> → <i>Group level</i> . As in the previous case, the search for this relation implies situating the learning process in the group. This option indicates that it is considered that individual actions directly influence the group learning process. We can find some examples in the approaches of Mazzolini and Maddison (2007), and Pata et al. (2005).	345 346 347 348
3) <i>Context level</i> → <i>Individual level</i> . The search for this relation implies understanding the learning process, at least in part, as an individual process. This alternative indicates that theoretically it is considered that certain aspects of the context level have a direct influence on the learning that takes place at the individual level. This option is relatively widespread in the field of CSCL. Some examples are the approaches of De Wever et al. (2007), Jeong and Joung (2007), Puntambekar (2006), Sparatiu et al. (2007), and Schellens and Valcke (2006).	349 350 351 352 353 354 355
4) <i>Group level</i> → <i>Individual level</i> . As in the previous case, the search for this relation implies situating the learning process at the individual level. Nevertheless, this alternative indicates the theoretical consideration that the individual learns partly because of the group activity. Therefore, from this position, certain aspects in the group level may have a direct influence on individual learning.	356 357 358 359 360
5) <i>Group level</i> ↔ <i>Individual level</i> . This kind of search implies the consideration of learning as an individual and a group process at the same time. Relations between the group and individual levels are reciprocally considered. An example of this option can be found, partly, in Schrire (2006).	361 362 363 364
<i>Search for relations at one and the same theoretical level</i>	365
6) <i>Individual level</i> → <i>individual level</i> . Several approaches in CSCL explore the relations between different elements at the individual level. Examples can be found in Ho and Swan (2007), Tseng and Tsai (2007), and De Wever et al. (2007)	366 367 368
7) <i>Group level</i> → <i>group level</i> . There are also approaches that explore the relations between different elements at the group level. An example is the approach of Häkkinen and Järvelä (2006).	369 370 371

Decisions regarding the theoretical elements in the dimensions of analysis

372

As we argued in the third section, the choice of the dimensions of analysis is a consequence of the operationalization of the “theoretical elements” that are considered relevant for the explanation of the phenomenon. However, these elements may be gathered in the dimensions in very different ways. For example, two or more elements may be included in one and the same dimension, or one element may be operationalized as a sub-dimension of another element, and so forth. Moreover, dimensions that reflect the same “theoretical elements” often receive different names. For example, the theoretical element “negotiation of meanings” (see the definition below) is operationalized through different approaches by dimensions called “social construction of knowledge” (Gunawardena et al. 1997), or “interactivity” (Sparatiu et al. 2007), or “social modes of co-construction” (Weinberger and Fischer 2006). Another example is the approach of Schellens and Valcke (2006), in which the element “negotiation of meanings” is operationalized through the dimension “task-oriented communication” (p. 355). The first category of this dimension is “presentation of new information,” which is then subcategorized according to the theoretical element “epistemological source”—see the definition below—by using the categories “facts,” “experience,” and “theory.” Here we will not dwell on the different options of organization and designation of dimensions, but focus on the “theoretical elements” that, in one way or another, these dimensions reflect. Below we offer a set of “theoretical elements” that, in different combinations, are often considered by the field of CSCL in terms of the dimensions of analysis. We classify these elements in five groups: elements regarding the nature of the meanings used by participants; elements regarding the interaction between participants; elements regarding the cognition of the participants; elements regarding the function of actions in the learning process; and elements regarding the context of interaction. We will intentionally use generic designations and definitions that, therefore, admit different kinds of operationalization in the specific dimensions of each approach.

373
 374
 375
 376
 377
 378
 379
 380
 381
 382
 383
 384
 385
 386
 387
 388
 389
 390
 391
 392
 393
 394
 395
 396
 397

Theoretical elements regarding the nature of the meanings used by participants

398

- 1) *Theme*, referring to *which* meanings are the objects of the participants’ discussion. *Theme* is considered, for example, in the approach of Arvaja et al. (2007). One of the thematic categories used by these authors is “reading comprehension,” which the authors apply when they consider that this is the topic that the participants *are talking about*. In the paper, they offer the example of two different messages that are assigned with this category (p. 451). Other thematic categories used by these authors are “means to develop reading comprehension,” “concrete examples relating to means to develop reading comprehension,” and “different methods for teaching to read” (pp. 453–455).
- 2) *Epistemological source*, which refers to the epistemological basis that participants use to construct their statements. *Epistemological source* can be found, for example, in the approach of Häkkinen and Järvelä (2006), by means of a part of the dimension “types of messages.” In this example, the authors use the categories “theory” and “experience” in order to characterize which is the source of the meanings used by the participants—theory based or experience based (Häkkinen and Järvelä 2006, p. 437; see also Järvelä and Häkkinen 2002). Another example is in the approach of Schellens and Valcke (2006), which considers this element by means of a subcategorization of the category “presentation of new information,” which corresponds to the dimension “task-oriented communication” based on the proposal of Veerman and Veldhuis-Diermanse (2001). In this case, the categories used are “facts,” “experience,” and “theory” (Schellens and Valcke 2006, p. 355).

