

# Using Transactivity to Understand Emergence of Team Learning

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## Abstract

Team learning is a recurrent topic in research on effective teamwork. However, research about the fact that team learning processes emerge from conversations and the different forms this emergence can take is limited. The aim of this study is to determine whether the extent to which team members act on each other's reasoning (transactivity) can be used to understand how team learning processes emerge. Research on teacher teams was used as the case study: Video recordings of three different teacher teams were used as primary data, and the data were analyzed using qualitative interaction analysis. The analysis shows that the content of team learning processes changes when team members act more closely on each other's reasoning. In particular, team learning processes related to the storage and retrieval of information took place only in sequences in which team members acted closely on each other's reasoning.

## Keywords

interaction analysis, teacher teams, team learning, transactivity, qualitative research

Teams are the building blocks of organizations (Senge, 1994), levers for organizational development (Crossan, Lane, & White, 1999), and “central

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and vital to everything we do in modern life” (Kozlowski & Ilgen, 2006, p. 78). Working in teams creates the opportunity for team members to make use of each other’s expertise and experience (Lewis, 2003). Subsequently, team members gain a more comprehensive “model” of their working environment (Van der Haar, Li, Segers, Jehn, & Van den Bossche, 2015). Accordingly, teams are considered to be “the important learning units within organizations” (Decuyper, Dochy, & Van den Bossche, 2010, p. 111). As a learning unit in itself, the team is perceived as a linking pin between individual learning and organizational learning (Crossan et al., 1999). According to Decuyper et al. (2010), team learning processes (i.e., sharing, co-construction, and constructive conflict) generate change or improvement when they are facilitated in the right direction. However, recent attempts to measure these team learning processes have encountered challenges that are difficult to solve with questionnaire research (see, for example, Raes, Boon, Kyndt, & Dochy, 2015; Van den Bossche, Gijsselaers, Segers, & Kirschner, 2006; Wijnia, Kunst, van Woerkom, & Poell, 2016). These challenges particularly involve capturing the emergence of processes that are different and interrelated at the same time. We elaborate further on this in the theoretical framework.

In this article, we discuss these challenges and explore a new and different approach to the analysis of team learning processes to obtain a better understanding of the processes themselves, and the emergence of these processes in particular. Similar to previous research, we take the conversational actions of team members as a starting point (Raes et al., 2015). However, we also examine the quality of these conversations by applying the concept of transactivity (i.e., the extent to which learners act on each other’s reasoning; Teasley, 1997) that is previously applied in research on student groups. Although student groups are different from teams in organizations, we argue that there might be merit in the idea that conversational quality relates to the emergence of team learning processes. Therefore, knowing how team learning processes emerge from conversations could enable researchers to better understand team learning and could enable team leaders to better use the team’s full potential as a learning unit. This line of reasoning is elaborated upon below.

## **Theoretical Framework**

### *The Intertwined and Interrelated Nature of Team Learning Processes*

Team learning is a compilation of team-level processes that circularly generate change or improvement for teams, team members, organisations, etc. Being a compilation, it consists of changing combinations of different types of

processes (sharing, co-construction, constructive conflict, team reflexivity, boundary crossing, team activity, storage and retrieval). Working circularly, it dynamically translates a complex body of influences from multiple levels into different types of outputs at multiple levels, which in turn influence team learning. (Decuyper et al., 2010, p. 128)

This comprehensive definition of team learning presented above is the result of an extensive systematic literature review on team learning research. In its comprehensiveness, the work of Decuyper and colleagues integrates and builds on existing theory and empirical work in highly specialized fields (Van der Haar, Segers, & Jehn, 2013). Examples are the organizational learning theory of Argyris and Schön (1978), the 4I model of Crossan et al. (1999), team learning research by Edmondson and colleagues (Edmondson, 1999; Edmondson, Dillon, & Roloff, 2007), and empirical studies based on the organizational sense-making theory of Weick (2001). As such, it gives us a very good idea of the complexity of team learning. Team learning not only occurs at the team level but also affects and is influenced by the individual and organizational levels. This relates to the dominant paradigm in team learning theory, which states that team learning processes emerge from interactions between individual team members (Decuyper et al., 2010; Kozlowski & Bell, 2008). Wilson, Goodman, and Cronin (2007) describe this emergence in three stages: (a) The repertoire of an individual team member changes to incorporate new knowledge, routines, or behavior; (b) other team members go through a similar process and gain the same knowledge, but there is no group-level learning; and (c) team members create a shared knowledge and understanding, which results in group-level learning. A similar process is described by Crossan et al. regarding the process of integrating, which is the third I in the 4I model of organizational learning. According to Crossan et al., “it is through the continuing conversation among members of the community that shared understanding or collective mind develops and mutual adjustment and negotiated action take place” (p. 528). These theories provide some guidance on how team learning processes emerge from individual members, yet the conversational actions (the vehicles that drive learning) remain implicit.

