Exploring the facilitators' behaviour supporting interprofessional learning

Juliette Schinkel

Faculty of Behavioural, Management and Social Science, University of Twente

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Abstract

The transformation of practice due to the energy transition requires Dutch installation companies to keep their employees´ knowledge and skills up-to-date. The companies draw upon Learning Communities (LCs) to enable a faster response to the need for new practices in their field and the required knowledge and skills by their personnel. LCs consist of a diverse group of professionals who build on each other's knowledge and skills to solve complex problems together. However, integrating diverse knowledge remains challenging, so team members must engage in collaborative interactions during activities of team learning (TL) and team reflexivity (TR). Team learning consists of experimenting, discussing results, seeking or receiving external feedback and collaborative idea generation. Team reflexivity consists of planning, monitoring and evaluation. The facilitator is essential to guide and support this process. For instance, they can refocus the conversation on the topic or ask relevant questions. These behaviours demonstrated by the facilitator or the members are referred to as dialogic moves. Nonetheless, how the facilitators' behaviours promote the interprofessional learning processes remains relatively unknown in the current scientific literature. Therefore, this study deepens the understanding of the facilitators' behaviour in interprofessional learning. More specifically, this research explores the facilitators' and members' behaviour initiating the TL and TR activities, during the TL and TR activities, how this changes over time, and which sequences of interactions occur between the facilitator and the members.

This study used a mixed-method design by analysing five LCs using transcriptions of the meetings. These meeting transcriptions were coded based on two codebooks. Subsequently, the codes were quantified using SPSS, and multiple contingency tables were created to answer the research questions based on the outcomes of the chi-square test and post-hoc analysis. The results indicate that the facilitator initiates more TR activities, with a trend that they initiate these activities mostly by providing evidence and reasoning. During the TL activities, it appears the facilitator mainly asks questions or makes supportive contributions, whereas they provide more evidence and reasoning during the TR activities. The change over time suggested a trend that the amount of initiation changes towards a more shared responsibility. The facilitators' behaviour changes over time during the TL and TR activities due to the activities that occur in a given moment and as the group builds familiarity. The interaction sequences showed that the facilitator mainly reacts by remaining focus on the topic, showing agreement, giving support, or giving concluding arguments or contributions during the TL activities. The facilitator mainly reacted by providing information, refocusing talk or presenting summaries during the TR activities. These preliminary findings build further on the exploration and understanding of the facilitator guiding and supporting interprofessional learning. Future studies should further develop these insights and consider our limitations to better understand how the facilitator provides guidance and support.

Keywords: facilitator, interprofessional learning, team learning, team reflexivity, dialogic moves, learning communities.

Problem statement

Nowadays, organisations need to respond quickly and adaptively to technological and societal developments in the marketplace (Kozlowski & Ilgen, 2006). This also applies to the installation sector, as they must adapt due to the current energy transition (Topsectoren, 2019). The energy transition involves using sustainable energy supplies such as solar panels or heat pumps to reduce CO_2-emissions (Ministerie van Economische Zaken en Klimaat, 2020). Due to these innovative solutions, employees' required knowledge and skills are changing (Topsectoren, 2019; Vermeulen et al., 2018). To cope with the impact of the energy transition on the required skills of employees, the Dutch installation sector has introduced Learning Communities (Topsectoren, 2019).

Learning Communities (LCs) should enable a faster response to innovative technological and societal developments and aim to ensure that members stay up-to-date with the latest knowledge and skills (Topsectoren, 2019). Within these LCs, professionals from various organisations and with different backgrounds work, learn and innovate collaboratively. They build on each other's knowledge and skills while attempting to solve a complex challenge within a short period of time (Corporaal et al., 2021; Topsectoren, 2019). All under the guidance and support of a facilitator (Corporaal et al., 2021; Topsectoren, 2019). For instance, a Learning Community could include two mechanics, a project leader, two engineers, a technical teacher, and an ICT worker. Together, they have been assigned the challenge of implementing a new software system that could reduce the time spent on specific tasks. The facilitator guides and supports their interprofessional learning process throughout the LC in which the team, for example, can discuss the software system's design, experiment with using it in their workplace, discuss outcomes and what could be improved. If they achieve their goal, they can implement the system in their company in a workable way.

These LCs consist of individuals from various organisations and with diverse backgrounds, including differences in profession, educational background, or discipline (Edmondson & Harvey, 2018). Each individual brings different perspectives to the group to innovate and solve complex problems, resulting in interprofessional learning (Edmondson & Harvey, 2018). However, integrating diverse knowledge remains challenging as the group needs to cross knowledge boundaries (Edmondson & Harvey, 2018). According to Akkerman and Bakker (2011), a boundary can be considered a sociocultural discrepancy that causes a discontinuity in interaction. These knowledge boundaries arise as individuals might have different interpretations of the problem, speak a different language or have contrasting interests due to their differences in functional background (Edmondson & Harvey, 2018).

To overcome these knowledge boundaries, members engage in team learning processes (Robbins, 2021). Team learning involves collaborative interactions and reflections in which each member engages with another's perspective by combining, developing and reframing knowledge to achieve a collective understanding (Edmondson, 1999; Edmondson & Harvey, 2018). In other words, team members must interact and collaborate through the ongoing process of action and reflection to overcome knowledge boundaries (Edmondson, 1999). During the ongoing process of action, team

members collaboratively perform activities of experimenting, discussing results, seeking external feedback and collaborative idea generation to find solutions to the problem (Edmondson, 1999; Widmann & Mulder, 2018). During the ongoing process of reflection, team members are involved in planning, monitoring and evaluating activities to discuss their goals, strategies, and processes (Decuyper et al., 2010; West, 2000). However, engaging in team learning is difficult due to the barriers that teams face, such as team members not expressing their true (contrary) feelings to avoid conflict (De Cuyper et al., 2010; Raes et al., 2013). Therefore, team members require the guidance and support of a facilitator during this process (Corporaal et al., 2021; Koeslag-Kreunen et al., 2018; Raes et al., 2013; Van Rees et al., 2022).

Facilitators are crucial in guiding and supporting members throughout the interprofessional learning process of action and reflection (Corporaal et al., 2021; Van Rees et al., 2022). They should balance their guidance and support by providing members autonomy over their learning (Van Rees et al., 2022). Encouraging participation and responsibility among group members can be challenging for facilitators (Tarmizi et al., 2006). Despite existing research on the skills and competencies required by facilitators to guide and support team learning in different contexts (e.g. Freeman et al., 2010; Kolb et al., 2008; MacNeil, 2001; Nelson & McFadzean, 1998), the impact of facilitators' behaviours on the learning behaviours of group members remains relatively unknown in the current body of scientific literature. To the best of my knowledge, only one previous study has investigated whether facilitator behaviours initiated the basic team learning processes within LCs and whether the facilitators' initiating behaviour changed over time (Van Weeghel, 2022). However, the previous study did not elaborate on the facilitators' behaviour during their interactions with the group, nor did a specification between the TL- and TR activities, which are relevant learning activities in interprofessional teams.

Due to the lack of knowledge of the facilitators' behaviours, this study aims to contribute a deeper understanding of the facilitators' behaviour in guiding and supporting the interprofessional learning process. More specifically, I will elaborate on previous research by exploring the facilitators initiating behaviour and whether this changes over time. I will use the dialogic moves to define the behaviours, and TL- and TR activities to define the learning processes. In addition, I will expand on previous research in two ways: first, by exploring the facilitator behaviours during the various TL and TR activities and how these behaviours change over time. Secondly, I will investigate the interaction sequences between the facilitator and the members during the TL- and TR activities. The theoretical background of these concepts will be further explained in the following chapter.