399
 400
 401
 402
 403
 404
 405
 406
 407
 408
 409
 410
 411
 412
 413
 414
 415
 416
 417
 418

Theoretical elements regarding the interaction between participants

419

- 3) *Negotiation of meanings*, which refers to *how* different participants consider other participants' meanings in order to discuss and co-construct individual and group meanings. The consideration of this element is widespread in the field of CSCL. Examples can be found in the approach of Sparatiu et al. (2007), via the dimension termed "interactivity" (p. 92), and in the approach of Lai and Law (2006), via the dimension termed "engagement in knowledge building" (p. 135), based on the categories of Gunawardena et al. (1997).
- 4) *Perspective taking*, which refers to the perspective toward the others from which the negotiation of meanings takes place. This element is not the same as the negotiation of meanings. Perspective taking is not about how participants consider the contributions of others to their own contributions, but how participants can think from the other's position and how they change (or not) the place or perspective for negotiating meanings. The approach of Häkkinen and Järvelä (2006), for example, considers this element by means of categories based on Selman's development of Piaget's ideas, which are defined in Järvelä and Häkkinen (2002, p. 21).
- 5) *Argumentation*, which refers to *how* the participants defend a specific position in relation to a meaning. Argumentation is considered, for example, in the approaches of Jeong and Joung (2007) with categories based on Toulmin's model of argumentation (p. 433), and in Weinberger and Fisher (2006), who also use categories based on Toulmin's model and other categories based on Leitaio (pp. 75–77).
- 6) *Responsivity*, which refers to the responsive relation between different participants' contributions. Some examples can be found in Mazzolini and Maddison (2007), who use categories such as "question," "answer," and "answer plus question" (p. 206) or in Schrire (2006), who uses categories based on Wells' (1999) version of the I-R-E conversational structure (Schrire 2006, p. 54, 60).

Theoretical elements regarding the cognition of participants

445

- 7) *Cognitive functioning*, which refers to the nature of mental processes. This element is considered, for example, in the approach of Schrire (2006, pp. 54–55), by means of the dimensions "level of cognitive processing," based on Bloom et al. (1956), and "structural complexity reflected in writing," based on the SOLO Taxonomy (Biggs and Collis 1982).
- 8) *Critical thinking*, which refers to the *process* of inquiry in which learners are involved when they learn. This is a central theoretical element, for example, of the proposals of Vaughan and Garrison (2005, p. 5), and Stein et al. (2007, p. 106), by means of the dimension "cognitive presence," based on Garrison et al. (2000). The categories used are "triggering event," "exploration," "integration of ideas," and "resolution" (Garrison et al. 2000, pp. 98–99).

Theoretical elements regarding the function of participants' actions in the learning process

458

- 9) *Epistemic activity*, which refers to the impact of an individual or group action in the resolution of the task. An example of the consideration of this element can be found in Weinberger and Fischer (2006), who use categories such as "construction of problem space," "construction of conceptual space," and "construction of relations between conceptual and problem space" (p. 74).
- 10) *Regulation of the learning process*, which refers to *how* the participants intervene with the intention of regulating or managing the process of collaborative learning. We

find an example in Beers et al. (2007b), who use “regulation of the problem solving-process” and “regulation of the conversation” as categories (pp. 431–432). Järvenoja and Järvelä (2009), instead, focus on the regulation of another specific aspect of learning, emotion, and categorize this regulation as “self-regulation,” “others-regulation,” or “shared-regulation” (p. 468).

- 11) *Educational assistance*, which refers to how the participants intervene with the intention of securing the success of the other participants in the learning process. The approach of Tseng and Tsai (2007), for example, reflects this element by means of the dimension “learning feedback,” based on the four categories of Chi (1996): corrective feedback, reinforcing, didactic, and suggestive (Tseng and Tsai 2007, p. 1167). Another example can be found in De Smet et al. (2008), which reflects this element by using the categories of Salmon (2000). These authors use categories as, for example, “support to socialization” or “support to knowledge construction” (De Smet et al. 2008, p. 210, 213).

