

An Overview of CSCL Methodologies

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Abstract: This study surveyed empirical CSCL papers published in seven leading journals of the field during 2005-2007 and analyzed methodologies of a random sample of 33 studies. The dominant features of CSCL research methodologies were descriptive studies in classroom settings with self-report/questionnaire that were quantitatively analyzed. Yet, studies were quite eclectic in their research method, adopting a variety of research design, data sources and analysis methods, leading to cross-over or hybrid methodologies. Studies of collaborative learning were carried out frequently both in experimental and descriptive studies in lab and classroom settings. Diverse data sources were collected and analyzed both quantitatively and qualitatively. New techniques for analyzing collaborative processes were also emerging. Still, it appears that the field needs to be more principled in its applications of design-based research. In addition, the field is in need of more diverse and systematic ways to analyze qualitative data in order to take a full advantage of the rich data afforded in CSCL research.

Introduction

There has been an increasing interest in collaborative knowledge construction for some time. With the advent of information technology, collaboration is also increasingly mediated by various technologies. Computer-Supported Collaborative Learning (CSCL) is an interdisciplinary research field that are concerned with how people can learn together with the help of computers (Myake, 2006; Stahl, Koschmann, & Suthers, 2006). In any field including CSCL, methodology is of utmost importance in advancing the field. Methodologies are constrained by the current level of understanding and available analysis tools in the field, and yet advancements in methodology can also open up new conceptual spaces and allow researchers to examine phenomena and questions that were not previously possible. Reflecting its interdisciplinary mission, diverse methodologies co-exist in CSCL. Traditional methods initially developed in the context of studying individuals (e.g., questionnaires, study of individual problem solving protocols) have been actively used by CSCL researchers. CSCL researchers also have reached out to methodologies in fields such as linguistics and anthropologies. The infusion of these methodologies has helped to advance the field a great deal. Currently, however, it is difficult to understand what the current state of research methodologies is in CSCL. Numerous methodologies co-exist without a clear understanding of what they are and how they are related to each other.

Recently, several meta-analyses have been conducted in related fields of CSCL. Hrastinski and Keller (2007) examined research approaches (e.g., empirical versus conceptual studies, quantitative or qualitative methods, etc.) of papers published in four leading journals of *educational technology* during 2000-2004 period. They found that about two thirds of the studies were empirical investigations, about half of which (51%) used quantitative methods, 25% used qualitative methods, and 24% used mixed methodologies (Hrastinski & Keller, 2007). Hew, Kale, and Kim (2007) also conducted similar meta-analysis on research topics and methodologies in the field of *instructional technology* based on publications in three journals also during 2000-2004. They focused on empirical articles and found that descriptive and/or correlational studies were the dominant research methods in educational technology, being used in more than half of the studies published. Methodologies varied somewhat depending on research topics; experimental method was more commonly used in studying the topic of psychology of learning and teaching, while correlational method was most frequently used with the topic of research and evaluation methodology. In addition, the studies most commonly collected survey/questionnaire data in higher education and K-12 settings (Hew et al., 2007).

Distinctions such as quantitative and qualitative methodologies have long existed in many fields. Quantitative methods were typically associated with experimental and survey studies where numerical data are collected. Analysis aimed to uncover 'general' trends that are true to the population at large, which lead to the focus on large sample sizes and quantitative analyses using inferential statistics. Qualitative methods, on the other hand, were associated with descriptive research such as case or ethnographic studies where qualitative data such as video-tapes, verbal transcripts, and artifacts are collected. Analysis aimed at uncovering 'meaningful' patterns and in-depth look at a small set of data was emphasized. While specific methodological traditions in qualitative research may focus on different aspects of the data and may take different routes to arrive at their interpretations, data were mostly analyzed qualitatively. Such a distinction, however, no longer seems appropriate. As qualitative methods become more popular, more attempts are made to triangulate data collection and analyses. Traditional descriptions of qualitative or quantitative research no longer adequately describe some of the research being carried out in the field. There is a need to develop a more sophisticated understanding of what quantitative and qualitative methods mean and how they can be better integrated to inform CSCL research at large. In addition, we need to examine and evaluate how the current CSCL methodology is addressing some

