CSCL collaborative meaning construction based on activity theory

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ABSTRACT: Collaborative meaning construction is one of the key issues in computer-supported collaborative learning (CSCL) research. This substantially is a practical social group activity within a social and cultural context. For the purposes of a case study, the analytical framework from activity theory was applied to the network curricular activities of the China-Britain e-learning research project. The relationships between the various elements in the collaborative meaning construction activity were analysed. This revealed that the subjects conducted meaning construction using a variety of products and tools to act on the objects under the influence of culture, rules, and the division of labour, as well as other factors.

INTRODUCTION

Computer-supported collaborative learning (CSCL) has been at the frontier of educational technological development in the last decade. It is concerned with how learners collaborate to study, supported by computers. In collaborative learning, learners participate in a social and cultural setting to construct meaning as a practical activity. New meanings and knowledge are the outcomes of a collaborative process, and they are the achievement of group members' co-construction. Stahl et al define CSCL as …*meaning and meaning construction practice in the common activity situation and the method for designed products to mediate these practices* [1].

This definition indicates that collaborative meaning construction and the tools to mediate or affect this process have become CSCL's main research thrust. Wegerif proposes that collaborative meaning construction should become the research focus for the next decade [2]. Suthers points out that CSCL researchers realise that the most important problem to resolve is meaning construction between subjects and how technology mediates and supports this process. He advocates meaning construction between subjects as the CSCL theme, being more suitable than *collaborative learning*, given its unique characteristics [3].

BACKGROUND TO THE STUDY

Computer-supported collaborative learning in today's network environment is an important learning strategy, which breaks the traditional teaching model by providing multi-directional interaction between teachers and students, students and students, as well as students and teams [4]. However, the process of collaborative meaning construction in CSCL has not attracted enough attention [5]. Many researches are focused on the results of collaborative learning and the structure and pattern of the group interaction, while there is a lack of research into collaborative meaning construction. Many researchers explore the interactivity in collaborative learning and the social process of knowledge construction through the analysis of on-line discussion records [5].

The focus of this study is the process and construction of the interaction and the results of collaborative learning. The strength of this approach is the handling of large amounts of data, which makes researchers cognise and grasp stages, as well as the results of meaning construction; the weakness of this approach is that analysis of the learning process is separated from the specific context of the learning situation [4]. Therefore, some researchers have begun to use the qualitative research method; namely, descriptive study, by which to deeply research and explore the meaning construction process.

In the computer-supported collaborative learning environment, the tools, which support and mediate a group dialogue can completely record the collaborative learning process. In this environment, the collaborative meaning construction is

social, open; easy to visualise and is shared. Researchers can analyse the record to identify the languages, texts and other knowledge products involved in the collaboration. As well, the way the tools mediate this process can be analysed, so as to further explore collaborative meaning construction. Stahl, then, uses conversation analysis, whereby to analyse learners, who use a real-time conversation tool [6].

These studies indicate that by analysing the dialogue in group collaborative learning, the group collaborating learning process and the construction meaning can be understood deeply. Most CSCL occurs in non-face-to-face asynchronous exchanges. These exchanges are multi-directional, thematic and reflective [7]. Therefore, there are some researchers who study collaborative interactions and meaning construction between learners in education using the method of discourse analysis.

These studies undoubtedly provide useful guidance in exploring collaborative meaning construction. However, the computer-supported collaborative meaning construction is a social-and-speech interactive practical activity within a social and cultural setting, and is a dynamic and relatively complicated system. The system includes a collaborative learning subject and common goals; it includes various products, tools and elements, which mediate and affect learning. Therefore, a comprehensive analytical framework is needed by which to guide and analyse the collaborative meaning construction process, as well as the generated utterances and knowledge products. Activity theory based on social and cultural theory can be seen as an analysis framework by which to analyse the activity of collaborative meaning construction.

COLLABORATIVE MEANING CONSTRUCTION BASED ON ACTIVITY THEORY

Activity theory mainly comes from the mediation action theory of Vygotsky. Under this theory, people do not interact directly with the environment; they are mediated to interact through tools and symbols [8]. Its basic assumption is that tool mediation has changed the nature of human activity. After the tool is internalised, it affects human psychological development.

Engestrom has positioned the activity system as a goal-oriented, collective and culturally mediated human activity. He developed the activity theory model and expanded the triangle model. Interactive elements are added, including subjects, objects and communities. Human activities' mediators are introduced; namely, tools, rules and a division of labour on the basis of Vygotsky's three relationships of mediation theory, viz. subject - medium - object [9].