Theoretical elements regarding the context in which the interaction takes place

- 12) *Community*, which refers to the collective nature of all the participants together in the interaction. It is considered, for example, in the approach of Stein et al. (2007), via the dimension “social presence” proposed by Rourke et al. (1999). These authors consider the nature of the community from the point of view of the nature of the responses between the members of this community. For example, Rourke et al. (1999) establish three categories for this purpose: affective responses, interactive responses, and cohesion responses. By considering the proportions of these three kinds of response in the collaboration, they characterize the nature of the community.
- 13) *Contextual resources*, which are “those aspects of the potential context that the participants make relevant in the ongoing activity” (Arvaja et al. 2007, p. 450). An example of the consideration of this theoretical element in a CSCL approach can be found in Arvaja et al. (2007), who uses the categories proposed by Linell (1998): co-text, surrounding concrete situation and background knowledge (Arvaja et al. 2007, p. 451).
- 14) *Pedagogical and technological design*, which refers to the aspects of the instructional design. It is considered by most of the approaches to CSCL, sometimes as an independent variable (e.g., De Wever et al. 2007; Jeong and Joung 2007; Sparatiu et al. 2007; Strijbos et al. 2007; Zumbach et al. 2006). This element is, in general, not included in the content analysis scheme, but is considered in the analytical infrastructure by the vast majority of approaches to CSCL that use content analysis. Variables that are usually considered are the type of communication (synchronous or asynchronous), the group size, the level of pre-structuring of the interaction, and technological support.

In the following section, we examine five approaches to CSCL via the indicators we have just established regarding the critical methodological aspects.

The critical methodological aspects: An example

The aim of this section is to try to illustrate how to use the indicators we have proposed and to show how they can help the dialectic development of approaches. Our intention is to show how apparently theoretically distant approaches are in dialectic relation, and how apparently theoretically close approaches embody important differences that have to be

taken into account for relating their respective results. For this reason, we have selected two approaches based on very similar explicit theoretical positions, and three others that are based on different explicit theoretical postulates.

The approaches that we will examine here are the following: the approach of Schrire (2004, 2006), clearly based on Vygotskian postulates; the approach of Garrison and colleagues (Garrison et al. 2000; Garrison and Arbaugh 2007), based on Dewey and Communities of Inquiry; the approach of Weinberger and colleagues (Weinberger and Fischer 2006; Weinberger et al. 2005), based on Toulmin, Leita, and argumentative discourse; the approach of Pata and colleagues (Pata et al. 2005), based on the concept of common ground; the approach of Beers and colleagues (Beers et al. 2005, 2007b; Beers et al. 2007a), also based on the concept of common ground.

Let us consider the analytic infrastructure of these five approaches by means of the indicators that we have established (Table 2). With regard to the “theoretical levels,” we can see that two approaches (Schrire & col. and Pata & col.) consider individual and group levels. Two other approaches (Beers & col. and Weinberger & col.) consider individual and context levels. Finally, one approach (Garrison & col.) considers only the individual level. Regarding the “search for relations between theoretical levels,” we can observe that the two approaches that consider the context level (Beers & col. and Weinberger & col.) search for direct effects from the context level to the individual level. On the other hand, the two approaches that consider the group level (Schrire and Pata & col.) search for differentiated relations: While Pata and colleagues search for direct effects from the individual level to the group level, Schrire, fundamentally, searches for relations in the opposite direction, from the group level to the individual, though with regard to “responsivity,” the relations are considered bidirectionally. Finally, the approach of Garrison and colleagues searches for reciprocal relations between the elements that are considered at the individual level.





These two indicators, then, already allow us to place the five approaches on the theoretical spectrum that we suggested in the third section of this paper. At one end of the spectrum, the approach of Garrison and colleagues situates learning fundamentally in the individual (although in their explicit theoretical postulates, the group level plays an important role). The approaches of Beers and colleagues, and Weinberger and colleagues also situate learning, fundamentally, in the individual, but they consider that the context level (understood as an independent variable) has a direct influence on this individual learning. Going along the spectrum, we find the approach of Schrire, which also situates learning in the individual, but which considers this learning to be closely related with the group. At the other extreme of the spectrum, we find the approach of Pata and colleagues, which situates learning in the group, and which considers the individual as an agent engaged in this group learning. In this way, the five approaches are reciprocally situated in the spectrum drawn by our first two indicators. Thus, for example, we can observe how the approaches of Pata and colleagues, and Beers and colleagues, although based on close explicit theoretical positions, are situated at a considerable distance. In contrast, the approaches of Beers and colleagues, and Weinberger and colleagues, which, in principle, are more distant theoretically, are situated close together.