of the unique challenges that CSCL faces. With its emphasis on social construction of knowledge mediated through technological tools, CSCL has been in need of methodologies to study learning as it happens in the process of interacting with learning partners and tools. Interaction is a complex phenomenon where traditional methodologies developed to study individual learning are not necessarily readily applicable. Moreover, interaction in CSCL environments is unique in that there exist diverse forms of interaction such as distributed as well as face-to-face interaction and that interaction is often mediated by technological tools (Lehtinen, Hakkarainen, Lipponen, Rahikainen, & Muukkonen, 1999). Because thinking often develops and is made observable through dialogues and discourse, research efforts have been directed to the analyses of dialogue and discourse both in face-to-face distributed interaction. Analysis methods such as content analysis, discourse analysis, and conversation analysis have thus become commonplace in CSCL literature. Combining methodologies from different research traditions has been useful for revealing ambiguities and contradictions, which in turn have led to new conceptual developments. However, it has increased the risk of confusion in different epistemological perspectives (Naidu & Jarvela, 2006). Individual researchers are confused about how different methodologies can be used to inform their research. It is equally unclear whether CSCL methodologies have been adequately addressing the key issues of CSCL.

In response to these concerns, this study attempted to provide an overview of current methodologies used in empirical investigations of CSCL. We first carried out a comprehensive examination of empirical CSCL studies, analyzing research methodology at the following four dimensions: (1) research designs (e.g., descriptive or experimental design), (2) study settings (e.g., classroom or laboratory), (3) data collected (e.g., survey data, log data, or synchronous or asynchronous text data), and (4) analyses carried out with the data (e.g., content analysis, social network analysis, multi-level analyses). Based on this analysis, we also examined how collaboration is studied in CSCL research.

Methods

Journal Selection

International Journal of Computer Supported Collaborative Learning (ijCSCL) is the flagship journal of the CSCL community. In addition to ijCSCL, there are numerous other research journals where CSCL research is published. We asked the leaders of CSCL community, CSCL committee of ICLS and the editorial board members of ijCSCL to nominate five leading journals of the field other than ijCSCL. Based on the responses from 16 community leaders, the following seven journals were selected: (1) *ijCSCL*, (2) *Journal of the Learning Sciences*, (3) *Learning and Instruction*, (4) *Computers and Education*, (5) *Journal of Computer Assisted Learning*, (6) *International Journal of Artificial Intelligence in Education*, and (7) *Computers in Human Behavior*. They are all peer-reviewed journals published by well-known publishers with international authorship and readership.

Paper Selection

From the papers published in the seven journals, we identified *empirical CSCL* papers to be used for the content meta-analysis. By *empirical*, we mean that the study collected and analyzed primary data. Secondary data analysis, simulated results, theoretical papers and meta-analyses were not included. The data may have been collected as part of a larger project, but the analysis and finding had to be new. Papers that described the design process were included if they reported on empirical data. By *CSCL* research, we mean studies where students learned collaboratively using computers or other technological tools. Learning needed to be collaborative, but it does not mean that all phases of learning needed to be collaborative. As long as parts of the learning process involve interaction (e.g., collaborative discussion after individual study), it was considered collaborative. We focused on small group peer collaboration, that is, collaboration among learners who are similar in knowledge and status. This means that studies that examined student-teacher interaction or whole class discussions were not included unless they included small group peer collaboration. The applied technologies do not necessarily have to be collaboration technology such as e-mails or discussion boards, but need to be specific. Interaction with computerized agents were included if it involved learning. Studies about motivation or attitudes were included if they were studied in relation to learning. In addition to empirical CSCL papers, we included methodological papers that addressed various methodological issues related to CSCL (e.g., introduction of new methods such as Social Network Analysis, development of specific rating schemes).

Excluding non-research articles (e.g., editorials, book reviews, or obituaries), 868 articles published in the 2005-2007 period were screened, which means three years of publication (two years of publication in the case of *ijCSCL*). The total numbers of selected papers is currently 175, indicating that 20% of the papers published in the seven journals during 2005-2007 were empirical or methodological investigations of CSCL.

Content Analyses

The following aspects were coded for each paper: (1) Design, (2) Study setting, (3) Data, (4) Analysis, and (5) Interaction. In this paper, we report on the analyses carried out on a random sample of 33 papers. This set constituted 21% of the total empirical CSCL paper (and 19% of the total CSCL papers including methodology papers; percentages did not come out even due to the ongoing nature of paper selection process) and were marked with * in the reference list. A combination of inductive and deductive approaches was used to develop coding categories for each code. Coding categories were initially generated top-down (e.g., using categories drawn from the submission descriptors of the 2005 CSCL conference) and then later refined bottom-up through multiple iterations of coding. Jeong and Hmelo-Silver (2010) reported on a different set of analyses (with the exception of the collaboration coding) carried out on the same sample. Specific codes for each category are described below.