In their model, Decuyper et al. (2010) attempt to explicate these conversational actions by describing team learning processes that “describe what happens when teams learn” (p. 117). The first of these three, so-called, basic team learning processes is sharing, which is the process of “communicating knowledge, competencies, opinions or creative thoughts of one team member to the other team members, who were not previously aware that these were present in the team” (Decuyper et al., 2010, p. 116). According to Decuyper et al., two types of conversational actions emerge from sharing, depending on

how team members deal with shared knowledge: co-construction and constructive conflict. Co-construction can be understood as

the mutual process of developing shared knowledge and building shared meaning by refining, building on, or modifying an original offer in some way . . . leading to shared knowledge and new meaning that was not previously available to the team. (Decuyper et al., 2010, p. 116)

Constructive conflict can be understood as “the process of negotiation or dialogue in the team that uncovers diversity in identity, opinion, etc. within the team . . . for example exploring different perspectives, error analysis, and error communication . . . to integrate differences in viewpoints” (Decuyper et al., 2010, p. 117). These processes emerge from conversations between team members and originate on the basis of all kinds of individual, team, and situational factors (Kozlowski & Bell, 2008). Because of the emergent character of these processes, they are often interrelated and intertwined (Decuyper et al., 2010). It is therefore difficult in empirical research to distinguish one process from the other. This difficulty is illustrated in recent questionnaire research in which items concerning these three different team learning processes all loaded on the same factor in a factor analysis (Van den Bossche et al., 2006; Wijnia et al., 2016). Therefore, researchers plead for more observational research to clarify how specific team learning processes contribute to team learning based on their own distinct purpose (Raes et al., 2015).

### *Learning by Acting on Each Other’s Reasoning*

In their research, Raes et al. (2015) found that sharing behaviors shape team learning “when they are the onset of a sequence of successive and constructive verbal behaviours that construct meaning” (p. 491). In addition, other verbal behaviors, such as asking questions, have the potential to trigger other team members to add contributions to the discussion and, therefore, to shape co-construction. On the basis of these findings, we argue that certain combinations of sharing, co-construction, and constructive conflict could be more desirable than others for team learning to emerge. However, the kind of combinations that are desirable remain implicit.

In this respect, we use this research to explore whether the framework of transactivity could provide insights. As mentioned in our introduction, the term *transactivity* as used by Teasley (1997) refers to the extent to which someone “uses his or her conversational turn to operate on the reasoning of the partner or to clarify his or her own ideas” (p. 362). The concept of transactivity originates from research in educational science that

points out that students who engage in transactive discussions “learn more from the collaboration than those who do not [engage in transactive discussion]” (Teasley, 1997, pp. 363-364). The level of transactivity can, therefore, be regarded as a quality indicator for conversational actions that take place in teams. The notion that transactive discussions contribute to learning has led to valuable insights in the fields of child education and computer-supported collaborative learning (CSCL) in higher education (e.g., Teasley, 1997; Weinberger & Fischer, 2006). It shows that transactive discussions lead to the most productive collaborative learning outcomes (Noroozi, Teasley, Biemans, Weinberger, & Mulder, 2012; Teasley, 1997). However, the concept of transactivity has not previously been used to create understanding about the emergence of team learning processes from conversational actions and the distinct role of different team learning processes as a consequence.

In this research, we explore this link by examining the different types of transactivity in conversational actions and the emergence of the basic team learning processes (sharing, co-construction, and constructive conflict) in these conversational actions. Weinberger and Fischer (2006) distinguish five different types of transactivity: *externalization*, *elicitation*, *quick consensus building*, *integration-oriented consensus building*, and *conflict-oriented consensus building*. In each mode, the extent to which team members act on the reasoning of their partner, and thus the potential for learning to take place, increases.

During externalization, learners “make contributions to discourse without reference to other contributions . . . learners externalize what they know, e.g., to explain their perspective” (Weinberger & Fischer, 2006, p. 78). During elicitation, team members aim “at receiving information from the learning partners” (Weinberger & Fischer, 2006, p. 78). This is typically done by asking questions, but other discourse actions can also be used. Quick consensus building refers to building “a task-specific minimum consensus or common ground regarding the learning task in a process of negotiation . . . may not indicate an actual change of perspective, but is rather a coordinating discourse move” (Weinberger & Fischer, 2006, p. 78). During integration-oriented consensus building, team members adopt the contributions of other team members that had not previously been shared. During conflict-oriented consensus building,

learners may be pushed to test multiple perspectives or to find more and better arguments. . . . When building consensus in a conflict-oriented manner, learners need to pinpoint out specific aspects of their peers’ contributions and modify them or present alternatives. (Weinberger & Fischer, 2006, p. 79)

According to Weinberger and Fischer (2006), these types of transactivity can be used to analyze segments of data consisting of multiple conversational actions.

Considering the previously mentioned findings that transactivity contributes to learning, we expect the distinct role of each of the three basic team learning processes to differ according to the transactivity of a segment (i.e., a sequence of multiple conversational actions). So, for instance, we expect co-construction to differ in segments in which team members act closely on each other's reasoning (e.g., integration-oriented consensus building) compared with segments in which team members do not act on each other's reasoning (e.g., elicitation). However, this is, to the best of our knowledge, the first attempt to link these three team learning processes with transactivity, with the result that no further hypotheses could be made about this link based on previous empirical research. The research questions of this study are, therefore, of an explorative nature:

Our research questions were developed to explore to what extent the framework of transactivity might reveal new insights for understanding the emergence of team learning in teams through the team learning processes of sharing, co-construction, and constructive conflict.

**Research Question 1:** What types of transactivity can be distinguished from observations of teams?

**Research Question 2:** To what extent can the types of transactivity be linked with the team learning processes of sharing, co-construction, and constructive conflict?

