Information as a Social Achievement: Collaborative Information Behavior in CSCL

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Abstract: In computer-supported collaborative learning (CSCL) environments, learners in problem solving contexts constantly engage in information seeking, information sharing, and information use. However, these activities have not been well investigated in CSCL research. We have studied information behavior of small groups of middle school students engaged in online math problem solving. More specifically, we examined how participants negotiate and co-construct their information needs, how they seek information, and how they make sense of discovered information. We argue that for learners in a CSCL environment, information is essentially a social achievement that emerges through the interactions of the group. Information only becomes *information* for participants when it is interactionally constructed to be meaningful and intelligible in their local situation. Analyzing learners' information behavior from such an interactional perspective can help us understand their *practices* of doing collaboration and learning. This has significant implications for designing CSCL environments and information resources to support small groups' information behavior and collaborative learning.

Keywords: CSCL, information behavior, conversation analysis, meaning making

Introduction

In his keynote talk at CSCL 2002, Koschmann (2002) defined the central concern of the CSCL field as "meaning and practices of meaning making in the context of joint activity and the ways in which these practices are mediated through designed artifacts". People often interact with information resources to learn. We experience intentional learning in schools, libraries, and other contexts. We also are engaged in a constant process of informal learning in our everyday life in order to make sense of what is around us, to solve a task or a problem, to make decisions, and so forth. Information seeking, processing, creating, and using are central activities in such a sense-making process in order to bridge the gap of understanding. In this paper, we argue that these activities of information practices are essential components of the *practices* of meaning making and learning for learners in collaborative environments, and thus need closer examination and understanding.

Information behavior, "the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use" (Wilson, 2000, p. 49), has been one of the central topics of information science. A large quantity of research has been done but most of them tend to focus on individuals. Information behavior has been of interest to CSCL researchers even though information practices in the context of collaboration are still relatively less studied thus not well understood. In the study presented in this paper, we have observed interactions of small groups of middle school students engaged in solving a mathematical problem collaboratively in virtual environments. We have examined how students identify and construct their information needs collaboratively, how they go about finding the information, and how informational artifacts are produced and recognized as meaningful and useful information for them.

This study is situated in a larger research agenda of the Virtual Math Teams (VMT) research project where researchers investigate the innovative use of online collaborative environments to support effective K-12 mathematics learning. At VMT, students are invited to participate in about one-hour-long chat sessions in online environments where they discuss and solve a math problem in small groups. The chat is recorded for analysis. We have applied an ethnomethodologically-informed approach that combines aspects of conversation analysis (Sacks, 1992) and ethnomethodology (Garfinkel, 1967) to analyze information practices of participants in small groups (Stahl, 2006b). We argue that information is a social achievement, that is, information is not given, but is a kind of status accorded various situated, locally designed and produced artifacts. This status is not a feature of the artifact but is produced as an interactional social achievement. Seeing information from such an interactional perspective can help us understand participants' *practices* of doing collaboration and learning.

Data Analysis

In this section, we show the analysis of one excerpt of interactional data on how participants construct information needs and how an informational artifact is produced as meaningful information for them. The following 7 minute long except (Table 1) is from a VMT chat session during which three participants (REA, PIN, MCP) are working on a geometry problem as presented in figure 1 through an AOL chat program. A moderator is there to get them started by first greeting them, presenting the problem, and explaining that the task for them is to share their ideas and collaborate on solving the problem. They are also asked to make sure everyone understands if they think the problem gets solved. It is about half way through a one hour and twenty minute session. Before the conversation gets to this point, REA and PIN have already engaged in active discussion. One of them created a picture as shown in Figure 2 and sent it to the moderator. It was made available to the group through a website, which they have been referring to in this excerpt of their interaction.

Table 1: An excerpt from a VMT chat session

Line#	*Handle*	*Posting*	*Time*	*Delay*
120	REA	Are u there PIN	8:48:08	0:00:17
121	PIN	ya im here	8:48:29	0:00:21
122	REA	checking	8:48:37	0:00:08
123	REA	u stuck cause i am:-(	8:49:07	0:00:30
124	PIN	well angle CED is congruent to angle B	8:49:56	0:00:49
125	PIN	if that helps	8:50:06	0:00:10
126	REA	It helps	8:50:48	0:00:42
127	REA	but i already estlabished that	8:51:15	0:00:27
128	PIN	im stuck	8:51:36	0:00:21
129	MCP	What's known?	8:51:42	0:00:06
130	MCP	BE:EC = 3:5, right?	8:52:05	0:00:23
131	REA	how did you get that	8:52:42	0:00:37
132	PIN	how did u get that	8:52:43	0:00:01
133	PIN	lol	8:52:46	0:00:03
134	MCP	Tri ABC similar to DEC	8:53:10	0:00:24
135	PIN	ya we got that	8:53:19	0:00:09
136	MCP	AB:DE = 8:5, right?	8:53:30	0:00:11
137	REA	We know that	8:53:33	0:00:03
138	PIN	ya	8:53:35	0:00:02
139	MCP	So BC:EC=8:5	8:53:51	0:00:16
140	REA	ya	8:54:11	0:00:20
141	MCP	That 8 breaks down 3 for BE, 5 for EC	8:54:23	0:00:12
142	REA	We might have to use law of sines	8:54:38	0:00:15
143	PIN	havent learned that yet	8:54:50	0:00:12
144	PIN	whats it say	8:55:04	0:00:14
145	MCP	Sine A / a = Sine B / b = Sine C / c	8:55:15	0:00:11

Finding CE - posted February 16, 2004

Given the following situation:
- Side AB of triangle ABC has a length of 8 inches.
- Line DEF is drawn parallel to AB so that D is on segment AC and E is on segment BC.
- Line AE extended bisects angle FEC.
- DE has a length of 5 inches.