<div align="center">**Theoretical Framework**</div>

Learning Communities

Innovation and maintaining employees' knowledge and skills is becoming increasingly essential due to technological and societal developments. Therefore, a group of people with a variety of knowledge can bring diverse perspectives to cope with specific issues and obstacles in practice (Edmondson & Harvey, 2018). Although interprofessional collaboration in the workplace has been occurring for a while to pursue professional development and innovation, LCs are a new concept in the installation sector, bringing these knowledge-diverse people together. As LCs in the installation sector are relatively new and originate from practice, they do not yet have a broad scientific basis (Hubers et al., 2021, Chapter 19, p. 333). Research relating to comparable concepts such as Communities of Practice (CoP) and Professional Learning Communities (PLC) inspire the characteristics of LCs. The objective of these communities is comparable; a group of people engages in interactions to learn (Cross, 1998). They work interdependently to construct knowledge on how to deal with problems and challenges in the workplace (Cross, 1998; Stoll et al., 2006; Wenger & Snyder, 2000). However, there are differences, for example, in the group's composition, ways of participation and time constraints. First, people within a CoP can share or acquire knowledge depending on their level of authority or seniority in the group (Lave & Wenger, 1991, as cited in Dochy et al., 2012). Newcomers in a CoP observe and work together with seniors and participate in the background until they slowly become seniors themselves. Contrarily, within LCs, people have a shared responsibility to express their knowledge based on their complementary expertise (Van Rees et al., 2022). Secondly, CoP may consist of ten to hundred members, while LCs are small groups with a maximum of ten members (Van Rees et al., 2022; Wenger & Snyder, 2000). Third, while a CoP remains to exist as long as there is interest in continuing the group, LCs end after a certain period (Van Rees et al., 2022; Wenger & Snyder, 2000). Last, PLCs consist of people from the same type of organisation, mainly in an educational setting, while LCs consist of a diverse group of people from different types of organisations (Hubers et al., 2021, Chapter 19, p. 333; Stoll et al., 2006).

Despite their differences, several specific characteristics of LCs that are inspired by PLC and CoP have been defined (Hubers et al., 2021, Chapter 19, p. 333). According to Topsectoren (2019), an LC consists of students, teachers and employees from various public and private organisations, giving them a variety of functional backgrounds and expertise (Hubers et al., 2021, Chapter 19, p. 333). They come together in physical or virtual learning environments to work, learn, and innovate collaboratively on a problem or challenge (Topsectoren, 2019). Although these characteristics mainly outline what an LC is, a few studies have investigated the underlying mechanism of an LC. The research of van Rees et al. (2022) first suggested that the subject of the LC should be connected to members' daily work practices to feel they are adding value to the learning process. Secondly, a psychologically safe environment must be created that allows members to share their knowledge (Van Rees et al., 2022). Sharing knowledge explicitly also requires support from a facilitator, as members might not always

understand each other due to their diversity in backgrounds and perspectives (Van Rees et al., 2022). By sharing and explaining their unique knowledge, members can overcome knowledge boundaries as they create a shared interest, try to understand each other's points of view and integrate their knowledge with others (Edmondson & Harvey, 2018). Third, according to Van Rees et al. (2022), members should be increasingly in control of their learning process, leading to self-regulated learning. When self-regulating their learning, members decide on the content discussed, control the process and direct the outcomes of their learning progress (Vermunt & Verloop, 1999). Fourth, according to Hubers et al. (2021, Chapter 19, p. 333), members can work, learn and innovate together using various formal and informal learning activities, such as receiving instruction (formal) or experimenting together (informal). Last, it is essential that a facilitator should guide the learning process by considering the members' diverse backgrounds (Hubers et al., 2021, Chapter 19, p. 333). In conclusion, the learning process and support of a facilitator are important underlying mechanisms for these knowledge-diverse teams to overcome knowledge boundaries.

Team learning and reflexivity activities

Research on team learning has extensively increased since Edmondson's study in 1999 and has been viewed from both a process and an outcome perspective (Decuyper et al., 2010). When viewing team learning as an outcome, it is about realising a change in the team's shared understandings and potential behaviours (Decuyper et al., 2010). On the other hand, when viewing team learning as a process, it consists of the occurrence of team members' interpersonal behaviours (Decuyper et al., 2010). Since there is a lack of understanding of how the facilitators' behaviour could support members' engagement in learning behaviours, the focus will be on the process perspective of team learning. This involves measuring learning as group behaviours and activities (Edmondson et al., 2007, Chapter 6, p. 269).

Edmondson (1999) also views team learning as a process. She defines team learning as: ''an ongoing process of reflection and action characterised by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes of actions'' (p. 353). Edmondson's view on team learning is relevant to overcoming knowledge boundaries within interprofessional teams (Edmondson & Harvey, 2018). During the ongoing process of action, team members work together while performing joint actions (Decuyper et al., 2010). Experimenting is a team learning activity in which team members 'learn by doing' (Decuyper et al., 2010; Edmondson, 1999). When experimenting, team members try new or different working methods (Bakkenes et al., 2010; Edmondson, 1999; Raes et al., 2017). The second team learning activity involves team members discussing results, errors, and unexpected outcomes. During the discussion, it may be revealed that previous actions had unintended outcomes (Edmondson, 1999). This could provide them with relevant information, for example, to make essential changes (Edmondson, 1999). The third team learning activity involves team members seeking external information and feedback (Decuyper et al., 2010). They can seek this information or feedback, for example, when the team feels it lacks specific

knowledge or needs insights from an expert (Raes et al., 2017; De Cuyper et al., 2010). Last, besides experimenting, discussing results and seeking external feedback, members need to be creative and come up with new ideas to solve complex challenges. Asking questions (Edmondson, 1999) is relevant to developing new ideas but does not capture the full extent. Therefore, this research adopts collaborative idea generation as an additional team learning activity in which the group generates new ideas for solving problems (Widmann & Mulder, 2018). Collaborative idea generation is especially relevant since knowledge-diverse teams may generate ideas and come up with innovative solutions by drawing upon each other's knowledge.

Besides the ongoing process of action, Edmondson (1999) emphasises the importance of the ongoing process of reflection. Decuyper et al. (2010) refer to this process as 'team reflexivity'. Team reflexivity is defined by West (2000) as "the extent to which group members overtly reflect upon, and communicate about the groups' objectives, strategies (e.g., decision making) and processes (e.g., communication), and adapt them to current or anticipated circumstances (p. 296). Reflection on team functioning positively influences collaboration within the team, resulting in better team performance and innovation (Konradt et al., 2016). In short, team reflexivity consists of discussing team goals, processes and outcomes (Schippers et al., 2014, p.731). During team reflexivity, the team monitors where they stand and what goals they want to accomplish, discusses plans to get there, and evaluates the outcomes (Decuyper et al., 2010). In other words, team members engage in planning, monitoring and evaluation activities. Planning involves goal setting and formulating strategies, monitoring refers to measuring progress and recognising the discrepancies between the current and desired state, and evaluation refers to discussing outcomes and goal accomplishment (Schippers et al., 2018, Chapter 10, p. 175; Wijga et al., 2023).

In sum, team learning activities (i.e. experimenting, discussing results, seeking or receiving external feedback and collaborative idea generation) and team reflexivity activities (i.e. planning, monitoring, evaluating) are relevant for interprofessional teams to work, learn and innovate collaboratively.

Facilitator

Team learning and team reflexivity do not occur automatically in teams (Koeslag-Kreunen et al., 2018; Schippers et al., 2008). Therefore, team members require support to engage in team learning and reflexivity activities (Koeslag-Kreunen et al., 2018; Raes et al., 2012; Schippers et al., 2008). Multiple studies have shown that leadership is one of the influences that positively fosters the engagement of team members in the learning process (De Cuyper et al., 2010; Edmondson, 2003a, Chapter 10, p. 239; Koeslag-Kreunen et al., 2018; Mathieu et al., 2008; Raes et al., 2013). However, no team leader is assigned within a learning community, but an external facilitator is assigned to support the learning process (Hubers et al., 2021).

According to Kolb et al. (2008), the facilitator's primary role is to guide group discussion by encouraging group members to achieve planned goals based on positive and collaborative interactions.

They define a facilitator as; ''a person who remains neutral in the actual decision(s) of the group but who assumes the responsibility for guiding the group's process while it is attempting to solve a problem or reach a decision'' (p. 123). A facilitator can guide or support the team learning process based on interactions such as asking questions and being critical (Van Maurik, 1994).

According to Van Maurik (1994) and Bentley (1994), leadership and facilitation have strong similarities, as they both need to manage the situation to the best of their capabilities. For example, leaders and facilitators should be able to focus the groups' directions. However, whereas leaders may direct and move a team in a specific direction, a facilitator should encourage and support the team to take control and responsibility in the learning process (Bentley, 1994; Macneil, 2001). Additionally, the benefit of assigning a facilitator is that the facilitator is unfamiliar with the in-depth details of the task content (Van Rees et al., 2022). As a result, a facilitator can bring in an objective view, which may induce team members to share, explain and discuss more implicit knowledge (Van Rees et al., 2022).