## Method

### *Research Design and Sample*

To study team learning processes as they emerge from interactions between team members, we started our data gathering based on the perspective that observational data of task-related communication were desired. This task-related communication should be "locally organized, with attention paid to the situated and demonstrably relevant interactional steps that participants take at the particular moment of their encounter thus producing and enacting the context" (Lahti, 2015, p. 517) and should, therefore, be examined in an authentic environment in which teams operate. In our case, team meetings of teacher teams at vocational education and training (VET) institutions in the Netherlands were used as an authentic environment in the research. The relevance of this context is discussed below, as well as the participants who took part in the research.

*The research context.* In Dutch VET, teachers from different disciplines work together in a team to organize education that is competence based (Wesseling, De Jong, & Biemans, 2009). A team in VET could be defined as a group of teachers from different disciplines (i.e., vocation-specific and general subjects) who are responsible for the organization of one or more educational programs. The idea behind competence-based education (CBE) is that students are prepared for a smooth transfer from education to the workplace. Teachers in CBE work together to provide a learning environment that is directed toward the future workplace of the student, student oriented, and also prepares students for their future roles in society (Sturing, Biemans, Mulder, & De Bruijn, 2011). To provide this type of education, which is interdisciplinary (e.g., representing the authentic practice of a workplace) in its nature, teachers have to cooperate closely and are together responsible for the final curricula. Because teachers do not in general have many opportunities to work together outside team meetings (Vangrieken, Dochy, Raes, & Kyndt, 2013), and because team meetings are the settings in which team learning should take place, these settings were considered to be useful sites for field research (Scott, Allen, Rogelberg, & Kello, 2015). The context of VET teacher teams is very specific, but the type of team (interdisciplinary, interdependent, heterogeneous) is, at the same time, representative of many teams in professional settings.

*Participants.* Three teacher teams from three different VET sectors (health care, life sciences, and technology) participated. The teams were selected based on survey data from a larger population of teacher teams that participated in a Dutch research project on team learning in VET teacher teams. Teams were selected that were considered representative of the population in terms of team size and composition (i.e., function, gender, work experience, team age). As an additional sampling criterion, only those teams were selected in which at least some of the members had the shared goal to improve a competence-based aspect of their curriculum. This last criterion was added to ensure that the data gathering would yield authentic interactions, that is, interactions that produced and enacted the context (Lahti, 2015). In the health care team (Team 1), a group of four teachers and the team leader ( $n = 5$ ) were redesigning their curriculum to prepare for the new qualification framework that was required to be implemented in all VET institutions in the Netherlands in 2016. In the life sciences sector (Team 2), the team—consisting of one team leader and seven teachers ( $n = 8$ )—was starting up as a team and was facing an increase in student numbers for the next school year. The team members, therefore, had to redesign their competence-based curriculum and renegotiate who would be responsible for which part. In the technology team

(Team 3), three teachers and the team leader ( $n = 4$ ) formed a project team to develop teaching material on employee competencies (e.g., communication with customer, colleagues, and supervisor; flexibility; punctuality), with the goal to incorporate this in their curriculum. All the teams had a team leader, but examination of the role of the team leader and how he or she was perceived as a team member fall beyond the scope of this research.

## *Procedure*

Data collection started when the project team started and lasted until the team came up with its first deliverable in relation to its assignment. During data collection, the researcher was a complete observer rather than a participatory observer (e.g., Lofland, Snow, Anderson, & Lofland, 2006) and kept interaction with the team members to a minimum, especially when the talk was content related. The primary data for this study were video data recorded using a 360° action camera and containing sound and visual recordings of team meetings. Data collection resulted in the recording of 10 meetings of Team 1, four meetings of Team 2, and seven meetings of Team 3, providing a total of 21 meetings. Team meetings were held once a week and took 1.5 to 2 hr on average. Documents and ethnographic observations were used to keep track of other developments in the context of the teacher teams and to aid interpretation of the video data. Data gathering in multiple teams using multiple data points and applying multiple research methods was used to triangulate our findings and ensure their trustworthiness (Guba, 1981; Miles, Huberman, & Saldana, 2014). Participants were informed of the purpose of the research and that it would involve audio/video recordings of team meetings. All participants gave their informed verbal consent for the recording of the team meetings on the understanding that the recordings were only to be used for research purposes. Participation was voluntary, and participants were assured that their anonymity would be protected. After data gathering, a member check took place to verify whether the interpretation of the events during the field research matched the interpretations of the participants to ensure credibility of the data (Guba, 1981).

## *Analysis*

To analyze our data, we used an interactional analysis approach that relates to both the suggestions made by Derry et al. (2010) and the use of interactional sequences as a unit of analysis introduced by Hogan, Nastasi, and Pressley (1999). First, we coded statements within each speaking turn with respect to how that statement contributed to the discussion. In the light of the



exploratory character of this study and despite the fact that we subscribe to the view of Decuyper et al. (2010) that team learning is a complex phenomenon that consists of and is influenced by many different types of activities, this study used task-related interactions as a starting point. Based on the coding scheme of Veldhuis-Diermanse (2002), which distinguishes these types of processes from nontask-related (i.e., metacognitive and affective) interactions in collaborative settings, we used task-related interactions to select the data that were analytically relevant (see Derry et al., 2010). This does not mean that metacognitive and affective interactions were not incorporated in the analysis, but the task-related interactions were leading in defining the interactional sequences.

