

Leadership of Transactive Discourse in Collaborative Problem Solving

Jun Oshima, Ritsuko Oshima, Shotaro Yamashita, Jun Lu
joshima@inf.shizuoka.ac.jp, roshima@inf.shizuoka.ac.jp, yamashita.shotaro.17@shizuoka.ac.jp,
ro.takashi.18@shizuoka.ac.jp
Shizuoka University, Japan

Abstract: Transactivity in discourse is key to successful learning. In this study, we propose a new temporal network analysis to visualize and calculate how small groups of learners engage in transactive discourse. Our temporal network analysis identified three leadership patterns in transactive discourse: collective, rotating, and fixed. Further interaction analysis revealed critical differences in the division of labor between a fixed and rotating leadership group.

Theoretical background and research purpose

In small groups, learners must regulate their epistemic engagements in successfully developing their knowledge through transactive discourse (e.g., Stahl, 2013). From the perspective of knowledge-building (Scardamalia & Bereiter, 2022), the transactive discourse is unfolded as collective cognitive responsibility. In this study, we introduce a new temporal network analysis to examine learners' transactive discourse around their ideas and each individual's contribution to their transactive discourse. The original algorithm of our temporal network analysis of discourse was to visualize a vocabulary network for identifying ideas in discourse and calculate the metrics of how each learner contributed to the final state of the vocabulary network (Oshima et al., 2012). Although it was a meaningful effort to represent the collective state of thoughts in collaborative discourse, the original algorithm could not capture the transactivity and temporal change in individual contribution to idea improvement in transactive discourse. We implemented new algorithms described in the method section (data analysis) to solve the problems.

Method

Participants and setting

The study's participants were 45 university students (fifteen groups of three). We asked students to collaboratively solve a Jasper Woodbury problem called "Rescue at Boones Meadow (CTGV, 1992)." They were provided an iPad (to watch the video) and a whiteboard (to write/draw their ideas). Their conversations and actions were recorded on video.

Data analysis

Temporal network analysis of transactive discourse (Oshima et al., 2012, 2021)

The students' conversations were transcribed verbatim and subjected to two temporal network analyses. First, for capturing the transactivity in discourse, we used the moving stanza-window method (Siebert-Evenstone et al., 2017). Because every conversational turn is influenced by the previous turn and influences the next turn, when participants take their transactive actions in discourse, we set a stanza-window of three conversation turns as a unit of analysis. We then calculated the cooccurrences of words in all transcribed interactions. Second, we evaluated each participant's contribution to the transactive discourse by calculating the difference in the total value of the degree centralities by excluding a target student's discourse from the original discourse data. We then compared each participant's contribution to the transactive discourse.

Interaction analysis (Jordan & Henderson, 1995)

After identifying patterns of the leadership of transactive discourse based on individual contribution, we further analyzed the discourse and participants' behaviors with artifacts they could use in more depth to understand how their leadership of transactive discourse emerged and changed over time. In particular, we were interested in the differences in the sequences of conversation turns, or discourse moves and patterns of behaviors with artifacts, between groups where all the students took their leadership in some way and those where some students failed to do so.

Results and discussion

Temporal change in transactive discourse and patterns of transactive leadership

Several patterns of the transactive discourse were identified. First, we did not find many “collective” groups where all three students engaged in transactivity ($n = 5$). Instead, many groups manifested “fixed” leadership in the transactivity, in such a way that a specific single student or specific pair engaged in transactive discourse over time. In between the collective and fixed groups, we found “rotating leadership” groups where different pairs took the leadership in transactive discourse at different points of time ($n = 2$). Results suggest that we need to consider at least two different scaffolds to promote students’ engagement in transactive discourse: (1) how to encourage “fixed leadership” groups to change their transactive discourse patterns to “rotating leadership,” and (2) how to improve the discourse patterns by “rotating leadership” groups toward “collective” patterns.

Differences in transactive discourse between fixed and rotating leadership groups

Our interaction analysis of the video-recordings of the fixed and rotating leadership group revealed the following differences between them. Their roles in problem solving activities were constrained and empowered by artifacts around them, such as a whiteboard and iPad. In the fixed leadership group, two students dominantly used the artifacts. The two student actively engaged in idea creation and elaboration through transactive discourse mediated by the artifacts. The third student also joined the discourse by supporting their idea creation and elaboration through paraphrasing and further explanation but did not take a leading role. In the rotating leadership group, the use of the artifacts was more systematically distributed among all three students. Two of them shared a whiteboard to inscribe their ideas, and another watched the video on iPad for providing new information to others and the third student smoothly shifted her role from providing information based on the video to jointly constructing their solution.

Through our interaction analysis, we could come up with a tentative hypothesis that leadership in transactive discourse is influenced by the division of labor through collaboration. Artifacts around participants constrain their division of labor. Participants who can take control of the artifacts will lead the transactive discourse. A division of labor with artifacts is intentionally or unintentionally established. When intentionally established by participants, it may be possible for all the participants to take lead in the transactive discourse. When it is unintentionally constructed, some participants may not be able to take control of them and consequently, cannot lead transactive discourse.

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