Although this positioning of the approaches is needed to make their dialectic development possible, it is not yet sufficient. Learning, as we said, can be conceptualized considering very different elements or processes. The dialectic relation between different approaches is only possible from the consideration of shared elements of study, even if only partially or generically. Our third indicator, therefore, is crucial in order to make this dialectic development possible.

With regard to this third indicator, Table 2 shows that two approaches (Schrire and Garrison & col.) share “critical thinking” as a theoretical element. Two approaches

t2.1

Table 2 Application of indicators on five specific approaches to CSCL

	Units of analysis		Theoretical elements	Search of relations ^a
	Theoretical level	Unity		
Schrire	Individual level	Movement	Responsivity	Ind. 
		Conversational turn	Cognitive functioning	
			Critical thinking	
	Group level	Exchange between conversational turns	Responsivity	Gr.
Garrison & col.	Individual level	Posting / Conversational turn	Critical thinking	Ind.
			Community	Ind.
			Educational assistance	Ind.
Weinberger & col.	Individual level	Thematic segment	Epistemic activity	Ind. 
		Argumentative movement	Argumentation	
			Negotiation of meanings	
	Contextual level	(Content analysis is not used)	(Scripts are used)	Con.
Pata & col.	Individual level	Illocutionary act	Negotiation of meanings	Ind. ↔ Ind. 
			Regulation of the learning process	
			Educational assistance	
	Group level	Discussion	Negotiation of meanings	Gr.
Beers & col.	Individual level	Posting / Conversational turn	Negotiation of meanings	Ind. 
			Regulation of the learning process	
	Context level	(content analysis is not used)	(scripts are used)	Con.

^a The arrows indicate the relations that are sought between theoretical levels and the direction of these relations

(Garrison & col. and Pata & col.) share “educational assistance” as a theoretical element. Three approaches (Weinberger & col., Pata & col., and Beers & col.) share the theoretical element of “negotiation of meanings.” Two approaches (Pata & col. and Beers & col.) share the element of “regulation of the learning process.” Finally, two approaches (Weinberger & col. and Pata & col.) share the use of scripts.

These five elements are the nodes from which these five approaches can enter into dialectic tension. It is a tension because they are different approaches, which, as the first two indicators show, are theoretically situated in very different places.

This means that one approach cannot directly assume the results of another approach regarding a shared element. However, this approach can and should consider them in order to challenge their own results and theoretical postulates. CSCL cannot be a field with a unitary, integrated theoretical frame, in the same way as psychology cannot be (i.e., because genetic epistemology, cultural-historical psychology, cognitivism, etc., cannot be integrated) and physics cannot be either (because relativity theory and quantum mechanics cannot be integrated). We need to move not toward an integrated field but toward a field in which the results of the different approaches challenge each other.

By means of the tensions between the approaches of Weinberger and colleagues, Pata and colleagues, and Beers and colleagues regarding the theoretical element of “negotiation of meanings,” we will try to briefly illustrate how these results might challenge each other. Table 3 summarizes some of the results of these three approaches. All results are extracted from the analysis of interactions in synchronous written communication.

These results permit two kinds of tensions. Firstly, the results of the approaches of Weinberger and colleagues, and Beers and colleagues are in a “non-challenging” tension, because, as we saw with our two first indicators, they are situated very close together. That is, the tension between the results does not represent a strong challenge for the theoretical positions behind each approach. In contrast, the tension between the results of these two approaches and the approach of Pata and colleagues is indeed “challenging”: It obliges us to question some of the theoretical principles of all the approaches involved in the relation.

Let us examine, first, the “non-challenging” tensions between the results of Weinberger et al. (2006) and Beers et al. (2005, 2007a). Essentially, the results of both approaches indicate that the use of certain scripts has implications for the negotiation of meanings at the individual level. The nuances are different, but they can be complementary. Weinberger and colleagues, for example, building on the results of Beers et al. (2005, 2007a) about the importance of coercion in scripts, could introduce different levels of coercion in their scripts without causing even a minimal change in their theoretical-methodological principles.