In the second step, we defined interactional sequences. According to Hogan et al. (1999), interaction sequences are “a productive intermediate unit of analysis between the atomistic unit of statement types and the broad unit . . . of entire episodes” (p. 390) that enable the researcher to analyze the flow in interactions. These interactional sequences are similar to the segments described by Weinberger and Fischer (2006). A sequence starts with a statement or query by a speaker, and “at least one statement from another speaker must follow the initiating statement to comprise a sequence” (Hogan et al., 1999, p. 390). In accordance with accepted procedures in interactional analysis (e.g., Poole & Roth, 1989; Weinberger & Fischer, 2006), a rule set (see appendix) was created to distinguish interactional sequences in the data. The interactional sequences used in this analysis comprised around 50% of our original data. The remaining data were discarded based on the mentioned rule set.

In the third step of the analysis, the interactional sequences were coded with the mode of transactivity. This coding procedure was based on the theory of Weinberger and Fischer (2006), which distinguishes five modes of transactivity: (a) externalization, (b) elicitation, (c) quick consensus building, (d) integration-oriented consensus building, and (e) conflict-oriented consensus building. To establish interrater reliability, three meetings (i.e., one of each team) were selected at random, and coded by two trained raters, and Cohen's kappa was calculated for each category. During this process, the first and second rater did not reach agreement on the mode of transactivity in the different interactional sequences. Based on a process of negotiation and recoding, the two raters established a final classification of three types of transactivity: low, moderate, and high transactivity. These types of transactivity and their distribution in the data are discussed below. Cohen's kappa for the final classification ranged from .42 to .81, which can be classified as moderate to very good agreement (Altman, 1991). Disagreement was mainly due to lack of contextual knowledge. The first rater's prolonged engagement in the field and his persistent observation of the variables under study

provided this knowledge, which was absent for the second rater. The lower kappa values, therefore, emphasize the necessity of deep contextual knowledge in making reliable interpretations of the data (Hogan et al., 1999). The results of this analysis are used to reflect on Research Question 1.

In the fourth, and last, step of the analysis procedure, we used a thematic conceptual matrix to make sense of the relation between transactivity type and team learning processes (Miles et al., 2014). In this matrix, the types of transactivity were listed in the rows, and the team learning processes of Decuyper et al. (2010; that is, sharing, co-construction, and constructive conflict) were listed in the columns. All sequences were reviewed for occurrences of team learning processes. When a team learning process occurred within a sequence, a description of this occurrence was stored in the specific cell in the matrix. For instance, when we reviewed a sequence in which a team member responded to another team member by expressing concerns about the suitability of an idea in light of the educational level of the students, we noted “expressing concern about idea for curriculum development by relating to educational level students” in the row of that sequence and in the column of co-construction. In this process, we used the definitions of Decuyper to distinguish sharing, co-construction, and constructive conflict from each other. A thematic content analysis was carried out on each cell of the matrix to distinguish main themes in the occurrence of team learning in each type of transactivity. The results of this analysis were used to reflect on Research Question 2.

## Results

### *Identifying Types of Transactivity in Teams*

Research Question 1 concerns the types of transactivity that can be distinguished in teams. The final classification distinguished three types of transactivity (low, moderate, and high) in the data set. Descriptive information about these types is provided below. There were no major differences between teams, which supports a qualitative analysis of interactional sequences across the data set.

*Low transactivity.* Of the data, 7.7% were coded as low transactivity sequences (see Table 1). Sequences were coded as such if team members responded to an initial statement, but their response did not, or only to a very limited extent, build on this initial statement. Responses were of a clarifying nature or repeated the information provided in initial statement, but the information was not related to other elements of curriculum development or other issues at hand. Other responses, such as a joke or a response that was not related to the initial statement in any way, were considered not to build upon the initial

**Table 1.** Summary of Durations and Descriptive Information of Interactional Sequences by Transactivity Type.

	Duration				Frequency (n) <sup>a</sup>	% of total
	Mean (h:mm:ss)	Minimum (h:mm:ss)	Maximum (h:mm:ss)	Sum (h:mm:ss)		
Transactivity High	0:03:38	0:00:15	0:29:59	11:06:46	183	52.1
type Moderate	0:00:58	0:00:03	0:06:58	2:18:28	141	40.2
Low	0:00:25	0:00:03	0:02:24	0:11:15	27	7.7
Total	0:02:19	0:00:03	0:29:59	13:36:31	351	100.0

Note. h = hours; mm = minutes; ss = seconds.

<sup>a</sup>Frequency is the amount of sequences from the total data set.

statement at all. Low transactivity sequences lasted 25 s on average with a maximum of 2.5 min (see Table 1).

*Moderate transactivity.* Of the data, 40.2% were coded as a moderate transactivity sequence. Sequences were coded as such when team members clarified or refined the initial statement by relating it to other elements of curriculum development or other issues at hand. As with the previous type of transactivity, statements were made that were not related to the initial statement (such as jokes), but this time, team members used repair mechanisms to focus, or refocus, the discussion. Moderate transactivity sequences lasted 58 s on average with a maximum of almost 7 min.

*High transactivity.* Of the data, 52.1% were coded as a high transactivity sequence. Sequences were coded as such when team members clarified or refined the initial statement by relating it to other elements of curriculum development or other issues at hand. In addition, an elaborate discussion took place in which additional information was shared that elaborated on, modified, or even replaced the information provided in the initial statement. As with the previous type of transactivity, statements were made that were not related to the initial statement (such as jokes) and team members used repair mechanisms to focus, or refocus the discussion. High transactivity sequences lasted 3.5 min on average with a maximum of 30 min.