The perspective of Bentley (1994) and Macneil (2001) aligns with the characteristics of LCs in which members increasingly self-regulate their learning (Corporaal et al., 2021; Van Rees et al., 2022). When members become more self-regulated, they take over responsibility for the learning process over time. This indicates that the facilitators' behaviour will change over time as team members become more responsible for their learning process. On the contrary, according to Kolb et al. (2008), the facilitator is responsible for guiding the group's process. When guiding and providing support, the facilitator should be flexible and decide when and how to intervene at the moment (Hunter et al., 2009; Shaw et al., 2010). In this perspective, the facilitator should constantly be ready to adapt to the particular situation, for example, based on the issues, new information or insights that arise during the meeting (Hunter et al., 2009; Shaw et al., 2010). This indicates that the facilitators' behaviour does not change over time when providing support, as they should remain flexible (Van Weeghel, 2022). Nonetheless, since Vermunt & Verloop (1999) state there is a complex interplay between members' self-regulation and facilitators' regulation, it might be that there are multiple possibilities showing change over time in the initiating and supporting behaviour of the facilitator. To investigate the facilitator's and members' behaviour, this research will investigate the interactional behaviours underlying the interprofessional learning process, as team learning emerges from team members interacting with each other (Raes et al., 2015).

Dialogic moves

The insights obtained from the studies of Bjuland and Helgevold (2018) and Warwick et al. (2016) will be applied to explore the interactional behaviours of the facilitator and team members. It is necessary to investigate the behaviours of the members to contextualise and understand the initiation and supporting behaviour of the facilitator.

Warwick et al. (2016) examined features of dialogue that show how learning processes can be enabled and what the outcomes of these learning processes are within a Lesson Study group. A Lesson Study group consists of teachers within their school or across schools who work and learn together and

share their insights with colleagues to pursue professional development (Warwick et al., 2016). The goal of Warwick et al. (2016) study was to clarify what characteristics of interactions (i.e. behaviours) support learning during dialogue. Their most important finding is that questioning (including negotiating meaning), building on each other's ideas, coming to some agreement, providing evidence or reasoning and challenging seem to be dialogic moves that foster productive professional dialogue and create a productive learning environment.

Warwick et al. (2016) developed a protocol including these five dialogic moves based on their findings. The first dialogic move refers to requesting information, opinions or clarifications. This behaviour could include asking questions. The second move refers to making positive and supportive contributions. This behaviour involves physical (e.g. nodding) or verbal (e.g. minimal responses of "yes" or "ok") contributions that create a friendly and relaxing environment (Warwick et al., 2016). The third dialogic move refers to expressing shared ideas and agreement. This behaviour could include building on the ideas of others and coming to some agreement. The fourth dialogic move refers to providing evidence or reasoning and encompasses behaviours of illustrating arguments (Warwick et al., 2016). The fifth dialogic move includes challenging ideas or re-focusing talk. This behaviour involves challenging others through constructive professional critique (Warwick et al., 2016). These dialogic moves characterise the interactional behaviours that enable the learning process.

However, in contrast to the current research, the members of the Lesson Study received training in the effective use of professional interactions (Warwick et al., 2016). This resulted in their ability to create a dialogue consisting of interactions that allowed each group member to contribute in a relevant way and receive support and constructive criticism from their peers (Warwick et al., 2016). Since the members in the current research did not receive any training, a facilitator is there to provide support and guidance in the group's learning process.

Bjuland and Helgevold (2018) investigated how a dialogic space is created in the conversations between student teachers and their mentor as a facilitator in a Lesson Study group context. They applied the five dialogic moves of Warwick et al. (2016), which they assume are necessary for the effectiveness of the dialogue and progression of learning. Their findings showed that the use of dialogic moves by the facilitator is essential during dialogue. The facilitator can create a dialogic space among the members and move the dialogue towards a collaborative learning experience. Nonetheless, the facilitators in the current research did not receive training regarding the effective use of professional interactions but have experience in guiding groups. As Bjuland and Helgevold (2018) found that using dialogic moves by a facilitator is essential in supporting the learning process, this research will use the dialogic moves to provide insights into the facilitator's behaviour during group interactions.

The present study and research questions

According to current research, facilitators need specific skills to guide and support learning, as this does not automatically occur in interprofessional teams. Nevertheless, facilitators encounter challenges to engage team members in the learning process. Since team learning relies on verbal interactions consisting of interpersonal behaviours, the facilitators' behaviour is essential in supporting this learning process. However, current literature provides limited insight concerning the facilitators' behaviour in supporting interprofessional learning in real-world practice. Therefore, this study aims to explore this understanding further.

The current study will replicate and elaborate on the research of Van Weeghel (2022) by further investigating the initiating behaviour of the facilitator and the change over time. The goal of replication is trying to test prior claims (Nosek & Errington, 2020). The research conducted by Van Weeghel and the current research used the data collected from the 'GasErop!' project. These data include transcriptions of meetings held by several LCs. However, besides the two LCs studied by Van Weeghel (2022), I will also use data collected from three other LCs. Important to note is that our research method differs from that of Van Weeghel (2022). She used the Interaction Process Analysis of Bales (1950) to identify the facilitator's behaviour, while this study will use the dialogic moves of Warwick et al. (2016). Using the dialogic moves would better fit the context of the current research. The dialogic moves show how learning processes can be enabled, and it was shown that the dialogic moves of the facilitator are essential to creating a dialogic space among the team members. We need to consider that the facilitator in the study of Bjuland & Helgevold (2018) was a knowledgeable other, did receive training in the effective use of professional dialogue, and a Lesson Study group does not have an interprofessional character. This is contrary to the current study, therefore, this research will be exploratory in using dialogic moves in the context of interprofessional LCs.

Another difference is that the previous research has investigated the basic team learning processes (BTLP) of sharing, co-construction, and constructive conflict, as described by Decuyper et al. (2010). The BTLPs are more focused on communicative behaviours that occur in team learning despite the nature of the team. Nonetheless, since LCs have an interprofessional character, this research will investigate the TL activities and TR activities. This is more suitable in the current context as these activities are relevant to cross-knowledge boundaries.

Additionally, this study will expand on the research of Van Weeghel (2022) by not only exploring the facilitators' behaviour initiating team learning but also by looking further into the facilitator's behaviour during interaction with the team. Investigating the interactions during the TL- and TR activities will also provide us with more data for analysis since there are multiple moves per activity, not just one initiating move. This leads to the first three research questions:

RQ1: To what extent does the facilitator (versus the members) initiate the TL- or TR-activities?

RQ2: Which dialogic moves of the facilitator initiate the TL- and TR activities?

RQ3: Which dialogic moves does the facilitator use during the TL- and TR activities?

To investigate the change over time, the fourth research question, consisting of sub-questions, will be answered:

RQ4: Does the behaviour of the facilitator (versus the members) change over time?

      a.   *Does the extent the facilitator (versus the members) initiates the TL- and TR activities change over time?*

      b.   *Do the dialogic moves of the facilitator initiating the TL- and TR activities change over time?*

      c.   *Does the use of the facilitator's dialogic moves change over time during the TL- and TR activities?*

The last part of the study explores the sequences of interactions based on the facilitators' and members' dialogic moves. These sequences will be studied to better understand the facilitator's behaviour when interacting with the members during the TL- and TR activities. In doing so, this research will adopt the method of Bron (2022) as this research also tried to gain a greater insight into the interactional sequences of behaviours in team learning in the workplace. This leads to the fifth research question:

RQ5: Which interactional sequences of dialogic moves (between members and the facilitator and members amongst themselves) occur during the TL- and TR activities?

Method

Research design

This research will apply a mixed-method multiple case study design since we explore real-life contexts to better understand the facilitators' behaviours during interactions in supporting interprofessional learning (Yin, 2009). As team learning emerges from team members' verbal interactions (e.g., dialogic moves), Raes et al. (2015) state that using observational data to identify behaviours is more suitable than questionnaires or interviews. Additionally, as this research is interested in the process perspective of team learning, observational data is more suitable than questionnaires or interviews conducted at a single point in time (Verhoeven, 2014).

