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HOW TO FOSTER DIALOGICALITY IN GROUP INTERACTION?

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Abstract

Well-functioning groups are essential in group-based learning and working life. Good interaction is a sign of a well-functioning group. We have investigated how the teacher and his group of teacher students interact during their group discussions. The students were asked what kind of interaction they experience as being the most dialogic in their own discussions. We sought to find answers to how emotions, the network structure of the conversation and the quantity and topics of utterances reflect dialogicality as well as whether we can discover in the data other issues that may co-occur with a high level of dialogicality. In this study we used a multimodal approach and a set of techniques, namely sentiment and network analyses, facial emotion recognition, and stimulated recall methodology to address these questions. Our findings reveal that expression of emotions as well as both positive and negative words are associated with a higher degree of dialogicality. We found a new interaction dominance category, called focused dominance, to further advance and enable research in the field. Focusing on shared phenomena and reduced teacher participation in conversation positively correlates with perceived dialogicality. Our results contribute to the understating of how to promote interaction in classroom and in teams.

Keywords: group interaction, dialogicality, focus dominance, multimodal approach, facial emotion recognition, sentiment analysis, network analysis, collaborative learning.

1 INTRODUCTION

Good interaction in meetings is a sign of a well-functioning group. Such groups are essential in group-based learning and crucial in working life where a great portion of work is done in groups or teams. Typically, a team refers to the group of persons who are committed to the shared purpose, goals and to each other, whereas a group refers to a collection of individuals who are connected to each other by social relationship, and who often have shared tasks or goals [1,2]. Thus, the team usually has stronger meaning than group. However, in this study, we use the terms team and group interchangeably. Research shows that discussion with both an instructor and peers is important for achieving good learning outcomes [3]. Both companies and research institutions have studied what makes teams productive [4, 5].

There is a lot of research on what makes teams successful and productive, be it at a workplace or in a pedagogical setting. This research is often centered around other features than the interaction that the team members are having in meetings. These features include characteristics of the team, such as size, personal traits of individuals, for instance, the level of expertise, and characteristics related to the interactions between team members. A great amount of the studies focuses on informal interaction between team members. Yet, the research focusing on the analysis of interaction of teams in meetings or in pedagogical sessions with the teacher is scant. There is surprisingly little research based on data collected from pedagogical conversations. Our study is one attempt to fill this research gap. From previous research, we know that successful teams let everyone in the team talk and listen roughly equally [5]. Their conversations and gestures are energetic. The connections happen directly with one another instead of through the team leader. Team members have side conversations, and they interact outside of the official team meetings as well [5]. We hypothesize that the same characteristics can be observed in a group interaction that the participants regard as dialogic. To verify this hypothesis, we have studied the network structure of dialogic conversations. This reveals which team members talk and which listen and what is the amount of talk produced by each member. It also shows if the interactions are going through the teacher or if there is direct interaction between the team members.

In interaction research, researchers have found many ways how people dominate the interaction: quantitative dominance (who does most of the talking), thematic dominance (who is introducing new themes or new words) and interactional dominance (the influence of one participant over the communicative actions, initiatives, and responses) [6, 7, 8]. We suppose that these dominance types have influence on the emotional and dialogical experiences of the participants.

In this study, we have investigated what are the characteristics of good interaction. More specifically, we have identified the features in conversation and interaction that are common in team meetings that the informants regard as being dialogic. By dialogicality we mean dialogue or dialogicality in a pedagogical and philosophical sense. Dialogicality refers, among other things, to reciprocity, responding to the other as a whole person, giving a space to the other to tell one's thoughts using one's own language, concepts, and interpretive schemes [9, 10]. More broadly, participants are "engaged intersubjectively in addressing the issue or problem at hand" [11]. Dialogue in a pedagogical sense has a long tradition starting from Socrates and continuing to our days. In this study, we investigate dialogicality in the interactions that take place in team meetings. We use the word conversations to describe the speaking that takes place in such settings.

In addition to the features described by Pentland [5], we have studied the relation between dialogicality and the emotions as expressed by the participants in their speech and while reflecting on their conversation. The research hypothesis is that the following four features have a connection with the dialogicality of the interaction:

1. emotions expressed by the participants,
2. the network structure of the conversation,
3. the quantity of utterances by each of the participant,
4. and the topical focus of the utterances of the participants.

This study contributes to the discussion on what are the features of conversation and interaction visible in meetings that can be observed in well-functioning groups. In addition, the current research addresses emotional characteristics of successful team meetings. The results of the study are especially relevant in a pedagogical setting where the teacher wishes to improve his abilities to facilitate group discussions. The results also provide recommendations for successful team meetings at workplaces.