### *Linking Team Learning Processes to Types of Transactivity*

In this section, we discuss Research Question 2, which aims to find out how the team learning processes of sharing, co-construction, and constructive

conflict can be linked to the three types of transactivity (see above). A thematic conceptual matrix (Miles et al., 2014) was used to analyze the data. An important step in this process was to examine cases that did not fit our expectations (i.e., deviant cases; Miles et al., 2014). Therefore, in illustrating our results with examples from the data, we did not limit ourselves to cases that are typical, but we also described deviant cases. Deviant cases are cases in which we did recognize a team learning process, but the process did not directly concern the primary task of the teacher team (i.e., curriculum development). The examples of the data were translated from Dutch by a professional translator. We use fictitious names in these descriptions to protect the privacy of our participants. In addition, teachers are indicated with (T), and the team leader is indicated with (L), to present a transparent account of the data in the illustrations.

*Low transactivity and team learning.* Table 2 summarizes the team learning processes that occurred during low transactivity sequences. The sharing of information generally occurred at the start of each interactional sequence. The information that was shared concerned either the curriculum that was to be developed, a reflection on shared information, or contributions that structured the discussion itself. Examples of the first are occurrences in which organizational policies about curriculum development were shared, or methods to use for curriculum development. An example of the second is reflections on the current curriculum, and an example of the third is asking team members to respond to documents that have been shared. With regard to co-construction, we were able to identify five different types: (a) concerning the curriculum development, (b) structuring the curriculum development process, (c) retrieving stored information, (d) clarifying information, and (e) other occurrences of co-construction. It goes beyond the scope of this article to discuss these different types in detail. However, we would like to take this opportunity to elaborate on the third type, in which co-construction was used to retrieve stored information. In these cases, the initial statement was followed by a statement that concerns stored information. The following sequence is an example from our data:

88:7Natalie (L): What did we do with that? [referring to a document that she cannot find on the computer]

88:8Matt (T): We filled in all kinds of things! And you were so skillful, quite skillful in automatically rearranging those things. We discussed two thoroughly. We finished two and we still needed to do . . .

**Table 2.** Summary of Team Learning Processes in Low Transactivity Sequences.

Sharing <sup>a</sup>	Co-construction <sup>b</sup>	Constructive conflict <sup>c</sup>
<ul style="list-style-type: none"> <li>• . . . concerning the curriculum development</li> <li>• . . . reflection on shared information and/or actions</li> <li>• . . . that structures the present discussion</li> </ul>	<ul style="list-style-type: none"> <li>• . . . concerning the curriculum development</li> <li>• . . . that structures the curriculum development process</li> <li>• . . . by retrieving stored information</li> <li>• . . . that leads to clarification of information</li> <li>• . . . of other information</li> </ul>	—

Note. Dashes indicate absence of this team learning process in the sequences labeled with this transactivity type.

<sup>a</sup>Sharing is “communicating knowledge, competencies, opinions or creative thoughts of one team member to the other team members, who were not previously aware that these were present in the team” (Decuyper, Dochy, & Van den Bossche, 2010, p. 116).

<sup>b</sup>Co-construction is “The mutual process of developing shared knowledge and building shared meaning by refining, building on, or modifying an original offer in some way . . . leading to shared knowledge and new meaning that was not previously available to the team” (Decuyper et al., 2010, p. 116).

<sup>c</sup>Constructive conflict is “The process of negotiation or dialogue in the team that uncovers diversity in identity, opinion, etc. within the team . . . for example exploring different perspectives, error analysis, and error communication . . . to integrate differences in viewpoints” (Decuyper et al., 2010, p. 117).

88:9Natalie (L): The only xls I can find there is only one finished. And that is the one that Deanna did the week before. Darn it!

88:10Matt (T): All our work that we did before. I knew it something like this would happen.

88:11Natalie (L): Um . . . I will first move on [Natalie moves on to another topic]

In this sequence, it is easy to see how discussions can be influenced by the availability (or absence) of stored information. In this case, both team members knew about the document that Natalie was talking about, but because they could not find it, they moved on to another topic and the interactional sequence stopped. We did not identify any occurrences of constructive conflict in low transactivity sequences.

*Moderate transactivity and team learning.* We found more variety in the team learning processes in sequences that were labeled with moderate transactivity.

With regard to sharing, we found five types of information that were shared: (a) information concerning the curriculum development, (b) information that structures the development process, (c) clarifying information, (d) stored information and experiences, and (e) other information. In comparison with low transactivity sharing, the information shared in moderate transactivity sharing also structured the curriculum development process, and stored information and experiences of previous meetings were used. For example, team members shared outcomes of meetings with other colleagues or they expressed a problem in scheduling activities concerning curriculum development. In addition, we found six types of co-construction of information: (a) co-construction concerning curriculum development, (b) co-construction that structures the curriculum development process, (c) co-construction by retrieving stored information, (d) co-construction by relating or linking different aspects in the curriculum development process, (e) co-construction that clarifies information, and (f) co-construction of other information. Other than in low transactivity co-construction sequences, relationships and linkages between curriculum development aspects were made in moderate transactivity sequences. Team members related, for example, to ideas that had been shared in the meeting or they related ideas to their own experience in practice. The example below is part of an interactional sequence from our data in which a team member refers to something that has been shared before:

105:298Richard (T): What Nick said, and I totally agree with him, was that we could add BCM to the KAM lessons.