Table 3 Summary of some of the results of three approaches about negotiation of meanings

Weinberger et al. (2006)	Beers et al. (2005, 2007b)	Pata et al. (2005)
One of the scripts used has positive effects on the negotiation of meanings, but at the same time, has negative effects on argumentation.	The more coercive the script, the greater the amount of negotiation of meanings (number of “verification” and “clarification” postings)	Certain negotiation actions by a participant (instructions, content-related prompts) promote certain negotiation actions by other participants (judgements, arguments, content-related agreements and disagreements)
		There is a positive relation between patterns of individual actions (tutoring styles) and the negotiation of meanings in the group level (ownership)

Beers and colleagues, meanwhile, could also accept without many theoretical problems that a script designed to promote the negotiation of meanings could prejudice other aspects of the interaction involved in learning.

However, despite being a non-challenging tension, the relation is dialectic: there cannot be a direct integration of the results. Although Beers and colleagues, for example, could consider that the application of their scripts might negatively affect other important elements in learning, it is not so clear that these authors consider that one of these elements is argumentation, nor that they do so in the same conceptualization as Weinberger and colleagues. It is precisely this dialectic relation, this tension between perspectives, that can open potential paths of development for both approaches. For Weinberger and colleagues, it can open the path of the consideration of scripts with variable coercion, although not the same scripts as Beers and colleagues nor probably the same kind of coercion. For Beers and colleagues, it can open the path of the consideration of the collateral effects of their scripts, although not necessarily searching for these effects in argumentation. It is in the dialectic relations between different perspectives where the main engine for their development can be found.

However, if the “non-challenging” tensions are powerful for this purpose, even more powerful are the “challenging” tensions. In this connection, let us consider the tension between the results of Pata et al. (2005) on one hand, and Weinberger et al. (2006) and Beers et al. (2005, 2007a) on the other. The results of Pata et al. (2005) show that the participant’s actions of negotiating meaning influence the forms of negotiation of meanings of the other individuals, and of the whole group.

The results of Pata et al. (2005) oblige us to reflect on the meaning of the results of Beers et al. (2005, 2007a) and Weinberger et al. (2006). If each participant’s actions of negotiating meanings are interdependent of those of the other participant, then the negotiation of meanings categorized by Weinberger and colleagues, and Beers and colleagues also has to be a consequence, to some extent, of this interdependence, of what a participant *decides* to write as a response to another participant. A number of questions then arise. For example, how do Beers and colleagues, and Weinberger and colleagues conceptualize this agency? Is it controlled by the script and, therefore, there is no need to consider it? Does it have to be considered as a second explicative principle of the negotiation of meanings? If it does, how is it related to the context level?

Meanwhile, the results of Weinberger et al. (2006) and Beers et al. (2005, 2007a) oblige us also to reflect on the significance of the results of Pata et al. (2005). If the context level, by means of the use of scripts, has such a strong influence on participants’ negotiation of meanings, the negotiation of meanings categorized by Pata and colleagues must also be influenced, to some extent, by the context in which this negotiation took place—in which, incidentally, Pata and colleagues also used flexible scripts, though the authors do not consider them as an object of study and do not mention them in the results. Thus, a number of questions also arise regarding the conceptualization of Pata and colleagues. For example, might the agency be dependent on the context? If not, what is the relation between agency and context? How is the context conceptualized in relation to the group and individual?

Once again, it is clear that the results cannot be integrated, because the perspectives from which they are obtained cannot be integrated. Nevertheless, the potential of the dialectic relation between these results for the development of the different approaches is clear. Now, this potential is much deeper. It concerns the theoretical development of approaches: The results of a different approach become a theoretical challenge to one’s own approach. Thus, the results of Pata and colleagues oblige Weinberger and colleagues, and Beers and

colleagues to consider agency and to situate it theoretically in their own conceptualization. The results of Weinberger and colleagues, and Beers and colleagues oblige Pata and colleagues to consider the context and to situate it theoretically in their own conceptualization.

It is by means of this kind of dialectic relations that the results can be articulated within the theoretical and methodological diversity of the field of CSCL: not as an integrated and unitary whole, but as a set of reciprocally situated and dialectically related perspectives. It is in these dialectic relations where, in our view, the main engine for the development of the field of CSCL should be located.

In this section, we have tried to show that the indicators we propose can be useful in facilitating these dialectic relations between results. These indicators, as we have tried to exemplify, make it possible to situate reciprocally the results of two or more different approaches from the instruments of content analysis used—overcoming the possible problem of the construct/content validity of these instruments—and to identify shared theoretical elements from which the different approaches can enter into dialectic tension.

Conclusions

The problem that we have tried to address in this paper is the difficult articulation of the results produced in the field of CSCL, in which there is large-scale theoretical and methodological diversity. We propose that these results cannot be directly integrated for the same reason that the different theoretical perspectives from which the results are obtained cannot be integrated. Our proposal is that the different theoretical perspectives, by means of their results, must be dialectically related. In our view, it is in the existence of these dialectic relations that the main potential for the development of the field of CSCL lies.