Research design

Research design refers to whether the study is (1) Experimental, (2) Descriptive, or (3) Design-based method. Experimental design refers to studies where variables are manipulated and was further divided into (a) randomized, (b) quasi-experimental, and (c) pre-post design. Descriptive studies do not manipulate variable and assign study participants to different conditions. They study the variables and phenomena as is and include studies such as case studies, surveys, and ethnographic investigations. Design-based method refers to research strategy where CSCL designs and interventions are theoretically-driven and are refined progressively over several iterations. In order to be coded as design-based method, the study not only needs to design CSCL systems or environments, but also the design needs to be theoretically grounded, instantiated in specific contexts, studied and refined iteratively as part of a bigger design-based research (Barab & Squire, 2004; Brown, 1992; Collins, Joseph, & Bielaczyc, 2004). Once a study was coded as design-based method, the design of individual iterations which can be either experimental and/or descriptive was not coded separately.

Study settings

Study setting refers to the contexts in which the research was conducted, that is, whether the research was carried out in (1) Laboratory, (2) Classroom, or (3) Other settings (e.g., informal learning environments or workplaces). Laboratory means that learning occurred in lab or lab-like controlled settings where the task occurred isolated by itself outside the context of classroom or other authentic learning situations. Classroom setting means that learning occurred as part of classroom/curricular activities, which could involve not only physical classroom but also other settings (e.g., field trips).

Data

Data refer to the types of data collected in the study and was coded into (1) Process, (2) Outcome, and (3) Miscellaneous data types. Process data were further divided into (a) text-asynchronous, (b) text-synchronous, (c) video, (d) audio, (e) log data, and (f) other. When papers reported on both video and audio data (e.g., Li et al., 2006), they were coded only as the video data unless they were analyzed separately. Outcome data were further divided into (a) multiple-choice questions, (b) open-ended questions, (c) expert ratings (e.g., experts' rating of students' work), (d) artifacts (e.g., contents of multi-media whiteboard), and (e) other (e.g., final course grades). Outcome data can be collected at the beginning of a study (e.g., pre-test) as well as at the end of a course. Miscellaneous data include (a) self-reports/questionnaires (e.g., demographic information, affects, perceived acceptance, etc.), (b) interview and/or focus groups, (c) field notes or observations, (d) individual difference measures (e.g., IQ, learning styles), and (3) other (e.g., course registration information).

Analysis methods

Analysis methods refer to the kinds of analyses carried out on the data. There were two general categories: (1) Quantitative and (2) Qualitative. Quantitative analyses were further coded into the following sub-types: (a) simple descriptive or quantitative (e.g., simple frequencies and means, as well as simple quantitative analysis of qualitative data such as coding numbers of words in messages or scoring an open-ended answers), (b) code and count, (c) inferential statistics, (d) causal or multi-level modeling, (e) sequential analyses, (f) social network analysis, and (h) other miscellaneous quantitative analysis (e.g., comparison with simulated data). Code and count refers to what is often called "quantitative content analyses" (de Wever, Schellens, Valcke, & van Keer, 2006). Qualitative analysis refers to analysis that analyzes data in a qualitative manner. Qualitative analyses were further coded into: (a) (qualitative) content analysis, (b) conversational analysis, (c) grounded theory, (d) interaction analysis, (e) loosely defined.

Collaboration

Collaboration refers to the types of student-to-student interaction and consisted of four categories: (1) Face-to-face, (2) Distributed synchronous, (3) Distributed asynchronous, and (4) Other. Face-to-face collaboration refers

to co-located and synchronous interaction. Distributed collaboration refers to collaboration among distributed learners and can be either synchronous (e.g., through chat) or asynchronous (e.g., through e-mails and discussion boards). Other collaboration refers to miscellaneous interaction such as non-verbal interaction (e.g., interaction through argumentation map), interaction with computer agents, or indirect interaction (e.g., collaborative filtering or data sharing).