...

105:304Richard (T): I offer myself as volunteer to pick that up. I'm familiar with the material, I don't need much preparation time. I would also like to do it. So, say that we are going through with this, then I'll pick it up. I would like that. [Another team member initiates a different sequence]

With regard to constructive conflict, we found three types of constructive conflict: (a) constructive conflict concerning curriculum development, (b) constructive conflict that structures the curriculum development process, and (c) constructive conflict that clarifies information. Examples of constructive conflict are sequences in which team members expressed disagreement about the definition of a competence or responded to a critical remark on an idea by explaining the reasoning behind it. The following sequence is an example from our data:

16:77Nina (T): It was not possible to make a test for that. You tried it, but it was very difficult.

16:78Trudy (L): And it is not . . . because it is also not necessary?

16:79Heather (T): No, that's right. You know, *we* (emphasis added) decide on those tests. . . . And as few tests as possible.

16:80Trudy (L): . . . Yes . . .

16:81Ruth (T): That must be a formative assessment. That seems to me . . . a formative, a formative, yes. But the exam will then be removed.

16:82Heather (T): Yes, that is what I would do, but not hold an exam anymore.

In this sequence, Trudy first wonders whether to implement a test, but her team members convince her that only a formative assessment (i.e., diagnostic assessment) is necessary. A summary of the results is provided in Table 3.

*High transactivity and team learning.* Sequences that were labeled as high transactivity differed significantly from moderate transactivity sequences. A summary of the results is given below (see Table 4). We only identified two types of sharing: (a) sharing information concerning the curriculum development and (b) sharing stored information and experiences. However, we identified nine different types of co-construction: (a) refining information concerning the curriculum development process; (b) elaborating on information concerning the curriculum development process; (c) reflecting on information, documents, and practices concerning the curriculum development process; (d) co-construction that leads to the elicitation of additional information; (e) co-construction by relating or linking different curriculum development aspects; (f) co-construction by retrieving stored information; (g) co-construction that expresses agreement with shared information; (h) structuring the present discussion; and (i) co-construction of other information (such as jokes or motivating statements). In comparison with moderate transactivity sequences, we found a much larger variety of co-construction information, specifically about the curriculum development itself. Team members did not only share information but also refined, elaborated on, and reflected on it, and related ideas to each other. The following sequence is an example from our data:

16:264Mary (T): Yes. They [the students] have incredible difficulty with terminologies. The language as well. It is a course—yeah—with learning a lot of characteristics and then they do not know precisely what to do with it. So we should take a look at it . . . Um one could also count psychiatric problems as part of this so then I want to cluster two courses together. “Psychiatric problems” is offered separately from “Syndromes and disorders” and why is that? I don't understand it actually.

**Table 3.** Summary of Team Learning Processes in Moderate Transactivity Sequences.

Sharing <sup>a</sup>	Co-construction <sup>b</sup>	Constructive conflict <sup>c</sup>
<ul style="list-style-type: none"> <li>• . . . concerning the curriculum development</li> <li>• . . . that structures the curriculum development process</li> <li>• . . . that leads to clarification</li> <li>• . . . stored information and experiences</li> <li>• . . . other information</li> </ul>	<ul style="list-style-type: none"> <li>• . . . concerning the curriculum development</li> <li>• . . . that structures the curriculum development process</li> <li>• . . . by retrieving stored information</li> <li>• . . . that leads to the creation of relationships or linkages in the curriculum development process</li> <li>• . . . that leads to clarification of information</li> <li>• . . . of other information</li> </ul>	<ul style="list-style-type: none"> <li>• . . . concerning the curriculum development</li> <li>• . . . that structures the curriculum development process</li> <li>• . . . that leads to clarification of information</li> </ul>

<sup>a</sup>Sharing is “communicating knowledge, competencies, opinions or creative thoughts of one team member to the other team members, who were not previously aware that these were present in the team” (Decuyper, Dochy, & Van den Bossche, 2010, p. 116).

<sup>b</sup>Co-construction is “The mutual process of developing shared knowledge and building shared meaning by refining, building on, or modifying an original offer in some way . . . leading to shared knowledge and new meaning that was not previously available to the team” (Decuyper et al., 2010, p. 116).

<sup>c</sup>Constructive conflict is “The process of negotiation or dialogue in the team that uncovers diversity in identity, opinion, etc. within the team . . . for example exploring different perspectives, error analysis, and error communication . . . to integrate differences in viewpoints” (Decuyper et al., 2010, p. 117).

16:265Ruth (T): The same applies to level 4.

16:266Mary (T): Yes, because they are offered as two separate courses, but actually have enormous similarities.

16:267Trudy (L): So they are two questions. So, the question is what do you offer as content to level 3. And is it possible to link or do you need to unlink.

16:268Mary (T): Exactly, yes.