Participants

The participants in this research consist of the members of the LCs of the project 'Gas Erop!'. The members are Dutch installation companies' employees, teachers at higher educational institutes, and external facilitators. These facilitators have some experience in guiding groups, as most of them are teachers in their daily practice. The project 'Gas Erop!' purposefully sampled the members, as they are already engaged with task content relevant to the Learning Community. Each Learning Community consists of five to ten members. Since five LCs of the project 'Gas Erop!' will be observed, the sample will include 36 members and five facilitators. Each member comes from a different team, department, or organisation. Table 1 includes descriptive information about the composition of each learning community (excluding the facilitator), and Table 2 shows the functions of the members and the facilitator, the topics and the number of meetings within each Learning Community. The meetings of LC A were held online via MS Teams because of COVID-19 measurements at the time. All other LC meetings were in person on-site at the company. The participation of members varied among the meetings because not every member was able to attend each meeting except for the facilitator. For specific meetings, an external member was invited. A project 'Gas Erop!' researcher also attended the meetings to observe and collect questionnaires from the members.

Table 1

Descriptive information members

	Team size	Gender		Age in years	
		Male	Female	*M*	*SD*
LC A	9	9	0	X	x
LC B	7	7	0	X	x
LC C	8	8	0	34	6
LC D	6	5	1	43	14
LC E	5	5	0	36	13

Table 2

Functions of members and facilitators, topic and total number of meetings

	Members	**Facilitator**	**Topic**	**Meetings**
LC A	1 ICT worker, 2 project leaders, 2 project engineers/modellers, 3 mechanics, 1 structural engineering teacher	HRD-teacher and researcher	Integration of a new computer system (BIM360)	8
LC B	2 project leaders, 2 project engineers/modellers, 1 mechanic, 1 workshop supervisor, 1 structural engineering teacher	Self-employed and has experience as a facilitator	Identifying optimisation of the pre-manufacturing of heat pumps	10
LC C	1 Assembly leader in Mechanical Engineering, 1 Assembly leader in Electrical Engineering, 1 Training coordinator, 1 Work planner/Draughtsman, 2 Leading mechanics, 1 Assembly leader, 1 Leading electrician	Headteacher in technical business administration	Improving the communication processes between inside and outside workers and between electrical and mechanical.	7
LC D	1 Warehouse manager, 1 Service contract manager, 1 Head of administration, 1 Work planner/draughtsman, 1 teacher, 1 Service mechanic	Project and process supervisor in higher vocational education	Promoting circularity: reusing boiler parts	10
LC E	1 Work planner/calculator/project leader, 1 teacher, 1 Service	Study coach	Guidance of BBL-students	6

and maintenance student, 1

First mechanic in electrical

engineering, 1 Study

coach/BPV

supervisor/internship

supervisor

Procedure

This study is part of the project 'Gas Erop!' and will use data collected within this project. The ethics committee of the Faculty of BMS at the University of Twente has already approved data collection for the project 'Gas Erop!'. The ethical approval number is 201093. Secondly, all members of the learning communities have signed an informed consent form to voluntarily participate in the research of the project 'Gas Erop!'. This informed consent form included the permission to be recorded and that their data will be processed for research. Since the data for this study has already been collected regarding the project 'Gas Erop!', the researcher has signed an agreement to use the data confidentially, anonymously, and with care.

Instrumentation

Within the project 'Gas Erop!', each learning community meeting was recorded using a 360-degree video camera, and each meeting was transcribed manually based on the recordings. Within this research, the choice was made to investigate the first, middle and last meetings because these are essential moments to investigate the change over time. Additionally, as this study is of an exploratory nature, a sample size of 15 meetings is sufficient to provide us with preliminary insights on the topic. Based on the meetings' transcriptions, the data was coded using ATLAS.ti. Two coding schemes have been applied for this purpose. The first coding scheme consists of the TL- and TR activities relevant to overcoming knowledge boundaries in interprofessional teams (Edmondson, 1999; Edmondson & Harvey, 2018). This coding scheme consists of seven elements and is retrieved from the research of Koekkoek (2023), as shown in Table 3. The second coding scheme consists of the dialogic moves and is retrieved from the research of Warwick et al. (2016). The coding scheme will be used to code the facilitators' and the members' moves during the TL- and TR activities. It is essential to analyse the behaviours of the members initiating and engaging in the activities to contextualise and comprehend the facilitator's initiation and supporting behaviour relative to the members. The coding scheme consists of five elements and is illustrated in Table 4. We made a minor adjustment to the codebook: the second dialogic move ''making positive and supportive contributions'' only consists of the verbal responses as we are coding based on transcriptions.

To ensure the reliability and validity of this study, the two coders compared their coding results after coding 10% and discussed their differences until an agreement was reached. Based on these reached agreements, the transcripts were re-coded. The inter-coder agreement was established by calculating Krippendorff's alpha coefficients. Since some of the results of the alpha coefficients were not yet sufficient ($\alpha \geq 0.667$), the codes of the two coders were compared and again discussed to reach an agreement (De Swert, 2012). The transcripts were recoded after reaching a sufficient overall alpha coefficient ($\alpha = 0.779$). When all the data had been recoded, the qualitative data was quantified using SPSS to answer the research questions.

Table 3

The coding scheme of the TL-activities and TR-activities

Code	Description	Protocol	Example
TL- Collaborative idea generation	Idea generation is defined as creating ideas that appropriately address existing needs and problems in a way that is new and useful for the work context (Widmann & Mulder, 2018).	Coding within TL will be started when team members discuss the current status of the problem on the work floor, share their thoughts and ideas and approach it from different angles, taking into account the different perspectives of the other participants and stopped when this is no longer the case	F: Maybe you guys can respond to this like this is what we need to consider regarding those challenges. If you look at yourself or if you look at the group, what are those challenges you have to think about? Those also came up in the individual interviews. M: For the prefab itself? F: Yes M: Okay, the challenge for the prefab. The quality, I think and the cost, so what the prefab costs.

TL- Seeking or receiving external feedback or information	Intentional exchange or search for information/opinions/ideas with/from parties external to the team (Edmondson, 1999). Team members invite people from outside the team to present information or have a discussion with them (Raes et al., 2017).	Will be coded when others from outside the team are joining to explain certain aspects of the subject and when team members discuss to seek external input or feedback	F: Nice 'R' that you can join this meeting. However, I think you had also asked 'R' right away... M1: I asked 'R'. We went over some points last time. F: Yes! M1: Of which we said that we should discuss that with 'R' first.
TL- Experimenting	Trying out a new approach, practising new behaviour, and undertaking working activities without an intention to learn but still results in learning (Decuyper et al., 2010; Raes et al., 2017; Bakkenes et al., 2010; Kyndt et al., 2016; Meirink et al., 2007).	Will be coded when a team member suggests to other team members to try out a new approach, and this is tried out within the meeting.	M1: shall we see what happens if I follow these steps in the system? M2: Yes let's try.
TL- Discussing results	Reflecting on results of experiments and discussing errors and unexpected outcomes of experiments, problems and mistakes made on the work floor, where things	Will be coded when a team member reports back on activities performed outside of the meetings and report their findings and experiences. When team members	F: I think it is good to have an introduction of how we come to it if you guys say something of how I want to tell it, but it is nice if you can do this yourself, of course.

	did not work as planned (Edmondson, 1999).	report on errors in the activities between meetings or when the activity led to unexpected outcomes.	M1: Well, so we have been together for several sessions M2: Humm... M1: We have had a session at Atag. We built on that in the different sessions. We also looked at the department with each other. Well, what is desirable for each department, and how will it work? Especially M2, because he works with it in practice, it was nice to have him there. Finally, at the last session, we made a swimming lane diagram.
TR- Planning	Discussing how to go about solving problems, goal setting, collaboratively discussing task directions, translating directions into a clear plan including scheduling, and designating task responsibility (Wijga et al., 2023)	Will be coded when team members are planning tasks or activities in, for, or between meetings or when goals are set for the present meeting, next meetings or throughout the collaboration.	F: So if I hear it like that, you guys can try these things. You have to make sure your app is updated or make sure the other technical things are fixed. M: yes

			F: And then you can at least try out the first things, and then you can have an idea of what is easy and what is complex, and then we can look at that again, on how we can make the difficult things our own. R4: Yes, it seems like a good plan.
TR- Monitoring	Monitoring content understanding, comparing a current state with a desired state (goal standard), assessing progress, recognising what remains to be completed, and monitoring the pace and time remaining (Wijga et al., 2023)	Will be coded when team members talk or ask questions about the planning and how far they are in the process, wondering what still needs to be done and assess if there is sufficient time to reach the goals that were set	F: If I look at the process, a few things are running in parallel right now. In mapping the process within (Company) that (member) started, you also raised this with colleagues. Then there is a new process to be started to see if (Company) can come here to tell something about that. Well, in both processes, we can take steps for the next time. How do we plan that for now and further on? Maybe you have an idea about it?