In order to contribute in this direction, we propose a set of indicators aimed at facilitating the reciprocal positioning of results from approaches that use content analysis and their dialectic development. These indicators are based on what we have termed “critical methodological aspects,” and are applied on the instruments of content analysis used by the different approaches. We have exemplified how these indicators can be useful for the dialectic development of the field. However, this tool also presents several limitations. The most important one is that these indicators can only be applied to results from approaches that use content analysis. Although content analysis is widely used in CSCL research, there are also approaches that do not use this technique. So we need to be able to relate dialectically results from content analysis approaches with results from approaches that do not use content analysis. Another limitation of the tool is that the set of indicators that we propose are not exhaustive. Although we think that the vast majority of approaches to CSCL using content analysis can be characterized by means of the tool, there may be specific decisions about the three methodological aspects that are not included in the tool as indicators, and especially, there will be decisions by approaches in the future that will be different from those that have been considered in this tool. Therefore, the tool is not something finished, but something that should be completed and expanded in the future, always by ensuring the exclusivity of the different indicators.

Despite these limitations, we think that this tool is useful for starting to address the problem of construction of knowledge in the CSCL field from a dialectic view, as we have tried to show in the fifth section. We believe that this problem is in need of urgent attention. The emphasis on the dialectic relations between different perspectives is, in our opinion, a promising line for the CSCL field to follow.

Acknowledgments This study was supported by the “Departament d’Educació i Universitats de la Generalitat de Catalunya,” the European Social Fund, and the GRINTIE research group at the University of Barcelona. We are deeply grateful to the anonymous reviewers of the previous versions of this paper for their detailed and challenging feedback. Thanks also to Sanna Järvelä for her helpful comments.

References

- Amseth, H. C., & Ludvigsen, S. (2006). Approaching institutional contexts: systemic versus dialogic research in CSCL. *Computer-Supported Collaborative Learning, 1*, 167–185.
- Arvaja, M., Salovaara, H., Häkkinen, P., & Järvelä, S. (2007). Combining individual and group-level perspectives for studying collaborative knowledge construction in context. *Learning and Instruction, 17*, 448–459.
- Beers, P. J., Boshuizen, H. P. A., Kirschner, P. A., & Gijsselaers, W. H. (2005). Computer support for knowledge construction in collaborative learning environments. *Computers in Human Behavior, 21*, 623–643.
- Beers, P. J., Kirschner, P. A., Boshuizen, H. P. A., & Gijsselaers, W. H. (2007a). ICT-support for grounding in the classroom. *Instructional Science, 35*, 535–556.
- Beers, P. J., Boshuizen, H. P. A., Kirschner, P. A., & Gijsselaers, W. H. (2007b). The analysis of negotiation of common ground in CSCL. *Learning and Instruction, 17*, 427–435.
- Biggs, J. B., & Collis, K. F. (1982). *Evaluating the quality of learning: The SOLO Taxonomy*. New York: Academic.
- Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives—the classification of educational goals, handbook 1 cognitive domain*. London: Longman Group.
- Chi, M. T. H. (1996). Constructing self-explanations and scaffolded explanations in tutoring. *Applied Cognitive Psychology, 10*, 33–49.
- Cole, M. (1996). *Cultural psychology. A once and future discipline*. Cambridge: Belknap Press of Harvard University Press.
- Coll, C., Colomina, R., Onrubia, J., & Rochera, M. J. (1995). Actividad conjunta y habla: Una aproximación a los mecanismos de influencia educativa [Joint activity and speech: An approach to the mechanisms of educational influence]. In P. Fernández Berrocal, & M. A. Melero (Comps.), *La interacción social en contextos educativos* (pp. 193–326). Madrid: Siglo XXI.
- De Laat, M., Lally, V., Lipponen, L., & Simons, R.-J. (2007). Online teaching in networked learning communities: a multi-method approach to studying the role of the teacher. *Instructional Science, 35*, 257–286.
- De Smet, M., Van Keer, H., & Valcke, M. (2008). Blending asynchronous discussion groups and peer tutoring in higher education: an exploratory study of online peer tutoring behaviour. *Computers & Education, 50*, 207–223.
- De Wever, B., Schellens, T., Valcke, M., & Van Keer, H. (2006). Content analysis schemes to analyze transcripts of online asynchronous discussion groups: a review. *Computers & Education, 46*, 6–28.
- De Wever, B., Van Keer, H., Schellens, T., & Valcke, M. (2007). Applying multilevel modelling to content analysis data: methodological issues in the study of role assignment in asynchronous discussion groups. *Learning and Instruction, 17*, 436–447.
- Garrison, D. R., Anderson, T., & Archer, W. (2000). Critical inquiry in a text-based environment: computer conferencing in higher education. *Internet and Higher Education, 2*(2–3), 87–105.
- Garrison, D. R., & Arbaugh, J. B. (2007). Researching the community of inquiry framework: review, issues, and future directions. *Internet and Higher Education, 10*, 157–172.
- Gerbic, P., & Stacey, E. (2005). A purposive approach to content analysis: designing analytical frameworks. *Internet and Higher Education, 8*, 45–59.
- Gunawardena, Ch N, Lowe, C. A., & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research, 17*(4), 397–431.
- Häkkinen, P., & Järvelä, S. (2006). Sharing and constructing perspectives in web-based conferencing. *Computers & Education, 47*, 433–447.
- Ho, C.-H., & Swan, K. (2007). Evaluating online conversation in an asynchronous learning environment: an application of Grice’s cooperative principle. *Internet and Higher Education, 10*, 3–14.
- Järvelä, S., & Häkkinen, P. (2002). Web-based cases in teaching and learning—the quality of discussions and a stage of perspective taking in asynchronous communication. *Interactive Learning Environments, 10*, 1–22.