What's the length of CE?

Figure 1. Problem: Finding CE

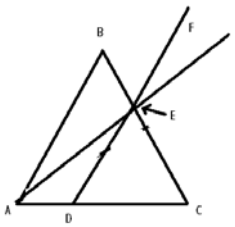

Figure 2. The drawing

REA's posting at line 123 is read as a question directed to PIN asking about PIN's status on solving the problem: "(are) *you stuck* (?)". It also establishes REA's own position as "being stuck". This inquiry is taken up by PIN as a request for information that could possibly help him getting "unstuck". PIN responds with providing some information that he possibly has discovered from the problem description ("*angle CED is congruent to angle B*"). This offering of information is followed by "*if that helps*", calling for work of assessment of its usefulness in terms of solving the problem, which is ratified by REA, followed by the statement that the information is not new ("*but I already established that*"). At this point, a request for information is made; an attempt of providing the information is assessed as "useful" but not new; therefore the earlier request is still open but revised as a request for something new. PIN articulates he cannot be of any help to take up the request, which opens up an opportunity for other participants to bring in new, potentially "useful" information.

Right at this moment, MCP joins this line of conversation by asking a question "What's known?". One of the features of this query is that it is calling for recipients to consider a set of resources that can be shared. It serves to preface what will follow as information action, organizing action in relation to others and to available resources in ways that provide for subsequent postings to be seen as informative. MCP takes over the call himself by proposing a math proportional equation. This proposition is phrased as a question to solicit assessment from the group. This

proposal is responded to by each of the two participants by directing an inquiry for further information, that is, a request for MCP to produce some elaboration or account for what he just provided as "known" fact. We see that three co-present participants displayed different levels of understanding on what is known at this point. This discrepancy needs to be resolved to bring the group into sync in order for them to proceed with collaborative problem solving, that is, to build a common ground for their subsequent interactions. In this excerpt, MCP is called upon to elaborate on his offering and share what he knows with the rest of the group. This is what we will see shortly in the following interactional moves. We will also see that "information sharing" here is not simply transferring a piece of information as a bounded object. Rather, participants do the work of building understanding of the *information* in their situated locus. It is the work they do that makes a potentially informative artifact meaningful and intelligible for them.

MCP takes up this request and starts to present to the group how that "known" fact is derived by what is given in the problem step by step. This expository work of MCP as an effort of producing an account of the information is led in an organized way of presenting base facts and what is being derived from them. Each step is aligned with agreement or acknowledgement from the other two participants. In line 141, by concluding "That 8 breaks down 3 for BE, 5 for EC", MCP completes the process of presenting a proof. MCP's last posting as part of the offered explanation doesn't get a response. The fact that this thread of expository work stops here marks the conclusion of the work of producing an account of the "known" fact "BE:EC = 3:5" and making meaning of this account by other participants. This also signals the transition between threads of conversation and opens the interactional space up possibly for a new incoming proposal. 15 seconds after the preceding posting, which is a noticeable gap in a live chat, REA makes a proposal that suggests the possibility of using "law of sines" as a strategy to proceed on tackling the problem. By stating he hasn't learned that yet, PIN positions himself as an inquirer seeking information. This information inquiry is responded to by MCP who provides the equations of law of sines.

Discussion

When students are working on a math problem together, they often need to find information that they think is useful for solving the problem. Usually the process starts with identifying what is known and what is needed. As demonstrated in the preceding analysis, information needs are negotiated and constructed by the group. When an information need is specified and posed, there are different ways the subsequent interaction unfolds. In this particular case, proposals on what information might be useful are provided. A proposal is either evaluated by participants on its usefulness or initiates a request for more information to elaborate on it. The latter constitutes the process of participants making meaning of the information being provided. The information provider is called upon on producing an account of it, which is achieved interactionally with calling for and getting assessment or acknowledgement. Only through such interactional work is the information artifact made meaningful for the participants in the local context, thus becoming real *information* for them. Information is not a predefined object with fixed boundaries but emerges as a product of the social interaction. In this exemplary case, we showed our analysis on how "BE:EC=3:5" as an information artifact is produced as meaningful information for the participants. Most online information resources are organized in a way that information is treated as an object with fixed boundaries. It is questionable how such resources can help learners find what they need and support their learning experiences and collaboration. Analyzing group's information behavior and seeing information from an interactional and social perspective can help information resource design, for example, how resources can be organized to provide multiple access points to learners at different levels and how social aspects can be brought into the design of digital libraries. We have noticed that most participants treat the group as a primary resource for seeking information although some of them also actively use online resources such as Google, the Math Forum digital libraries, wikipedia, etc. How to integrate various resources in to CSCL environments to support learners' needs is another question being put on the research agenda for the community.

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