			M: No, I did not have an idea about it at all, but yes, you should first talk with (Company) to hear the story from them first.
TR- Evaluating	Making a judgement about goal attainment, discussing what could be improved next time (Wijga et al., 2023)	Will be coded when a team member makes comments about the achievement of the personal or collective goal and makes statements about what could be done differently in the process to more effectively achieve the common goal.	F: Where has the learning community been able to help you with that? Not falling into those traps anymore? M: Well, by opening the eyes and setting the right priorities. Yes, and that is always a very noble aspiration, but practice does tend to be more recalcitrant … at least I will have taken a lot of the things that take much time off my plate…

Table 4

The coding scheme of the dialogic moves based on the theory of Warwick et al. (2016).

Code	Description	Protocol	Example
DM1: Requesting information, opinion or clarifications	This behaviour could include negotiating meaning and questioning (Warwick et al., 2016). Requesting information, opinion and clarification: Refers to when facilitators or members asked clarification questions, invited opinions or reasoning, and negotiated meaning (Vrikki et al., 2017).	The same for both members and facilitator	M: What kind of files are you thinking of? Are those inspection reports or actual records or something? It is hard for me to get an idea of that.
DM2: Making positive and supportive contributions	Specifically, these supportive contributions could be found verbally (e.g. minimal responses), in the facilitator or member being non-disputation, and in creating a friendly and relaxing environment. These 'supportive moves' are reflected in the second protocol code (D2) (Warwick et al., 2016).	Both: ''Yes'' that is not an expression of agreement/ all expression not having any content, but to keep the conversation going/ filling silences. Members: A yes that is not an expression of agreement. Facilitator: "Yes" when it is in between the	M: This week, we put two old central heating boilers back in the house. F: Okay M: Which is also part of circular time

		contributions of the participants. Expressions that support participants in moving on, explaining more, and elaborating on their answers.	
		Expressions that make participants feel supported, like "I hope you will manage."	
DM3: Expressing shared ideas and agreement	This code refers to expressing shared ideas and agreement (D3); Building on each other's ideas and coming to an agreement (Warwick et al., 2016)	Members: Expressing shared ideas: speaking on behalf of the whole group and repeating the same as a preceding participant.	F: If I understand, you do not care how you get it delivered? M: no
	Building on ideas: Refers to when facilitators or members built on ideas and when they came to some agreement after a difference of opinion. (Vrikki et al., 2017)	Agreement: Answering questions by agreeing and not providing any arguments could also be just answering "no" to a question when it agrees with what the previous person is saying/ asking	F: Guys, we are still missing aspects: price, quality, sustainability, deliverability, logistic processes, expertise…

		Facilitator: Expressing shared ideas is not something a facilitator really does, but they do summarise what participants say as some sort of closing/ coming to an agreement.	shortage of technical staff we are obviously talking about. Communication internally.
			G2: Support, I think, is also a nice one.
			F: Support, yes.
		Agreement: when a participant makes a process suggestion (like, are we going to talk about this subject now or later) and the facilitator agrees on doing that/ steers the process	
DM4: Providing evidence of reasoning	The fourth identified move, providing evidence or reasoning, is again reflected in the fourth protocol code, which is used whenever participants illustrate their arguments (Warwick et al., 2016) c) Providing evidence or reasoning: Refers to when facilitators or members explained their reasoning	Members: When answering a question more elaborate. With arguments on the task content or when the answer to an informative question is "no", the answer provides evidence to the group that the participant did not	M: Eventually, that is going to outgrow. They only said we could start slowly and get the logistics process in order before we eventually take that step further. They have also given more information on why they can give longer guarantees on specific products…

	or when they illustrated their opinions (Vrikki et al., 2017)	do or knew something.	F: That is fine, then. We will look at the boiler next week. Moreover, maybe we should just say we can look at it the following hour. We are still looking at what we are going to do. How should we do it? And so on? So, this is still some kind of orientation phase…
		Facilitator: Providing evidence and reasoning arguments on the process level (why do something now or later, explaining the process to participants), or speaking for or on behalf of a participant giving arguments/ input to the discussion.	
		Building upon each other	
DM5: Challenging ideas or re-focusing talk	challenging each other is reflected in the fifth protocol code, which accounts for challenging ideas or re-focusing talk (D5) in the form of positive professional critique (Warwick et al., 2016)	Members: Signs of disagreement like "but", "however", "on the contrary", "in my opinion.." and then giving alternative ideas/ suggestions/ etc.	M: No, but there is a difference. In my part, you go, and then you talk about a different study, but the students of Mechatronics do different things. F: Well, already nice work, and we still have a few weeks left. I want to briefly go to you because you are obviously also in the field but as students or ex-students.
		Facilitator: Refocusing talk: because they do not have any content knowledge, there is	

almost no

challenging on the

topic, only

refocusing on

another topic or

steering back to the

previous topic.

Not building upon

previous ones but

posing new ideas/ a

contrasting

opinion/

challenging the

latter opinion.

Note. During coding, distinctions were made between the facilitator (DMF) and the members (DMP) dialogic moves.

Data analysis

The data has been coded on three levels: episode level, TL- and TR activity level, and moves level. The episode is a part of the conversation in which each member talks about the same topic. A new episode begins when the topic of the conversation shifts its focus (Bjuland & Helgevold, 2018). When the episodes have been segmented, it will be decided which episodes are regarded as a certain TL-activity or TR-activity. This implies coding at the activity level. The TL- and TR activities will be coded using the first coding scheme (Table 3). Lastly, to code the facilitators' and the members' dialogic moves, each utterance within a TL- or TR activity will be coded based on the second coding scheme (Table 4). This implied coding at the level of the move. To ensure the data was displayed correctly in SPSS, each utterance was double-coded with the dialogic move and the TL- or TR activity in which the utterance occurred. Each utterance at the start of a new episode was remarked as the facilitator's or a member's initiating move.

After the data had been coded, it was analysed in four steps to answer the first four research questions. First, the data has been exported to SPSS, allowing us to quantify the results. The data from all learning community meetings were examined in combination. Because the data from ATLAS.ti did not immediately show up correctly in SPSS, we had to compute variables into one variable. The new variables were the facilitator's or a member's initiation, TL activities, TR activities, (initiating) dialogic moves of the facilitator, (initiating) dialogic moves of the members, and the type of meeting. We had to remove the missing value in each variable to obtain the correct frequencies. During the second step, multiple contingency tables were created. During the third step, chi-square tests were performed since we were analysing categorical variables. To check whether it is acceptable to use the chi-square test and

not an alternative test, we checked the rule of thumb (fewer than 20% of the expected values is lower than 5, and the minimum expected count is at least 1) (Yates et al., 1999, p. 734 as cited in Butler & Gannon, 2021). Since these were acceptable, the chi-square test showed (depending on the research question) whether the variables were related. During the fourth step, when the chi-square test showed significance, the adjusted residuals were analysed to investigate the relationship. A residual is the discrepancy between a cell's observed and expected values. When the adjusted residual is more than 1.96 or less than -1.96 (or in the case of using SPSS 2 or -2), this indicates that the number of cases in that cell significantly deviates from the expected frequency. The larger the residual, the more outstanding the cell's contribution to the size of the computed chi-square value (Sharpe, 2015).