- Järvenoja, H., & Järvelä, S. (2009). Emotion control in collaborative learning situations: do students regulate emotions evoked by social challenges? *British Journal of Educational Psychology*, 79, 463–481.
- Jeong, A., & Joung, S. (2007). Scaffolding collaborative argumentation in asynchronous discussions with message constraints and message labels. *Computers & Education*, 48, 427–445.
- Krippendorff, K. (1980). *Content analysis. An introduction to its methodology*. Beverly Hills: Sage.
- Lai, M., & Law, N. (2006). Peer scaffolding of knowledge building through collaborative groups with differential learning experiences. *Journal of Educational Computing Research*, 35(2), 123–144.
- Linell, P. (1998). *Approaching dialogue. Talk, interaction and contexts in dialogical perspectives*. Amsterdam: John Benjamins.
- Mazzolini, M., & Maddison, S. (2007). When to jump in: the role for the instructor in online discussion forums. *Computers & Education*, 49, 193–213.
- Naidu, S., & Järvelä, S. (2006). Analysing CMC content for what? *Computers & Education*, 46, 96–103.
- Pata, K., Sarapuu, T., & Lehtinen, E. (2005). Tutor scaffolding styles of dilemma solving in network-based role-play. *Learning and Instruction*, 15, 571–587.
- Puntambekar, S. (2006). Analysing collaborative interactions: divergence, shared understanding and construction of knowledge. *Computers & Education*, 47, 332–351.
- Redmond, P., & Lock, J. V. (2006). A flexible framework for online collaborative learning. *Internet and Higher Education*, 9, 267–276.
- Resta, P. E., & Laferrière, T. (2007). Technology in support of collaborative learning. *Educational Psychology Review*, 19, 65–83.
- Rourke, L., & Anderson, T. (2004). Validity in quantitative content analysis. *Educational Technology Research and Development*, 52, 5–18.
- Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (1999). Assessing social presence in asynchronous text-based computer conferencing. *Journal of Distance Education*, 14(2), 50–71.
- Rourke, L., Anderson, T., Garrison, D. R., & Archer, W. (2001). Methodological issues in the content analysis of computer conference transcripts. *International Journal of Artificial Intelligence in Education*, 12(1), 8–22.
- Salmon, G. (2000). *A model for CMC in education and training. E-moderating. The key to teaching and learning online*. London: Kogan Page.
- Schellens, T., & Valcke, M. (2006). Fostering knowledge construction in university students through asynchronous discussion groups. *Computers & Education*, 46, 349–370.
- Schrire, S. (2004). Interaction and cognition in asynchronous computer conferencing. *Instructional Science*, 32, 475–502.
- Schrire, S. (2006). Knowledge building in asynchronous discussion groups: going beyond quantitative analysis. *Computers & Education*, 46, 49–70.
- Sparatiu, A., Hartley, K., Schraw, G., Bendixen, L. D., & Quinn, L. F. (2007). The influence of the discussion leader procedure on the quality of arguments in online discussions. *Journal of Educational Computing Research*, 37(1), 83–103.
- Stahl, G. (2005). Group cognition in computer-assisted collaborative learning. *Journal of Computer Assisted Learning*, 21, 79–90.
- Stahl, G., Koschmann, T., & Suthers, D. D. (2006). Computer-supported collaborative learning. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 409–425). Cambridge: Cambridge University Press.
- Stein, D. S., Wanstreet, C. E., Glazer, H. R., Engle, C. L., Harris, R. A., Johnston, S. M., et al. (2007). Creating shared understanding through chats in a community of inquiry. *Internet and Higher Education*, 10, 103–115.
- Strijbos, J. W., & Stahl, G. (2007). Methodological issues in developing a multi-dimensional coding procedure for small-group chat communication. *Learning and Instruction*, 17, 394–404.
- Strijbos, J. W., Martens, R. L., & Jochems, W. M. G. (2004). Designing for interaction: six steps to designing computer-supported group-based learning. *Computers & Education*, 42, 403–424.
- Strijbos, J. W., Martens, R. L., Prins, F. J., & Jochems, W. M. G. (2006). Content analysis: what are they talking about? *Computers & Education*, 46, 29–48.
- Strijbos, J. W., Martens, R. L., Jochems, W. M. G., & Broers, N. J. (2007). The effect of functional roles on perceived group efficiency during computer-supported collaborative learning: a matter of triangulation. *Computers in Human Behavior*, 23, 353–380.
- Suthers, D. D. (2006). Technology affordances for intersubjective meaning making: a research agenda for CSCL. *Computer-Supported Collaborative Learning*, 1, 315–337.
- Tolman, C. (1981). The metaphysic of relations in Klaus Riegel's "Dialectics" of human development. *Human Development*, 24, 33–51.
- Tseng, S.-C., & Tsai, C.-C. (2007). On-line peer assessment and the role of the peer feedback: a study of high school computer course. *Computers & Education*, 49, 1161–1174.