Methodological features of the studies were generally coded according to the authors' definitions. If authors call their design as 'experiment' then we coded them as such. In unclear cases where the authors did not explicitly state information relevant to the coding categories (e.g., no mention of whether the study was carried out in lab or in classrooms), we relied on contextual information presented in the paper. For example when a study did not specify its setting, if 'recruited' students performed a stand-alone activity with no connection to classroom activities, its setting was coded as laboratory (e.g., Mercier & Frederiksen, 2007). Similarly, when a study did not specify data and only stated that the number of words in asynchronous notes was analyzed, it was assumed that asynchronous text messages were collected as data (e.g., Hewitt & Brett, 2007). In a few controversial cases, we followed a more conventional approach so that 'near synchronous' interaction was coded as asynchronous interaction and that an 'experiment' without any mention of treatment conditions were coded as a descriptive study. Multiple coding was allowed when more than one coding categories were applicable. For example, if the study compared different versions of a course that was implemented in face-to-face, synchronous, and asynchronous learning situations (e.g., Kitsantas & Chow, 2007), all different types of collaboration were coded. Reliability check was completed in all code (except for the collaboration code, which is still in progress) by having two coders independently code the set while discussing unclear cases. Cohen's kappa values between the two coders were all above .75 in all coding categories.

Results

Methodological Features of CSCL Research

The analyses indicated that the most prevalent CSCL research design is descriptive design: 58% of the studies were descriptive, 33% were experimental, and 9% were design-based. Of the experimental studies, 45% used randomized experiments, 27% quasi-experimental method, and 27% single-group pre-post design.

As for the settings of CSCL research, studies were mostly carried out in the classroom: 82% of the studies were carried out in the classroom, 12% were in the laboratory, and 6% in other settings (e.g., workplaces and informal settings). Classroom studies are typically associated with descriptive design, whereas laboratory studies are typically associated with experimental design. While this indeed was a case with most of the descriptive studies being carried out either in classrooms or other settings, there were a sizable number of studies that 'crossed over'. The majority (70%) of the classroom studies was either descriptive or design-based studies, 30% were experimental studies. Classroom experiments were typically quasi-experiments using intact classrooms or single group pre- and post-test comparisons (e.g., Cho, Gay, Davidson, & Ingrassia, 2007), but there were a few cases of randomized classroom experiments as well. Random assignments in classroom setting were carried out by assigning different treatment groups to separate laboratory sessions (e.g., Vizcaino, 2005) or by online groupings (e.g., Cho & Schunn, 2007).

As for data collection, 73% of the CSCL studies collected process data, 61% of the studies collected outcome data, and 70% collected other data. The majority of the studies collected more than one data types: Only 15% of the studies collected a single data type, and the rest of the studies collected multiple types of data. Studies on average collected 3.0 data in a given study with some studies collecting up to six different data. Of the process data, log data were the most frequently collected (42%), asynchronous text-messages were the next (30%), followed by synchronous text (15%), video-(12%) and audio-data (9%). Of the outcome data, and other types was most popular (24%), followed by artifacts (21%), open-ended (18%), multiple-choice questions (12%) and open-ended questions (12%), and experts' rating (9%). Other outcome types include data such as final grades, students' self-ratings and evaluations. Of the miscellaneous data types, self-report/questionnaire was most popular (61%), followed by interviews (21%), field notes (12%), individual difference (6%), and other (3%). A quite diverse set of data is being collected in CSCL research. Additional sources of data can provide more information about the questions. It appears that CSCL researchers are actively attempting to examine learning from multiple perspectives.

As for the analysis method, some form of quantitative analyses was carried in all studies. The most common forms were simple descriptive and inferential statistics (58% each), followed by code and count (52%); Causal or multi-level modeling was used in 6% of the articles, and social network analysis and other analysis were used in 3% of the studies each. A notable trend was a development of new quantitative methodologies such as social network analyses (Cho et al., 2007) and multi-level analyses (de Wever et al., 2006) that aimed to analyze collaborative processes quantitatively. Qualitative analyses were also used quite frequently, being used in 42% of the studies. However, the methods in general were not well described or attributed to one of the more

specific genre of qualitative research such as grounded theory (Glaser & Straus, 1967) or conversational analysis (Goodwin & Heritage, 1990). The majority of the studies (93%) adopted the “loosely defined” method in which data was qualitatively described with some examples.