Activity theory is a social and cultural analytic model that focuses on the activity system as the analysis unit [7]. Relationships between various elements in the activity system are studied, both concerning the individual activities, and more concerning the interaction between the subjects and the community. Jonathan points out that the activity theory can serve as a useful analytical framework by which to study a knowledge construction community, because it can both explain the individual activity and also the group or community activity. At the same time, it is concerned about multiple activity paths for individuals in the community; this is the important aspect of knowledge construction [10].

Activity theory mainly is a descriptive framework, which is widely used in practical social research, so as to analyse activities. Jonathan has proposed five principles for analysing study activity using activity theory [7]. This research analysed collaborative meaning construction within the framework of activity theory. A real collaborative learning case was chosen and the relationships between various elements analysed, in particular, how the tool mediates the meaning construction process. Finally, conclusions were drawn.

RESEARCH METHOD

Research Case

The case study, or *case*, concerns the network course group activity of the China-Britain cross-culture e-learning community project. The course was designed and developed jointly by Chinese-British experts and teachers from six universities. The purpose was to explore common topics of e-learning practitioners, both in teaching and research in a cross-cultural context. As for the course study, groups on the course's Moodle Web site consulted, so as to agree themes for group discussions. All of these themes were related to participants' e-learning experiences. The group members explored a theme together, to develop a shared understanding of the work of the group. Finally, the individual learner reflected on the learning process and reported their learning outcomes in the form of an e-portfolio. The discussion activity of the fourth group was selected for analysis. There were five university teachers in this group; three from Britain and two from China. One Chinese teacher also served as a counsellor or e-tutor to organise and guide the discussion, as well as to participate in the group discussions.

Activities and Tools

For the purposes of this research, the discussion activity of the second unit of the fourth group was used. This activity required the group to consult together to decide on the discussion topic and, then, discuss the topic together and create the common work of the group. After the group confirmed the topic, the group members decided to create together the

works of the group by using the Google Docs tool. This tool is an on-line document editing tool developed by Google to allow people in different locations to collaborate on the creation of a document. The system can track and record the creation process, including the comments and advice from group members, and the specific date, among other details. In addition, a learning log was also used for the course, so as to encourage learners to record reflections on their on-line learning. On-line discussions of the groups were mainly in the form of forums and study logs based on the Moodle platform.

Data Collection and Analysis Method: a Focus on Several Issues by Using Method of Utterance Analysis

Since the group discussion occurred mainly in the forum space of the Moodle system, there was a complete record and log of the dialogue of the group discussion in the collaborative learning process. Hence, it was straightforward to obtain this information for researchers. These data were saved in a notepad for analysis. The text record of the co-authored works from the group members based on Google Docs is also important data for this research. The text analysis tool Concordance3.2 was also used in the analysis to add up utterance, keywords and theme words in the group discussions.

In collaborative meaning construction, utterances mainly focused on situation, structure, function, meaning and tools.

Below are several issues of focus in a specific analysis:

- How can the group members consult on meaning, whether they accomplish the common goal or not, and what are the achievements?
- How do the tools mediate the collaborative meaning construction process?
- Does the group learner regard him/herself as one of the group or as a community by which to attend to the activity and how does he/she construct their identification?
- How are the rules and the division of labour in collaborative meaning construction formulated and regulated; how does this affect the meaning construction activity?

DATA ANALYSIS

Process and Objectives of Group Activities

The first issues were how group activities are carried out; whether the group accomplishes a shared goal; what the outcome of the group is; and whether team members collaborate or not, in the construction meaning activity. An analysis was carried out of the utterances from the Moodle discussion space and the text and history record from the collaborative creative group works from Google Docs. The discussion activities of the group were divided into three stages, viz. group consulting to decide the theme, exploring the issues together and collaborating on document creation. Through analysis of the content and outcome of the group activity, each stage can be summarised as shown in Table 1.

Table 1: Group collaborative meaning construction activity.

Activity stages	Activity content	Activity time and space	Utterance record	Construction achievement
1st	Consult to decide group discussion theme.	(11.6-11.17) Group discussion space in Moodle.	The group members' utterance record in the discussion space consists of 26 posts.	The group discussion theme was: learners' on-line actions are the key element to efficiently promote e-learning study.
2nd	Group deeply explores the theme together.	(11.18-12.19) Group discussion space in Moodle.	There are 42 posts for group members in the discussion space.	Consult the main content and issues of the theme discussion and confirm them outline.
3rd	Group collaborates to create documents.	(11.22-12.19) Group discussion space in Moodle and on-line editing space in Google Doc.	The group collaborated to create 2,637 document words in English and added, modified and commented 542 times. There were 21 posts in the Moodle group discussion space.	According to discussion content and issues, the group collaborated to create common works. The article has three parts and states the theme from six aspects. The works content is the achievement of the group consultation construction and is shared by the group.