2 METHODOLOGY

The research methods are based on the analysis of both video data gathered from pedagogical group conversations and on questionnaire data collected from the participants of the conversations. The data was analyzed using various software. The main analysis method was qualitative.

The video data consisted of nearly 10 hours of group conversations, which included 11 group discussions in three separate groups, five people each, including the teacher/instructor and four students, a total of 16 people. Interaction sessions, where participants discussed topics of pedagogy, were followed up by reflection meetings where also dialogicality was assessed. The data collection was conducted in 2019 – 2020 by the School of Vocational Teacher Education at the Haaga-Helia University of Applied Sciences. This data has been analyzed through a) network analysis, b) natural language processing (NLP) technologies such as sentiment analysis, and c) facial expression analysis using the AFFDEX [12] algorithm that is implemented in the iMotions software (2018).

The AFFDEX algorithm is based on FACS (Facial Action Coding System) [13]. For one, FACS is based on discrete emotion theory, called the basic emotion view as well [14]. It assumes seven basic, separate emotions (anger, contempt, disgust, fear, joy, sadness, and surprise). However, there are other theories of emotions which do not share the background assumptions of discrete emotion theory [15]. In addition, AFFDEX measures the engagement of the participants. The AFFDEX algorithm was used to analyze the emotional reactions and engagement of the participants. Since emotions are hard to detect, we have used also sentiment analysis from text to analyze the emotions of the team members.

In this paper, we present the findings concerning one team and one interaction video. We concentrated on two conversation snippets: evaluated as the most and least dialogic ones.

Furthermore, participants gathered to reflect on their interaction video (so called, stimulated recall methodology) reflecting on their dialogicality experiences at the same time [16]. We completed analysis with qualitative and quantitative analyses of the dominance of the interaction. The dialogicality of each distinct part of the conversation was assessed qualitatively by each participant using a new visual tool called the Continuum of Dialogue. The tool was used when the participants gathered to reflect on their interaction video. The researcher had split the discussion into thematic phases and after watching each phase, every participant rated its dialogicality. The Likert scale was used 1 (very non-dialogic) to 5 (very dialogic).

As the concept of dialogicality might not have been familiar to the informants, they were told to apply the following definition to the Continuum of Dialogicality: "Dialogisuudella tarkoitetaan vastavuoroista, kohtaavaa, arvostavaa ja kunnioittavaa vuorovaikutusta, jossa jaetaan ja luodaan yhteyttä, ymmärrystä, merkityksiä ja toisinaan myös uutta tietoa osallistujien välillä". Translation into English is as follows: "With dialogicality we mean reciprocal, appreciative and respectful interaction in which interaction, understanding, meanings and sometimes even new knowledge are shared and created between participants".

For sentiment analysis, a lexicon-based method was used. The sentiment score of a text snippet was calculated as (number of positive words - number of negative words) / total number of words. In the network analysis, the standard metric of degree was used. The text and network analyses were performed using the KNIME software [17].

Often one method is far too vague to reach the whole phenomenon. Thus, we used multimodal data to combine subjective and objective methods for investigating both the physiological reactions, subjective experiences and social functions of the emotions of social interaction. Computational techniques create possibilities to separate significant patterns in the research data [18]. Multimodal data comes from different data channels and can combine subjective and objective measurements. At its best, multimodal data can "cross the ontological boundaries between the human body (i.e., neurobiological processes), the environment (i.e., actions), and the mind (i.e., dispositions)" [19]. Multimodal interaction data answers the challenges of the complexity and social and contextual issues of collaborative activity [18].

3 RESULTS

3.1 Overview of the results

This section presents the results of the study. One discussion from a total of six discussions was chosen to be studied in detail and presented here. This group conversation was selected because it contains the widest differences in the perceptions of dialogicality. A total of three groups of five people participated in the conversations on education-related topics.

We begin the presentation of results with the Continuum of Dialogicality (Figure 1). After that we present the relation of the sentiment of the words of the conversation and dialogicality (Figure 2). This is followed by the network analysis of the most dialogical segment of the conversation (Figure 3). After this the quantitative dominance and the focus dominance of the most and least dialogical phases of the discussion are depicted in Figure 4 and Figure 5, respectively. Figure 6 illustrates some results of the AFFDEX algorithm. There also, the most and least dialogical phases of the discussion are analyzed. Each figure is explained in the following.