Studying Collaboration in CSCL Research

How is collaboration studied in CSCL research? In terms of the types of collaboration investigated in CSCL research, 36% of the CSCL studies examined face-to-face collaboration, 36% synchronous, 48% asynchronous, and 12% other types of collaboration. The majority of the studies (70%) implemented and studied only one type of collaboration, but there were studies that implemented either two (24%) or three (6%) different types of collaboration. It was due to the fact that CSCL environments often allow students to interact with each other not only asynchronously through e-mails, but also synchronously through chats (e.g., Yang & Liu, 2007) and also because studies compared different types of collaboration in a given study (e.g., Kitsantas & Chow, 2007).

How were these various forms of collaboration studied in CSCL research? Comparisons of the studies that examined different collaboration types (see Table 1) indicated that while face-to-face and synchronous collaboration are studied equally likely with experimental and descriptive design, asynchronous collaboration were mostly studied with descriptive design. Distributed collaborations, both synchronous and asynchronous, were studied exclusively in classroom settings, less likely to collect outcome data and carry out qualitative analyses. Other types of collaboration were more likely to be studied in experiments in laboratory setting with quantitative analysis. Further analyses on the sub-type of data showed that, not surprisingly, face-to-face collaboration studies collected either video or audio data, whereas synchronous and asynchronous collaboration studies collected synchronous and asynchronous text data, respectively. Studies of other collaboration types mainly collected log data, but also collected video or other types of process data along with the log data. While quantitative analyses were used across all collaboration types, qualitative analyses were more frequently used to study face-to-face collaboration than distributed collaboration. A number of factors such as theoretical commitments, research questions, and available study settings influenced the choice of research methodologies. More analyses are needed, but it appears that the choice of CSCL research methodology is also dependent on the type of collaboration examined.

Table 1: Studying collaboration in CSCL research

	Research Method			Settings			Data			Analyses	
	Exp	Des	DB	Lab	Class	Other	Proc	Out	Misc	Quant	Qual
F2F	38%	50%	13%	25%	75%	0%	88%	100%	63%	100%	63%
Synch	40%	40%	20%	0%	100%	0%	80%	40%	80%	100%	40%
Asynch	14%	71%	14%	0%	100%	0%	86%	71%	57%	100%	43%
Other	100%	0%	0%	67%	33%	0%	67%	67%	33%	100%	0%

Notes. *F2F* refers to face-to-face, *Synch* refers synchronous, and *asynch* refers to asynchronous collaboration. *Exp* refers to experimental, *Des* refers to descriptive, and *DB* refers to design method. *Proc* refers to process, *Out* refers to outcome data. *Quant* refers to quantitative and *Qual* refers to qualitative analyses. Note that there were studies that investigated more than one type of collaboration. In order to isolate research methodologies uniquely associated with different collaboration types, studies that investigated only one form of collaboration were included in the comparisons: There were eight studies that exclusively studied face-to-face collaboration, five such studies for synchronous collaboration, seven studies for asynchronous collaboration, and three studies for other types of collaboration.

Study of collaborative interaction in CSCL research is often accompanied by an accumulation of large amount of qualitative data such as video-data and discussion board messages. Such qualitative data were traditionally analyzed qualitatively most of the time using methods such as discourse analysis (Brown & Yule, 1983; Gee, 2005) or grounded theory (Straus & Glaser, 1967). How does recent CSCL empirical research approach the analyses of these qualitative data? With this question in mind, we examined how the six types of qualitative data coded in this study—video audio, text-synchronous, text-asynchronous, open-ended outcome, and artifacts—were analyzed in recent CSCL research (see Table 2). Additionally, we also examined how log data were analyzed in CSCL research. An ever increasing amount of log data is collected in CSCL research, and yet there is only a scant understanding as to how they can be used in the context of studying collaborative learning. The results indicated that the majority of the qualitative data was quantified. The quantification was mostly done using procedures such as code and count or scoring, but “simple descriptive” measures were also directly calculated in some cases, using quantitative indices of the qualitative data (e.g., word counts in notes). While most of the process data were quantified with code and count procedure (i.e., coding the presence of certain code and counting its frequency), open-ended outcome data was analyzed with scoring procedure (i.e., assigning a score using a criterion). In addition, qualitative data, especially video-data and synchronous and

asynchronous text data were also often analyzed ‘qualitatively’, but specific kinds of qualitative analysis methods were seldom used. The qualitative analyses were mostly ‘loosely defined’ in that they provided qualitative descriptions of the data along with examples without committing to specific qualitative methods. As for the log data, not surprisingly, they were analyzed quantitatively, but the range of log data used for analysis was quite diverse. Studies examined time to post messages, length or duration of given threads, pages read, number of files in the folders, or participation rates. Lastly, the results also indicated that CSCL research may be good at collecting multiple types of data, but are not always good at analyzing them. Of the 50 pieces of data examined, one fifth (19%) was either unanalyzed or lacked sufficient detail as to how they were analyzed.