As can be seen from Table 1, there were seven weeks of discussions for the group in which to decide on the discussion theme, collaboratively explore the theme and, finally, to collaborate to create the group works through three stages of study.

After analysing the works, it was found that the works content reflects the outline and content based on the second stage, and the discussion contents in Moodle and Google Docs tool in the third stage of the activity.

The Role of Tools in Collaborative Meaning Construction

Tools mediate the relationship between subject and object. Tools can be physical or psychological, e.g. computers, artefacts, language, culture and ways of thinking [11]. Mediation by tools of human social activity is the core content of activity theory. In group collaborative knowledge construction, which tools are involved and how they mediate the process, is considered. In a group collaborative discussion activity, the main tool is communication mediated by the language and computer; namely, it is the utterances based on the Moodle discussion space, discussion process, Google Docs on-line editing tool, and so on.

- Language

  Language is the most important tool in social practice activity. In the research and discussion of this course, English is required. Chinese teachers' level of English generally is good and they communicate smoothly with the British teachers. But, there are also some teachers who lack adequate English expression, which affects their participation in activities and the correct understanding of the British teachers' discourse. This affects their enthusiasm and capacity for in-depth discussions. Hence, language and culture here affect Chinese teachers' participation level and the quality of their dialogue.

- Group forum based on the Moodle platform

  Because the group discussion using Moodle was asynchronous, participants had more time to read colleagues' posts. Participants, thus, were better able to reflect on the usage of words in a post and subsequently to express their views as correctly and clearly as possible. Hence, the computer mediated the response.

  Deep and wide collaborative discussion is promoted by the system, which automatically records and notes the time and content of learners' discussion. Each discussion topic's posts are displayed on the same page, therefore, when a group member logs into the forum space, they quickly can grasp the content of the ongoing dialogue. However, as the posts increase in number a participant, after log in, may need to read large quantities of content, which increases the burden of recognition. As a result, the understanding of the relationship between the utterances and the shared group meaning can be reduced. Therefore, group members need to summarise the outcome of group discussions. Also, there is a need for some bracket tools to support and promote the smooth conduct of the dialogue.

- Google Docs on-line editing tools

  An on-line collaborative document editing tool is required when creating the group works and to link the collaborative tool's space directly to the groups' discussion space in the Moodle system. This link avoids the inconvenience of transferring between discussion spaces. This tool was identified following a proposal by a group member in a discussion. Group members expressed their views in accordance with pre-determined questions and contents and other members added or modified the content. Members could comment on and evaluate the contents added by other members. The direct result of the tool mediating discussion was assistance in the creation of the group's works. Also, because the co-authored content is in a page, and is well organised according to themes, group members could easily understand current discussion content and the discussion process. In addition, the group members were able to see how the works could continue to be improved. This increased the group's sense of achievement and promoted successful completion of the group task. Since the discussions had a number of themes, the content and views were difficult to integrate into one whole in the discussion space based on Moodle, where the discussion content often is relatively messy [12]. Here, the Google Docs tool plays the role of integrating group discussion content.

  The above-mentioned tools and products have mediated the collaborative learning process, and the tool products also contain and reflect the shared understanding and construction meaning of the group members. For example, the document of the last group is a language product, including and reflecting the common meaning constructed by the group members.

Learners' Identity Construction in the Group and its Impact on Collaborative Meaning Construction

The CSCL places emphasis on the social characteristics of learning, where participants should join in the learning activities as a member of a group or community, so as to co-construct meaning or knowledge. Identity construction is a major aspect of learning and is also an important component in the process of collaborative meaning construction [13].

In social situation theory, learning is a social participation process, and at its core is the construction of an individual's identity as a group or community member within the study group. In a network environment, the identity of the group

or community can only be expressed by participating in dialogue, because group members are invisible to each other. Participants can only reflect their identity by expressing their comments positively and contributing their comments about the discussed issues. This also is the common characteristic of a virtual learning community in a network environment. Learners participate in collaborative learning activities and use specific words, tools and products in a social and cultural setting to consult with groups or other members from the community; thus their identity comes into being. In the collaborative activities of a group, does the participant join in activities as a group member? One of the main language constructs, which can be used by a member of a group or community, is the personal pronoun.