We identified four types of constructive conflict: (a) constructive conflict concerning curriculum development, (b) constructive conflict that structures the curriculum development process, (c) constructive conflict related to the



**Table 4.** Summary of Team Learning Processes in High Transactivity Sequences.

Sharing <sup>a</sup>	Co-construction <sup>b</sup>	Constructive conflict <sup>c</sup>
<ul style="list-style-type: none"> <li>• . . . concerning the curriculum development</li> <li>• . . . stored information and experiences</li> </ul>	<ul style="list-style-type: none"> <li>• . . . that refines information concerning the curriculum development process</li> <li>• . . . that elaborates on shared information, documents, etc. concerning the curriculum development process</li> <li>• . . . that reflects on information, documents, and practices concerning the curriculum development process</li> <li>• . . . that leads to the elicitation of additional information</li> <li>• . . . that leads to the creation of relationships or linkages in the curriculum development process</li> <li>• . . . by retrieving stored information</li> <li>• . . . that expresses agreement with shared information.</li> <li>• . . . that structures the present discussion</li> <li>• . . . of other information</li> </ul>	<ul style="list-style-type: none"> <li>• . . . concerning the curriculum development</li> <li>• . . . that structures the curriculum development process</li> <li>• . . . related to the storage and retrieval of information in the team</li> <li>• . . . that structures the present discussion</li> </ul>

<sup>a</sup>Sharing is "communicating knowledge, competencies, opinions or creative thoughts of one team member to the other team members, who were not previously aware that these were present in the team" (Decuyper, Dochy, & Van den Bossche, 2010, p. 116).

<sup>b</sup>Co-construction is "The mutual process of developing shared knowledge and building shared meaning by refining, building on, or modifying an original offer in some way . . . leading to shared knowledge and new meaning that was not previously available to the team" (Decuyper et al., 2010, p. 116).

<sup>c</sup>Constructive conflict is "The process of negotiation or dialogue in the team that uncovers diversity in identity, opinion, etc. within the team . . . for example exploring different perspectives, error analysis, and error communication . . . to integrate differences in viewpoints" (Decuyper et al., 2010, p. 117).

storage and retrieval of information in the team, and (d) constructive conflict that structures the present discussion. In comparison with moderate transactivity constructive conflict, there were constructive conflicts related to the storage and retrieval of information and conflict that helped to structure the discussion. Examples are using deliverables of past meetings to disagree with decisions in the present meetings, or postponing a subject based on the curriculum development phase. The first example is illustrated with an excerpt from our data:

18:274Mary (T): But in fact, if you scroll back to their hours, then they are already above the required minimum. So, actually the scheduling is correct.

18:275Nina (T): Yes, given the condition that the scheduled hours are carried out. They need to be carried out.

18:276Trudy (L): You always need to account for 5% dropout.

18:277Heather (T): It is just enough if you take into account 5% dropout.

18:278-279[Team members agree with Heather]

18:280Trudy (L): Yes, exactly. Heather, could you scroll back up. What did we do? We removed it. Well then that is settled. And “Entrepreneurial skills” is included?

18:281Ruth (T): No, no that was what felt wrong, because that is not part of level 3 [curriculum]

18:282Heather (T): It’s part of level 4, I think.

18:283Trudy (L): It’s in level 4. Then it’s correct.

18:284Heather (T): This is level 4 and that contains “Entrepreneurial skills”

[Heather verifies this information by searching on the computer]

18:285Mary (T): So do we actually say that we don’t need to repair something?

18:286Trudy (L): There is nothing to repair. It’s all right.

18:287Ruth (T): No, the repair already took place, because you removed it.

## Conclusion and Discussion

In this section, we reflect on the research questions of this research. In this research, we want to assess to what extent transactivity (i.e., the extent to which learners build on each other’s reasoning) can reveal new insights that can be used to understand the emergence of team learning through the team learning processes of sharing, co-construction, and constructive conflict. These insights, which are based on the results described in the previous section, are provided below.

As a first conclusion, our data show that team learning processes do not solely concern the content of the task but also focus on other topics such as

team goals, responsibilities, and tasks and roles of team members in the process. Within each of the three team learning processes, we found conversational actions relating to the task of the team to develop a competence-based aspect of their curriculum, as well as found conversational actions that were not directly concerning the task but structured the discussion or the team process in general. Moreover, the content of each of the processes changed as the transactivity of the conversations increased. For example, in high transactivity sequences, sharing was always related to the task of the team, whereas in low or moderate transactivity sequences, it could also be related to the team process or something else.

The finding in itself, that team learning has different topics, is not new but has been argued in previous work on team learning (e.g., Jehn & Rupert, 2008). The fact that the content of each of the processes changed when transactivity increased does suggest that *team entitativity* could play a role here. Team entitativity is the extent to which a group of individuals display the qualities of a team (Vangrieken, Dochy, Raes, & Kyndt, 2015). Team members show a high degree of team entitativity if they have shared goals and responsibilities, shared commitment to the task, a sense of affinity with the team, task interdependence, and outcome interdependence (Vangrieken et al., 2015). The results of our analysis suggest that the perceived team entitativity in the teams under research was low, especially in sequences where transactivity was moderate or low. This could have resulted in some kind of process learning (i.e., creating work routines and procedures to organize work), which differs from task learning (i.e., improving the team's understanding of the content of the task; Jehn & Rupert, 2008).

The fact that process learning occurs, instead of task learning, supports that making a direct relationship between the three team learning processes of sharing, co-construction, and constructive conflict and the extent to which a team improves itself in its task work is not always legitimate. So, for example, regardless of the fact that this relationship is often implied in research on team learning (e.g., Van den Bossche et al., 2006), our research shows that a team can co-construct information that does not improve the task work. In this regard, this research shows that the application of the transactivity framework to video observations of team learning processes enables researchers to capture these different kinds of team learning topics and, thus, provides a more sophisticated view of team learning.