Table 2: Analyses of qualitative (& log) data in CSCL research

	Simple descriptive	Scoring	Code & count	Qualitative analysis	Unanalyzed	Unspecified
Video	0%	0%	75%	75%	25%	0%
Audio	0%	0%	67%	0%	33%	0%
Text-synchronous	0%	0%	60%	40%	20%	20%
Text-asynchronous	10%	0%	70%	30%	0%	10%
Open-ended	29%	71%	0%	0%	14%	0%
Artifacts	14%	0%	29%	14%	29%	14%
Log data	93%	0%	0%	0%	7%	0%

Discussion

The analyses of this study showed that the typical methodology of CSCL research was descriptive studies carried out in classroom settings with the most frequently collected data being self-report/questionnaire data analyzed quantitatively. While these emerge as dominant features of CSCL methodologies, CSCL methodology is far from monolithic and can be characterized as multi-method. Studies often collected multitudes of data and also used both quantitative and qualitative analyses. As a result, research methodologies of a given study often do not fit the traditional quantitative and qualitative divide and/or experimental and descriptive divide. This seems to be driven both by the need to understand CSCL from multiple perspectives (Hmelo-Silver, 2003; Suthers, 2006) and also with the infusion from different methodological traditions. Learning, especially in CSCL contexts, is a complex phenomenon, understanding of which requires multiple approaches and perspectives ranging from individual learner, interactive processes, tool mediation, teacher roles, to general cultures. In order to achieve a richer and integrated understanding of learning, CSCL research is increasingly required to examine learning from multiple perspectives, using multiple data sources and analyses methods in the contexts of specific research questions and settings.

In spite of the dynamic developments in the field, it appears that there are a number of areas where more sophisticated methodological understanding and practices are needed. One is with what researchers called as design-based research. Although we did not carry out systematic analyses, it was clear in the coding process that researchers often did not distinguish design as a research goal from design as research methodology. Even in the case where design research was used to refer to the research method or strategies, its applications were often name in only. While exceptions exist, studies that reported on multiple iterations and progressive design refinements were rare. The field needs to be more principled in its applications of design-based research. In addition, there is a need for the field to develop a larger repertoire of analytical tools to deal with the large amount of qualitative data collected in CSCL research. Large amounts of online and offline messages and dialogues can be and are collected in many CSCL investigations. The advancement of the field greatly depends on how well these rich sources of data can be utilized. While existing qualitative methods have their values, they are not well suited to a large-scale analysis. In addition, epistemological commitments of some of these methodologies are often in conflict with those from more quantitative traditions emphasizing objectivity and generality of findings. Although qualitative analyses were used in close to half of the studies examined in this study, they rarely adopted a specific qualitative method and just described the data with no reference as to how the conclusions were derived. It might be the case that the researchers failed to attribute their analyses to specific methods even though their analyses belong to that category, but it might also be the case that existing methods may not adequately describe what researchers are currently doing with qualitative analysis. Qualitative analyses tend to be less explicit in its procedures and more challenging to learn and execute. Efforts are needed to systematize existing qualitative analyses procedures so that they are easy to understand and carry out and also

to develop new analytical procedures to analyze them.

Given the small sample size of this study, the results and conclusions from this study should be taken as tentative at the moment. We aim to obtain more robust findings with additional analyses, but hope that an overview of CSCL research methodology even in this small scale is informative to researchers both in terms of understanding current CSCL research methodologies and guiding their future research. We also hope that the methodological issues raised in this study contribute to establishing a common conceptual framework for CSCL methodologies and integrating diverse findings from different research traditions.

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Acknowledgments

This research was in part funded by the National Research Foundation of Korea (NRF) (Grant No. 2009-0068919) awarded to the first author and a Rutgers University Faculty Research Council grant to the second author.