To answer the last research question, a sequential analysis has been performed in three steps to investigate the interactional sequences of dialogic moves underlying the TL- and TR activities. During the first step, the interactional sequences of dialogic moves were listed below each other and placed in the first column (preceding dialogic move). An activity change code has been included in the transition from one TL- or TR activity to the next to distinguish the transition from the last move of an activity to the first. To create a 1-lag sequential analysis, the first dialogic move was ignored when copying the interactional sequences in the second column (following dialogic move). This procedure was repeated until all interactional sequences for each activity were included in both columns. See the table below for an example. This table shows the facilitators' challenging ideas and refocusing talk'' is followed by a member's ''providing evidence and reasoning''. To prevent violating the chi-square test assumptions due to insufficient frequencies, it was decided to combine the individual TL-activities, on the one hand, and the individual TR-activities, on the other hand.

Table 5

Example of 1-lag sequential analysis

Preceding dialogic move	Following dialogic move
DMF – Challenging ideas and refocusing talk	DMP – Providing evidence and reasoning
DMP – Providing evidence and reasoning	DMP – Requesting information, opinion or clarification
DMP – Requesting information, opinion or clarification	DMP – Providing evidence and reasoning
DMP – Providing evidence and reasoning	DMF – Making positive and supportive contributions
DMF – Making positive and supportive contributions	DMP – Expressing shared ideas and agreement
DMP – Expressing shared ideas and agreement	Activity change
Activity change	DMP – Requesting information, opinions or clarifications (new activity)

During the second step, three contingency tables (6 x 6) were created for the TL activities and three for the TR activities. In the first table, the rows included all preceding dialogic moves of the facilitator, and the columns included the following dialogic moves of the members (DMF – DMP). In the second table, the rows include the preceding dialogic moves of the members, and the columns include the following dialogic moves of the facilitator (DMP – DMF). In the third table, the rows included the preceding dialogic moves of the members and the columns included the following dialogic moves of the members (DMP – DMP). Important to note is that only transitions in moves between two different members or a member and the facilitator have been considered since team learning occurs between individuals. Therefore, three contingency tables were created to meet the chi-square test assumptions, as the facilitator does not interact with him/herself. The cells included the frequency of each transition between two moves. A chi-square test was performed during the third step to show whether the preceding and following dialogic moves were related. During the last step, the adjusted residuals were analysed to determine whether a particular transition occurred significantly more frequently than what would be expected by chance. The results of the data analysis will be presented in the following chapter.

Results

Descriptives

Throughout 15 meetings, 423 activities took place. Each meeting consisted of 28 activities on average (SD =13.18, max = 52, min = 12). The TL activities occurred 77% of the time, with 324 activities in total. On average, 22 TL activities occurred at each meeting (SD = 10.69, max = 42, min = 8). The TR activities occurred 23% of the time, with a total amount of 99 activities. On average, 7 TR activities occurred every meeting (SD = 3.69, max = 15, min = 0). Overall, the TL activities occurred more frequently than the TR activities.

Table 6 displays the total number of each TL or TR activity. Experimenting did not occur during the LC meetings, so this activity was excluded from the data when answering the research questions. Collaborative idea generation was the most prominent TL activity, occurring almost half the time. Subsequently, discussing results occurred most frequently (18%), followed by seeking or receiving external feedback (9%). For the TR activities, planning occurred most of the time (11%), followed by evaluating (7%). Monitoring was the least common activity (5%).

Table 6

Total number of each TL and TR activity

TL activities				TR activities		
Collaborative idea generation	Discussing results	Seeking or receiving external feedback	Experimenting	Planning	Monitoring	Evaluating
n	n	n	n	n	n	n
210	77	37	0	48	22	29

Figure 1 shows the number of dialogic moves of the members and facilitators. 7304 dialogic moves occurred during all TL- and TR activities. The facilitators' contribution is 24%, and the members' contribution is 76%. A TL- or TR activity consisted of 16 dialogic moves on average (SD = 4.59, max = 20.78, min = 9.92). During an activity, there was an average of 4 dialogic moves by the facilitator (SD = 0.66, max = 5.48, min = 3.67) and an average of 12 dialogic moves by the participants (SD = 4.42, max = 17.03, min = 6.25).

Figure 1

Total number of dialogic moves of the facilitators and members
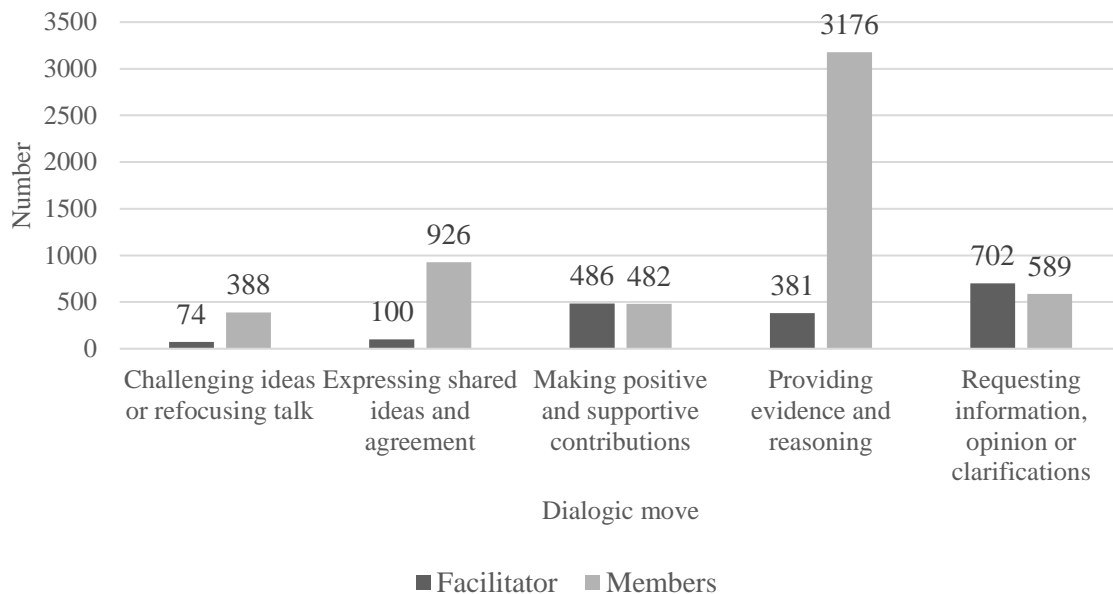
For the facilitator, the dialogic move of requesting information, opinion or clarification has occurred most of the time (40%). This is followed by making positive and supportive contributions (28%) and providing evidence and reasoning (22%). Investigation of the data showed that the facilitator mostly talked about process steps if he/she provided evidence and reasoning. The dialogic move of expressing shared ideas and agreement (6%) and challenging ideas or refocusing talk (4%) has occurred the least. When expressing shared ideas and agreement, the facilitator mainly gave summaries or showed small agreements like ''good idea''. When challenging ideas or refocusing talk, the facilitator mostly refocused talk, as shown in Excerpt 1. This excerpt occurred during the first meeting of LC C, line 393.

Excerpt 1 – Collaborative idea generation - Challenging ideas and refocusing talk

Facilitator: We don't have very much time left by the way, officially 15 minutes left, but I would still like to let you speak as well.

For the members, the dialogic move of providing evidence and reasoning (57%) occurred most frequently, in which the members mostly gave arguments about the task content. This is followed by expressing shared ideas and agreement (17%) and requesting information, opinion or clarification (11%). When expressing shared ideas and agreement, the members mostly answered questions by agreeing or repeating the same arguments as another member. The dialogic move of making positive and supportive contributions (9%) and challenging ideas or refocusing talk (7%) has occurred the least. When challenging ideas or refocusing talk, the members mostly challenged ideas.

RQ1: To what extent does the facilitator (versus the members) initiate the TL- or TR activities?

The results show there is a difference between who initiates a TL- or TR activity ($\chi 2$ (5) = 39.878, $p < .001$) as displayed in Table 7. This indicates that it depends on which TL- or TR activity is triggered by the initiation of the facilitator or a member.

Table 7

Number of TL or TR activities initiated by the facilitator or the members

	Activity						
	TL Activities			TR Activities			
	Collaborative idea generation	Discussing results	Seeking or receiving external feedback	Planning	Monitoring	Evaluating	Total
Initiation	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Facilitator	92 [110] (-3.4)	31 [30] (-2.3)	19 [19] (-0.1)	38 [24] (4.2)	17 [11] (2.4)	23 [15] (3.0)	220
Members	118 [100] (3.4)	46 [37] (2.3)	18 [18] (0.1)	10 [22] (-4.2)	5 [10] (-2.4)	6 [14] (-3.0)	203
Total	210	77	37	29	22	48	423

Note. Formatted as Observed [Expected] and below (Adjusted residuals).