Figure 1 shows the Continuum of Dialogue from instructor Antti's group second meeting. Each group discussion session, from which an interaction video was recorded, was followed by a so-called reflection video session. In the reflection video session, which was also recorded, the informants were shown the interaction videos and asked to grade the dialogicality of discussion of each topic. Evaluation was done using the Likert scale: 5 – very dialogic, 4 – fairly dialogic, 3 – not dialogic, but also not non-dialogic, 2 – rather non-dialogic, 1 – very non-dialogic. As illustrated in Figure 1, the most dialogic snippet "peer learning I" and the least dialogic snippet is "flexibility". See Methodology for more details.

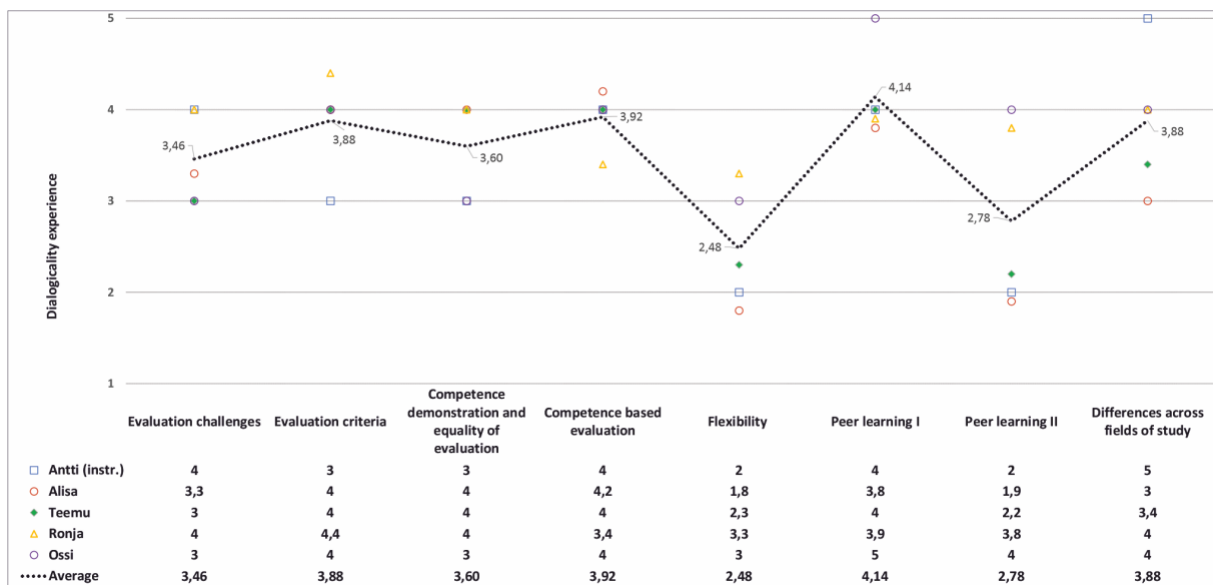


Figure 1. Continuum of dialogical experiences. Individual evaluation of interaction segments by topic during reflection. Antti is the instructor and Alisa, Teemu, Ronja, and Ossi are the students.

Figure 2 displays the correlation matrix of the same team discussion as the one presented in Figure 1. The parts that are perceived as dialogic are also emotionally loaded from the point of view of the vocabulary used. Both negative and positive words occur more often in parts that are rated as being more dialogical. After analyzing the correlation of the entire discussion, we concentrated on the most dialogical and least dialogical phases. In Figure 3 we present the interaction network of the participants of the most dialogical phase. It shows that the amount of speech and interaction is distributed very unevenly, but every student participates in the discussion. The teacher (Antti) is quiet during this conversation and thus he is not depicted at all in the figure.

