Visualizing Representations of Interaction States during CSCL

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Abstract: Existing methods for analyzing video data of small groups during collaborative problem-solving focus on analyzing certain aspects of students' task-related verbal interactions by coding and counting. In this paper, we present a method that was used to construct a visual representation to illustrate how the occurrence of students' task-related verbal interactions changed sequentially over the class duration as a function of other dimensions of the group activity. Possible uses of these representations are discussed.

Introduction

One of the key features of embedding CSCL activities in real classrooms is the highly complex nature of the collaborative process, and the multiple dimensions that influence the learning of groups within the ecosystem of a classroom. There is an increasing number of research studies in CSCL face-to-face classrooms that collect video data of the groups as they solve the task (e.g. Paquette et al., 2018). We need additional methods to analyze this data and understand how the group activity, especially students' task-related verbal interactions, unfolds sequentially over the class duration and change from one class to another over time (Hmelo-Silver et al., 2011; Reimann, 2009). This information can be used to inform future analytical approaches to the data and future design iterations. In this paper, we describe a method that uses the video recordings of small groups during collaborative problem-solving classrooms to construct a visual representation of each of the group's activity sequentially over the class duration. Then, we discuss the possible uses of these representations in making inferences about factors that can influence group activity and in planning further analysis of the data.

Collecting the video data

This method was developed as part of a multi-year design-based implementation research project that is focused on integrating collaborative problem solving in a large introductory engineering course. The project involves collecting video data, using ceiling mounted cameras and lapel, table or hanging microphones, from undergraduate engineering students and teaching assistants during discussion sessions (classes) that took place in a lab classroom. During each class, students worked in small groups to solve an authentic engineering task presented as a digital worksheet on 11-inch tablets. Tablets of students in the same group were synchronized, allowing them to see the work of their team. The duration of each class was approximately 50 minutes. Data was collected from 28 classes (4 per week, over 7 weeks).

Coding the video data

To identify how the activity of a group unfolded over the class duration we segmented the video recording of the group during one class into consecutive 20 seconds clips. We then coded each clip using a coding scheme adapted from Paquette et al. (2018) for dimensions that define or influence the group activity in the context of a face-to-face CSCL classroom. These dimensions were *task-relatedness* (on-task or off-task), *students' verbal interactions* (present or not present), *teacher's verbal interactions* (with the whole class, with the group, or not present), *content of verbal interactions* (on-task talk, other talk, or no talk), *potential issues during students' verbal interactions* (the conversation is dominated by one group member, the conversation indicates that the group is confused, or none of the group members responded to an interaction attempt by another group member), *potential issues during group work* (the group is divided into sub-groups, or one group member is left out), and *technical issues* (present or not present).

Constructing a Visual Representation of Group Activity Over Class Duration

After coding all number consecutive 20 seconds clips of the group, we used the codes of each clip to categorize the group activity into one of seven states that dominated the activity. These states are described in Table 1.

Table 1. The seven states of group activity

State	Task-Relatedness	Students' Verbal Interactions	Teacher's Verbal Interactions	Content of Verbal Interactions	Issues - Verbal Interactions	Issues - Group Work	Issues - Technology
Positive	On-Task	Present	Not Present	On-Task Talk	None	None	Not Present
Silent	On-Task	Not Present	Not Present	No Talk	None	None	Not Present

Other Talk	On-Task	Present	Not Present	Other Talk	None	None	Not Present
Off Task	Off-Task	N/A	N/A	N/A	N/A	N/A	N/A
Teacher-Whole Class	N/A	N/A	Present with the whole class	N/A	N/A	N/A	N/A
Teacher-Group	N/A	N/A	Present with group	N/A	N/A	N/A	N/A
Issue	On-Task	N/A	Not Present	N/A	Any code (other than none) under these three dimensions is present		

N/A: Not applicable

Using the state of the group activity in each of the consecutive 20 seconds clips, we constructed a visual representation of the group activity over the class duration. The representation illustrates how the occurrence of the positive state changed over the class duration as a function of the other six states. An example of this representation for two groups (A and B) that are in the same class is shown in Figure 1.

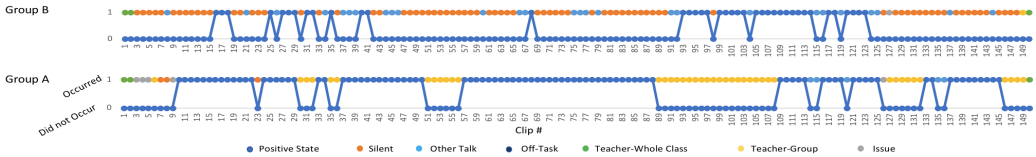

Figure 1. The Occurrence of the Positive State Over Class Duration

Possible Uses of the Visual Representations

Comparing the visual representations of different groups in the same class provides a snap-shot of the groups' processes and can suggest inferences about factors that may have influenced the occurrence, duration, and sequence of occurrences of the positive state in groups. For example, Figure 1 shows that Group A had longer positive state durations and less silent states than Group B. Both groups did not have many or long issues states; however, only Group A had teacher-group states that preceded the occurrence of the positive states. This suggests that these teacher-group states may have promoted students' task-related verbal interactions. Further examination of the representations from other groups in the same class and the analysis of the transcript from Group's A video allow us to test this, or other, hypotheses. Comparing the visual representations of different groups in the same class could provide insights about how the design of the task may have influenced the groups' activity. For example, if the representations of all the groups of one class show that positive states did not start occurring until half way through the class, or if they show that the majority of the sequences of positive states were very short, then it is possible that the design of the task did not promote verbal interactions between students and further investigation might be warranted. In addition, comparing the visual representations of the same group across different classes can help us understand how stable collaborative behaviors are for each group, or whether variables such as the content or nature of the task or absence or change of one or more group members had an impact on the occurrence and duration of the positive state of this group. This can inform further iterations of tasks and tools, taking into account the complex ecosystem of the group within the classroom context.

References

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