When further investigating the adjusted residuals, the facilitator initiated the TR activities of planning ($z = 4.2$), monitoring ($z = 2.4$) and evaluating ($z = 3.0$) more than expected. Excerpt 2 shows the facilitator initiating monitoring during the middle meeting of LC A, line 268.

Excerpt 2 - Monitoring – Providing Evidence and reasoning

> Facilitator: Yes, if I summarise it so far, we have a consultation in two weeks in which [Member] and [Member] come back to that analysis of the [Company] document so that you know what we can pick up from it to use it within [Company]. Then the consultation with [Company] has also been about all the IT components, structure elements, and furthermore so that is also clearer. And then, from that point on, we could also continue to work on who is going to perform what actions in the BIM360 docs per function, so to speak. So from there on you can also discover what is required of the various colleagues. Is that right?

The members initiated collaborative idea generation ($z = 3.4$) and discussing results ($z = 2.3$) more than expected. For seeking or receiving external feedback, there is no difference whether the facilitator or the members initiated more often. These results indicate that the facilitator mainly initiates the TR activities, and the members mainly initiate the TL activities. Excerpt 3 shows a member initiating the discussion of results during the middle meeting of LC C, line 105.

Excerpt 3 - Discussing Results – Providing evidence and reasoning

Member: How did we do that? We called a colleague, a fabrication builder. We have a colleague, who is in Houten and who happened to have experience with airtight built-in boxes. We asked him: What is the best way to do that?

RQ2: Which dialogic move of the facilitator initiates the TL and TR activities?

Since the dialogic moves of expressing shared ideas and agreement ($n = 2$) and making positive and supportive contributions ($n =1$) are not typical to start a new activity, these moves are removed from the data. To investigate the initiation of the facilitator for each TL or TR activity separately, the assumptions of a chi-square test were violated and computing a Fisher's exact test was not possible within the limited capacity of IBM SPSS 27 due to a limited number of data, causing no results. Therefore, it was decided to combine the individual TL-activities, on the one hand, and the individual TR-activities, on the other hand.

The results show a trend in which the facilitator's dialogic move initiates the TL or TR activities ($\chi2(2) = 5.208$, $p = 0.074$) since the p-value is between .05 and .10 (Wood et al., 2014). The findings of the members observed no significant difference[1], as shown in the first table in Appendix A. Table 8 shows that the facilitator initiated the TL activities by requesting more information, opinions and clarifications than expected ($z = 2.0$). The facilitator initiated the TR activities more than expected by providing evidence and reasoning ($z = 2.1$), for example, by explaining the process or summarising where they are in the process and what steps still need to be taken.

Table 8

Number of initiating dialogic moves of the facilitator during the TL or TR activities

	Activities		
	TL Activities	TR Activities	Total
Initiating Dialogic Moves Facilitator	*n*	*n*	*n*
Challenging ideas or refocusing talk	17 [18] (-0.4)	11 [10] (0.4)	28
Providing Evidence and Reasoning	18 [24] (-2.1)	19 [13] (2.1)	37
Requesting information, opinion or clarifications	104 [98] (2.0)	48 [55] (-2.0)	152
Total	139	78	217

Note. Formatted as Observed [Expected] and (Adjusted residuals)

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[1] There is no significant difference in the use of dialogic moves by the members when initiating TL and TR activities ($\chi2 (8) = 3.452$, $p = 0.178$)

RQ3: Which dialogic moves does the facilitator use during the TL- and TR activities?

The results indicate a difference in the use of dialogic moves by the facilitator during a TL or TR activity ($\chi2$ (20) = 116.805, p < .001), as shown in Table 9. These results also apply to the members,[2] as shown in the second table in Appendix A.

Table 9

Number of facilitator dialogic moves during the TL- and TR activities

	Activity						
	TL Activities			TR Activities			
	Collaborative idea generation	Discussing Results	Seeking or receiving external feedback	Planning	Monitoring	Evaluating	Total
Dialogic moves Facilitator	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	28 [23] (1.4)	9 [8] (0.2)	2 [4] (-0.9)	5 [4] (0.4)	2 [2] (-0.3)	0 [4] (-2.2)	46
Expressing shared ideas and agreement	54 [50] (0.8)	15 [18] (-0.8)	8 [8] (0.1)	9 [9] (0.0)	9 [5] (1.8)	4 [9] (-1.8)	99
Making positive and supportive contributions	191 [245] (-5.9)	124 [88] (5.1)	59 [38] (4.3)	26 [44] (-3.4)	21 [25] (-1.0)	62 [43] (3.6)	483
Providing evidence and reasoning	162 [174] (-1.5)	50 [63] (-2.0)	19 [27] (-1.8)	54 [31] (4.9)	25 [18] (2.0)	34[31] (0.7)	344
Requesting information, opinion or clarifications	336 [279] (6.1)	80 [100] (-2.8)	32 [43] (-2.2)	44 [50] (-1.1)	22 [28] (-1.6)	36 [49] (-2.5)	550
Total	771	278	120	138	79	136	1522

Note. Formatted as Observed [Expected] and below (Adjusted Residual).

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[2] There is a significant difference in the use of dialogic moves by the members during the TL and TR activities ($\chi2$ (20) = 120.831, p < .001)

During collaborative idea generation, the facilitator requested more information, opinions or clarifications ($z = 6.1$) and made less positive and supportive contributions ($z = -5.9$) than expected. The second table in Appendix A shows that the members provided evidence and reasoning ($z = 2.5$) and challenged ideas or refocused talk ($z = 3.9$) more than expected. This indicates that the facilitator asks questions to encourage members to provide the group with more information, opinions or explanations rather than making small, supportive contributions. Excerpt 4 shows the facilitator asking a question during collaborative idea generation in the first meeting of LC E, line 82.

Excerpt 4 – Collaborative idea generation – Requesting information, opinions or clarifications.

Facilitator: Yes, let's ask the question back. I don't know how you guys, hearing this, how do you look at this?

During the discussion of results, the facilitator made more positive and supportive contributions ($z = 5.1$) than expected. The facilitator provides less evidence and reasoning ($z = -2.0$) or requests less information, opinions or clarifications ($z = -2.8$) than expected. The members made more positive and supportive contributions ($z = 4.8$). This suggests that the facilitator allows members to talk about what they have done or who they have talked to in between the meetings without extensive interference from the facilitator. This also applies to the members.

When seeking or receiving external feedback, the facilitator made more positive and supportive contributions ($z = 4.3$) and requested less information, opinions or clarifications ($z = -2.2$) than expected. The members made more positive and supportive contributions ($z = 3.5$) and requested more information, opinions or clarifications ($z = 2.1$) than expected. This indicates the facilitator supports members in seeking external feedback or encourages an external member to provide the group with information by making small contributions such as ''yes'', ''aha'' or ''hmm''. This also applies to the participants, but they were more likely to ask questions when seeking or receiving external feedback rather than the facilitator.

During planning, the facilitator provided more evidence and reasoning ($z = 4.9$) than expected and made less positive and supportive contributions ($z = -3.4$). The members challenged ideas or refocused talk ($z = 2.1$) and expressed shared ideas and agreement ($z = 4.3$) more than expected. This indicates that the facilitator interferes more extensively during planning as the facilitator provides the group with practical information about the planning. This involves, for example, steering members on what they should do or think about in terms of goal attainment, making arrangements with the members, or talking about what the group will work on next time. Excerpt 5 shows an example from the first meeting of LC B, line 773. Members either challenged ideas about the planning or agreed on the proposed plans.

Excerpt 5 – Planning - Providing evidence and reasoning

> Facilitator: Guys, [member] and I are going to work out these aspects, combined with your learning objectives. We're going to communicate those to you in my proposal. Then I want to agree that you can prioritise the three of which you say that's what we should focus on in this learning community. Can we agree on that for next time? You will receive a picture in the app and you will then prioritise and think, this one is the most important. I think that's important. So that you prioritise the top three. Then we will discuss them next time.

During monitoring, the facilitator provided more evidence and reasoning ($z = 2.0$) than expected, whereas the members did not have a significantly more occurring dialogic move. This indicates that the facilitator provides the group with information or summaries about what remains to be done or what goals still need to be addressed during the meeting or throughout the learning community, as shown in Excerpt 6 from the middle meeting of LC D, line 646.