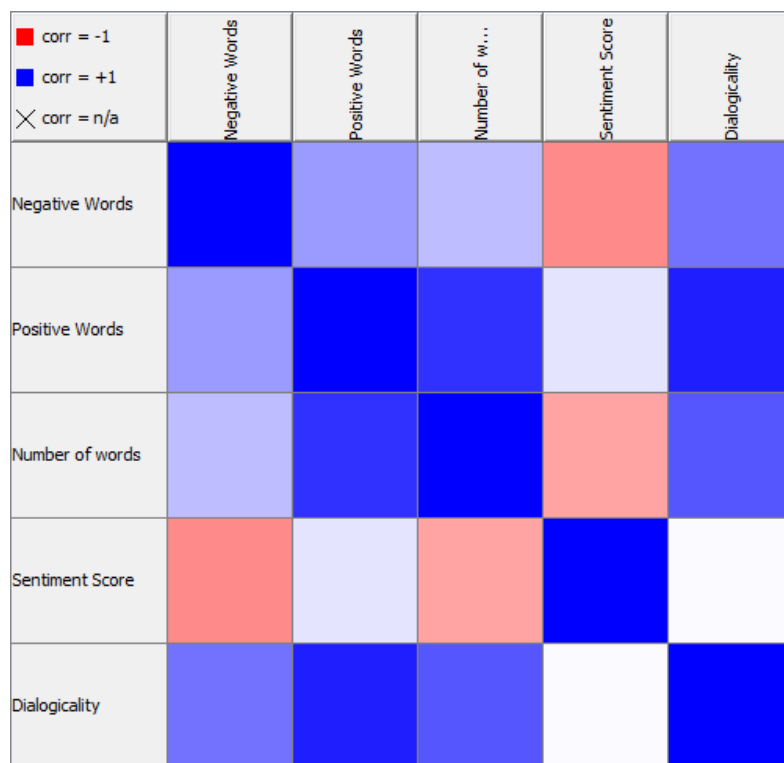


Figure 2. Correlation matrix of the conversation segments depicted in Figure 1. Different shades of blue show positive correlation, white denotes no correlation and red means negative correlation.

Dialogicality correlates positively with both negative and positive words as well as with the high number of words.

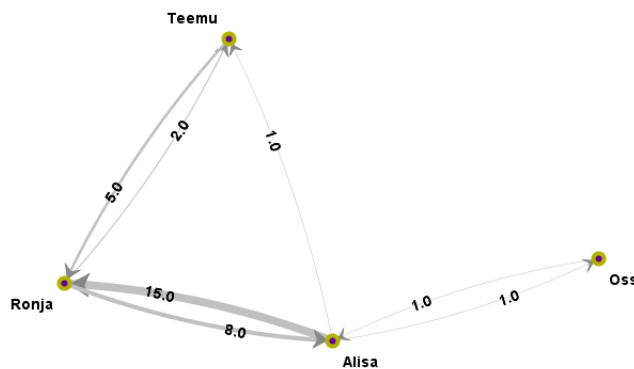


Figure 3. The interaction network of the most dialogically rated conversation. The width of the directed edge demonstrates the amount of speech from one person to another. The numbers on the edges show the number of rows of transcribed speech uttered by the person.

In the following analyses we calculated first the amount of speech produced by each participant (quantitative dominance) and then the focus of the speech (focus dominance). In our research, we have found a new category called *focus dominance* (whether the talk is focused on the individual himself, the others in the group, or on common phenomenon). It is to be crucial in emotional and dialogical experiences as well. Our results showed that the experience of dialogicality could be high even if the amount of speech was partly unevenly divided if it was strongly theme focused. On the other hand, an evenly distributed amount of speech did not lead to the experience of dialogicality if everyone was talking strongly only about own views and experiences. Thus, both a common theme and even distribution of talk are meaningful factors in the experience of dialogicality but neither of them alone entails dialogicality.

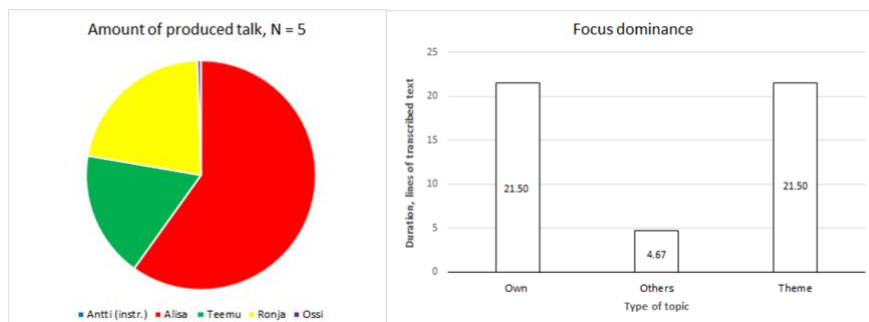


Figure 4: The most dialogical phase of the discussion (peer learning I: 4, 14 / 5).