As a second conclusion, our findings show that in conversational actions with a particular level of transactivity, teams were more prone to retrieve stored information and use storage and retrieval of information in the process of team learning. From our results, it is clear that storage and retrieval of information primarily took place in sequences with moderate or high

transactivity. The sharing of stored information took place both in moderate and high transactivity sequences; co-construction by retrieving stored information took place in sequences with low, moderate, and high transactivity; and constructive conflict related to the storage and retrieval of information took place only in sequences with high transactivity. A possible explanation for this finding is given by Weick and Sutcliffe (2006), who describe how individuals and organizational subunits (e.g., teams), in the reality that they cannot attend to all issues at once, should use “enhanced attention and awareness of current experience or reality [and its relation to the bigger picture]” (p. 522) to elaborate on information. It is possible that this *mindfulness* in the teams was facilitated in sequences with more transactivity.

### *Limitations and Future Research*

Although this study offers useful insights into the emergence of team learning, the limitations of the study itself and the methods should be acknowledged. A first limitation of the study is that the research sample is limited in size and scope, which may influence the generalizability of the findings. With regard to the size of the sample, it should be noted that the three teams that participated were observed during four to nine meetings. In comparison with cross-sectional measures, multiple measures of a team provide a “thick description” of the variables under study (Guba, 1981). With regard to scope, we mention in our discussion that teacher teams may differ in terms of team goals, interdependency in tasks and outcomes, and so on, from teams in other contexts. Such differences also exist between teacher teams (Vangrieken et al., 2013). In our case, the participating teacher teams were working as project teams on curriculum development and should therefore be interpreted as such. Future research is necessary to decide to what extent these findings can be applied in other contexts.

A second limitation concerns our method, in which we used observation that was limited to conversational actions. Nonverbal behavior was only used to interpret conversational actions in the coding process. In relation to this limitation, it should be noted that the type of analysis that was used in this study to analyze the conversational actions draws upon the interpretation of the researcher. In addition, the analysis draws heavily upon the time and labor resources of researchers. Procedures have been carried out and described to ensure the confirmability of the findings. However, in future research, perceptual measures for transactivity and team learning could be used to triangulate the findings.

Finally, because our study was explorative in nature, we did not look into the effects of team learning processes on team performance and into patterns of team learning processes over time. We started our research based on the assumption that team learning processes have a positive

influence on team performance, an assumption that is based on empirical research. We did find evidence to suggest that team learning processes in low transactivity sequences are different from team learning processes in high transactivity sequences. Further research is required to find out what kind of team learning processes are more effective and if there are patterns over time that influence their effectiveness.

### *Practical Implications*

This study presents a first attempt to link the framework of transactivity to the emergence of team learning in teams. This research has some implications for practice. In relation to our first conclusion, team leaders should reinforce aspects such as shared goals and responsibilities, shared commitment to tasks, and outcome interdependence. These aspects strengthen the team entitativity. Teams with team entitativity are expected to be more involved in task learning instead of process learning. Research on teams in so-called high-responsibility organizations (HROs; for example, emergency teams, military teams, SWAT teams), who are supposed to have a strong feeling of team entitativity, indicates this as well by reporting strong relationships between team learning processes and team effectiveness measures in these type of teams (e.g., Van der Haar, Segers, Jehn, & Van den Bossche, 2015; Veestraeten, Kyndt, & Dochy, 2014). To reinforce aspects related to team entitativity, team leaders could organize team-level interventions (such as team building) that are, for example, targeted to create a shared understanding about the team's objectives.

In relation to our second conclusion, team members should pay mindful attention and awareness to their discussions so as to use more elaborate forms of team learning. In this respect, research on HRO teams could again inform other teams. According to Weick and Sutcliffe (2006), team leaders of HRO teams facilitate this mindful teamwork by promoting the following characteristics: (a) preoccupation with failure, (b) reluctance to simplify, (c) sensitivity to operations, (d) commitment to resilience, and (e) deference to expertise (Weick & Sutcliffe, 2006; Wesner, 2015). These are characteristics that could help team leaders of teacher teams, and help to facilitate elaborate forms of team learning.

## **Appendix**

### *Defining Interactional Sequences*

To distinguish interactional sequences in the data, we used the following rule set:

- If two or more subsequent turns were labeled as task-related interactions, an interactional sequence was created, providing that the interactional sequence started with a turn that contained a statement or query. This rule relates to the definition of an interactional sequence by Hogan, Nastasi, and Pressley (1999), which states that an interactional sequence should start with a statement or query and that this statement or query should be followed by at least one statement made by another speaker.
- If three or more nontask-related turns disrupted the sequence, we defined it as disorganized talk and started a new sequence on the task-related turn that immediately followed the disorganized talk (provided that it was a turn labeled according to the rule above; see also, Poole & Roth, 1989).
- If silence (recording with no utterances) lasted 5 s or more, this was defined as disorganized talk.
- If nontask-related turns or silence were followed by task-related turns that were not a statement or a query, this was defined as disorganized talk.
- If the first or the third nontask-related turn in a row of three turns showed overlap with a task-related turn, the sequence was not disrupted.

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