- Vaughan, N., & Garrison, D. R. (2005). Creating cognitive presence in a blended faculty development community. *Internet and Higher Education*, 8, 1–12. 807
- Veerman, A., & Veldhuis-Diermanse, E. (2001). Collaborative learning through computer-mediated communication in academic education. In P. Dillenbourg, A. Eurelings, & K. Hakkarainen (Eds.), *European perspectives on computer-supported collaborative learning. Proceedings of the first European conference on CSCL* (pp. 625–632). Maastricht: McLuhan Institute, University of Maastricht. 809
- Vygotsky, L. S. (1997). The historical meaning of the crisis on psychology: A methodological investigation. In R. W. Rieber & J. Wollock (Eds.), *The collected works of L.S. Vygotsky. Volume 3. Problems of the theory and history of psychology* (pp. 233–343). New York: Plenum. 810
- Weinberger, A., & Fischer, F. (2006). A framework to analyze argumentative knowledge construction in computer-supported collaborative learning. *Computers & Education*, 46, 71–95. 811
- Weinberger, A., Fischer, F., & Stegmann, K. (2005). Computer-supported collaborative learning in higher education: Scripts for argumentative knowledge construction in distributed groups. *Proceedings of the 2005 conference on computer support for collaborative learning* (pp. 717–726). 812
- Wells, G. (1999). *Dialogic inquiry: Towards a sociocultural practice and theory of education*. Cambridge: Cambridge University Press. 813
- Woo, Y., & Reeves, T. C. (2007). Meaningful interaction in web-based learning: a social constructivist interpretation. *Internet and Higher Education*, 10, 15–25. 814
- Woodrum, E. (1984). “Mainstreaming” content analysis in social science: methodological advantages, obstacles, and solutions. *Social Science Research*, 13, 1–19. 815
- Zemel, A., Xhafa, F., & Cakir, M. (2007). What’s in the mix? Combining coding and conversation analysis to investigate chat-based problem solving. *Learning and Instruction*, 17, 405–415. 816
- Zumbach, J., Reimann, P., & Koch, S. C. (2006). Monitoring students’ collaboration in computer-mediated collaborative problem-solving: applied feedback approaches. *Journal of Educational Computing Research*, 35(4), 399–424. 817

AUTHOR QUERIES

AUTHOR PLEASE ANSWER ALL QUERIES.

- Q1. Please check authors' affiliation if captured appropriately.
- Q2. Reference "Weinberger et al. 2006" was cited here but not found in the Reference list. Please provide complete bibliographic information.
- Q3. The citation "Beers et al. 2007" (original) was changed to "Beers et al. 2007b". Please check if appropriate.
- Q4. Reference "Strijbos, Martens, & Jochems 2004" was not cited anywhere in the text. Please provide a citation.