The text analysis tool, Concordance, was used to count the personal pronouns used by the group in the entire activity (see Table 2). It shows how participants consider themselves members of the group or community, to participate actively, by the way participants express their views, reveal their attitudes or contribute their efforts to the activity.

Table 2: Usage of personal pronouns and address terms.

The first person plural				The collectives		
We	Our	All	Us	Group	Everyone	Members
119	104	21	10	58	16	22
The first person			The second person			
I	My	Me	You	Your	Call participants names directly	
162	27	44	91	30	89	

The participants used the first person (*I*, *My and Me*) the most (233 times). The second person (*You*, *Your*, as well as *call participants names directly*), appear in the dialogue 210 times. It also shows that the dialogue between the groups is between the subjects, and the meaning is generated from the dialogue. The first person plural (*We, Our, All, Us*) and the collectives (G*roup*, *Members* and *Everyone*) appear 350 times in total. The use of these words clearly shows that the participants joined in the discussion as a member of a group or community.

Participants in collaborative activities should be willing to share ideas, take responsibility, contribute their effort and respect others; these are major features of a mature community. Task interdependence makes group members share the learning tasks with a positive attitude and to support, and help each other. When they have problems, they give advice or suggest a method by which to approach the problem; which demonstrates their duty to the group.

This encourages the group to continue to discuss the issue, complete the common task and, finally, to construct the shared works. These are the characteristics of people who have a mature sense of identity [12]. The group activity utterance analysis indicates that members of the group have a mature sense of identity, and that they regard themselves as part of a group or community when participating in collaborative activities.

Formation and Impact of Rules and the Division of Labour in Collaboration Meaning Construction

Rules are the specified regulations and requirements for the group members in a social learning situation. These are essential, so as to ensure collaborative activities are carried out smoothly. Rules include those that already exist or requirements set by curriculum designers or set for the implementation of the learning. Or, rules may be made by the group members through consultation in a collaborative learning setting, i.e. the group constructs these rules. There are interpersonal rules or values that group members should abide by in social interactions. All these are the components of community culture.

In the design and implementation of this course, consideration was given to both the Chinese and British teachers actively participating in the discussion and completing in time the course learning tasks. Before the curriculum implementation, the learner handbook was specifically formulated to describe, in detail, the requirements and rules for the learners who participated in the discussion. For example, the learners were asked to attend the discussions periodically (at least three times a week) and they were required to be willing to share their experiences, express their views and participate in on-line discussions. Participants should understand the structure of the dialogue and how to participate. They should positively reply to posts, respect team members' views, and continue to construct meaning by seeking new ideas. The formulation of these rules has guaranteed that learners regularly participate in group activities, share and enjoy their own and others' views and together accomplish group tasks.

However, too many rules can make group discussions less flexible and creative. The group can construct their own rules according to the activity, the characteristics of the problem and the need to mediate collaborative activity in the group discussion.

With activity theory as a framework, analysed in this study was how various activity elements mediate collaborative meaning construction and the relationships between these key elements, according to the questions raised during the collaborative meaning construction activity. In fact, the key elements in activity system together affect collaborative meaning construction. This model defines the various elements and their relationships in the group activity process. Researchers and practitioners can analyse the group or community meaning construction process, according to the

activities in specific situations and, at the same time, they can regard this system as a framework for studying the effect of tools or for research on how learners use these tools in meaning and knowledge construction.

CONCLUSIONS

In this research, using activity theory as a framework, collaborative learning in a real situation was analysed. The analysis included the subject activity, objects and goals in the group collaborative activity, as well as factors that affect or mediate activities.

It was found from the research that collaborative meaning construction is a goal-oriented activity of a group or community. Group members can regard themselves as a member of the community, so as to participate in discussing topics, exploring issues together, collaboratively creating group works and building personal relationships. At the same time, their roles and identities enhance the group's cohesion and sense of belonging. Each activity element mediates meaning consultation and knowledge construction and computer-mediated tools support, and promote the group's collaborative learning.

By automatically recording the contents of collaborative learning, the participants are kept abreast of the activity progress and content. But, the multi-topic characteristic of the group discussion space and linear distribution of content means the discussion content can become relatively messy. However, the Google Docs tool makes the group discussion more focused and collaborative construction content more effective. This shows that a tool with different functions can be integrated effectively into the activity, in accordance with its functions and features. The group members can consult to decide to use a more efficient tool. The interaction between various elements in the activity system may all support or block the construction of a collaborative meaning.

Researchers need to analyse the characteristics of these elements, especially, the roles of different tool products. They also need to understand the mechanisms of collaborative meaning construction, to provide useful guidance on the design and evaluation of collaborative learning.

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