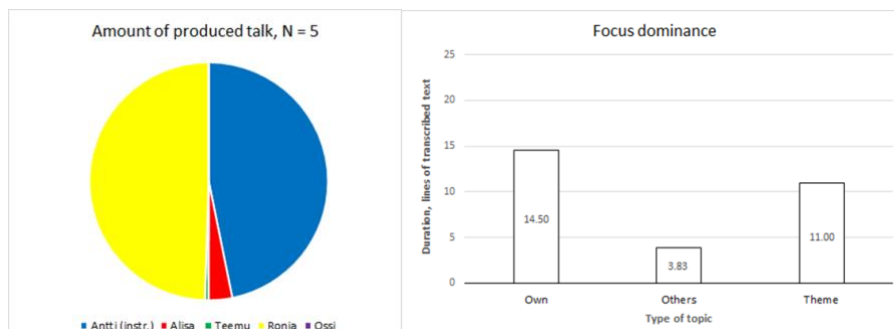


Figure 5: The least dialogical phase of the discussion (flexibility: 2,48 / 5).

After a qualitative analysis of the results produced by the AFFDEX algorithm, we observed that the least dialogical phases often had less engagement and emotional reactions when compared with more dialogically experienced phases. The most dialogical phases often had high engagement and strong emotional reactions, both positive and negative. Figure 6 illustrates one example of the analysis provided by the AFFDEX algorithm. It presents two time series data based on the reflection video of the conversation under study. The first grey vertical line shows the place where the informant Alisa experienced the conversation non-dialogical. The markers for joy (the uppermost green) and for engagement (the lowest green) are at a very low level. On the other hand, in the conversation phase where Alisa experienced dialogicality (shown by the rightmost vertical grey line), the markers for joy and engagement are at a high level.



Figure 6. Facial expression detection by AFFDEX algorithm of one student, Alisa (threshold level 50, recording 25 Hz and 80% coverage). On the left the reactions by the marker of joy (the uppermost green) and engagement (the lowest green) after the least dialogical phase. On the right the reactions by the marker of joy and engagement after the most dialogical phase.

3.2 Analysis of the results

We have analysed data from group conversations where the teacher is present, and we have studied which conversational and emotional features co-occur with the participants' subjective perceptions of dialogicality. It is known that the communication patterns outside of formal conversations or meetings do provide valuable information on whether a group is well-functioning or not. For instance, Pentland finds that the amount of informal discussion outside formal meetings is an important measure for well-functioning teams: the more there is informal communication, the more productive the team is [5]. The study shows that there is a relation between dialogicality as perceived by the participant and engagement and energy (measured by quantity and network structure) brought to the discussion as well as emotional reactions as measured from facial expressions and linguistic features in transcribed speech. A scheduled meeting with the teacher and his group of students may be somewhat similar to a scheduled meeting in working life. In this study, particularly, the scheduled meetings with the teachers could resemble quite a lot the meetings of working life because the students were adults who were in working life and thus were used to meetings. The teacher did not follow any specific pedagogical model in facilitating the discussion but acted rather as the chairman: defined the topics and then let the students discuss quite freely. The topic of the team discussions was the teacher education of the team members. More specifically, themes of teaching practice and assessment were discussed.

Thus, discussions in these groups were more theme-oriented and peer-experienced than in teams of workplaces where the focus is usually on certain work tasks. It was not inquiry-based learning [20], since the goal was not to learn certain content or facts, but rather to share experiences and modify the student's own understanding based on other participants' opinions and experiences. Therefore, the participants got new thoughts and ideas for their teacher education, teacher identity process and upcoming teacher job. Consequently, this type of conversation has the possibility of being dialogical. The above-mentioned special characteristics of the pedagogical group discussions should be kept in mind when generalizing the results to teams in working life.

4 CONCLUSIONS AND FUTURE WORK

Our study has yielded several conclusions. Firstly, there is a relation between dialogicality, as perceived by a participant, and engagement and energy brought to the discussion as well as emotional reactions, as measured from facial expressions and linguistic features in transcribed speech. Meanwhile, an interaction where all students participate and where the teacher is not speaking much are perceived as being the most dialogic. In addition, a relation between the use of positive words and perceived dialogicality was observed.

Secondly, we found that the quantitative and interactional dominance have effect on the experience of dialogicality. We identified a new dominance category, called focus dominance. Our evidence shows that the discussion is experienced as more dialogic, at least in the pedagogical setting, if the focus is on commonly shared and discussed themes rather than own experiences of participants. However, the best thematic discussion also includes sharing individual experiences.

Thirdly, multimodal research delivers a more complete approach to interaction studies than applying only single methods. The strength of this study is that it takes advantage of both objective and subjective research methods. The new research tool called the Continuum of Dialogicality was created and tested. The tool seems to capture well the experiences of the participants during the reflection video session. Thus, it generates more detailed knowledge than assessing the experiences only once, right after the discussion.

Future research on a larger and more complete dataset will show if these findings can be generalized. If so, the results will be useful for any teacher or team leader who wishes to foster successful team interaction.

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