Excerpt 6 – monitoring – providing evidence and reasoning

> Facilitator: Okay, well, that's a bit of a wait and see I guess from [Company] whether they can indeed come here and then, I also ask myself out loud, whether an hour is enough… I don't know.

During the evaluation, making positive and supportive contributions ($z = 3.6$) occurred significantly more than expected by the facilitator. Challenging ideas or refocusing talk ($z = -2.2$) and requesting information, opinions or clarifications ($z = -2.5$) occurred less than expected by the facilitator. This indicates the facilitator mainly gives supportive contributions so the members continue to share, for example, their experiences, what they have learned, or what can be done better next time. The members expressed more shared ideas or agreement than expected during evaluation ($z = 4.3$), which indicates they agree, for example, with others' evaluations.

Interesting to notice is that, for the facilitator, there is no significant difference in expressing shared ideas and agreement between all TL or TR activities. This could indicate that when members share information, ideas or opinions, for example, to create new ideas or make plans, the facilitator summarises these shared ideas or shows agreement on the ideas or the given information.

In conclusion, when comparing the facilitator's initiation behaviour (at the beginning of an activity) with the supporting behaviour (during an activity), the results showed a trend in terms of the facilitator initiating collaborative idea generation, discussing results and seeking or receiving external feedback more than expected by requesting information, opinions or clarifications. The facilitator initiated planning, monitoring and evaluating more than expected by providing evidence and reasoning. When supporting, the facilitator is making more positive and supportive contributions overall. These

results indicate a clear difference. However, the results also show consistency between the facilitator's initiating and supporting behaviour. The facilitator provides more evidence and reasoning when initiating and supporting planning and monitoring. The facilitator requests more information, opinions and clarifications when initiating and supporting collaborative idea generation.

RQ4a: Does the extent the facilitator (versus the members) initiates the TL- and TR activities change over time?

The results show a trend that the facilitator initiated the first meetings more than expected ($\chi2$ (2) = 5.541, p = .063), as shown in Table 10. These results thus indicate that who initiates the TL and TR activities changes over time. During the first meetings, the facilitator initiated more TL- or TR activities ($z = 2.3$) compared to the members. For the middle and last meetings, it makes little to no difference whether the facilitator or a member initiates a TL or TR activity.

Table 10

Number of initiations by the facilitator or the members over the first, middle or last meetings

	Type of LC meeting			
	First	Middle	Last	Total
Initiation	*n*	*n*	*n*	*n*
Facilitator	70 [59]	73 [77]	77 [83]	220
	(2.3)	(-0.9)	(-1.2)	
Members	44 [55]	76 [71]	83 [77]	203
	(-2.3)	(.0.9)	(1.2)	
Total	114	149	160	423

Note. Formatted as Observed [Expected] and below (Adjusted residuals).

RQ4b: Do the dialogic moves of the facilitator initiating the TL- and TR activities change over time?

The results, as displayed in Table 11, show there is no difference between the dialogic moves of the facilitator initiating the TL and TR activities and the change over time ($\chi 2(2) = 1.395$, $p = .845$). This also accounts for the members[3], as shown in the third table in Appendix A. These results indicate that the type of dialogic move of the facilitator initiating the TL or TR activities does not change over time. It makes little to no difference which behaviour the facilitator uses to initiate a TL or TR activity during the first, middle, or last meeting.

Table 11

Number of dialogic moves of the facilitator when initiating during the first, middle or last meetings

	Type of meeting			
	First	Middle	Last	Total
Initiating Dialogic Moves Facilitator	*n*	*n*	*n*	*n*
Challenging ideas or refocusing talk	10 [9] (0.5)	8 [9] (-0.5)	10 [10] (0.0)	28
Providing Evidence and Reasoning	14 [12] (0.9)	12 [12] (0.0)	11 [13] (-0.8)	37
Requesting information, opinion or clarifications	45 [48] (-1.1)	51 [50] (0.4)	56 [53] (0.6)	152
Total	69	71	77	217

Note. Formatted as Observed [Expected] and (Adjusted residuals).

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[3] The chi-square test shows no significant difference in the initiating dialogic moves of the members and the change over time ($\chi 2 (4) = 7.563$, $p =.109$).

RQ4c: Does the use of the facilitator's dialogic moves change over time during the TL- and TR activities?

The results show there is a change over time in the use of dialogic moves of the facilitator during the TL and TR activities ($\chi2$ (8) = 98.981, $p < .001$), as shown in Table 12. These results are also significant for the members,[4] as shown in the fourth table in Appendix A.

Table 12

Number of facilitator dialogic moves during the TL and TR activities

	Type of meeting			
	First	Middle	Last	Total
Dialogic moves Facilitator	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	11 [12] (-0.2)	16 [17] (-0.4)	19 [17] (0.6)	46
Expressing shared ideas and agreement	23 [25] (-0.5)	51 [37] (3.0)	25 [37] (-2.6)	99
Making positive and supportive contributions	66 [122] (-7.0)	209 [181] (3.2)	208 [180] (3.1)	483
Providing evidence and reasoning	74 [87] (-1.8)	118 [129] (-1.3)	152 [128] (3.0)	344
Requesting information, opinion or clarifications	210 [139] (8.7)	175 [205] (-3.4)	165 [205] (-4.5)	550
	384	569	569	1522

Note. Formatted as Observed [Expected] and below (Adjusted Residual).

First, to understand the use of the facilitators' dialogic moves and the change over time, it is helpful to understand whether the TL- or TR activities also change over time, as this could explain the changing behaviour of the facilitator. The results in Table 13 show a significant difference in the occurrence of activities over time ($\chi2$ (10) = 134.260, $p < .001$). This indicates that certain activities occur more frequently during the first, middle or last meetings, which could help us answer the research question.

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[4] The chi-square test shows there is a significant difference in the use of dialogic moves of the members during the activities and the change over time ($\chi2$ (8) = 51.679, $p < .001$).

Collaborative idea generation ($z = 6.4$) and planning ($z = 3.1$) occurred the most during the first meetings. During the middle meetings, seeking or receiving external feedback ($z = 2.9$) and monitoring ($z = 2.4$) occurred more than expected. Discussing results *($z = 5.4$)* and evaluating ($z = 7.2$) occurred more than expected during the last meetings.

Table 13

Number of TL or TR activity for the first, middle or last meetings

	Type of LC meeting			
Type of Activity	First	Middle	Last	Total
	n	*n*	*n*	*n*
Collaborative idea generation	86 [57] (6.4)	72 [74] (-0.4)	52 [79] (-5.5)	210
Discussing results	2 [21] (-5.3)	25 [27] (-0.6)	50 [29] (5.4)	77
Seeking or receiving external feedback	2 [10] (-3.1)	21 [13] (2.9)	14 [14] (0.0)	37
Planning	22 [13] (3.1)	18 [17] (0.4)	8 [18] (-3.2)	48
Monitoring	2 [6] (-1.9)	13 [8] (2.4)	7 [8] (-0.6)	22
Evaluating	0 [8] (-3.4)	0 [10] (-4.1)	29 [11] (7.2)	29
Total	114	149	160	423

Note. Formatted as Observed [Expected] and below (Adjusted residuals).

These results indicate that during the first meetings, the group is collaboratively generating ideas on how they want to address the overall problem, and the group is making plans on how they want to achieve the goals they have set or activities they want to perform in order to solve the problem, as shown in Excerpt 7. This excerpt occurred during the first meeting of LC E, lines 26-27.

Excerpt 7 – Collaborative idea generation

> Facilitator: And imagine, this group will soon come in some kind of improvement process, some kind of advice, what do you need for [Company] in this case? What are for you the crucial points to keep in mind? – *Requesting information, opinion or clarification*
>
> Member: Well, I think there's one key thing you can't describe and that, if you know each other, things will go a lot better. What you want further, which is that, as a kind of end result, we're going to give a presentation to everyone within the company who has to deal with this. And maybe then we'll also bring in more people from [Company] for that. And I would like to join them, for example at [Company], the installers in Deventer and the surrounding area, to give a presentation as [Company] on what we have achieved and show what a "BBL handbook" is, or a "learning within a company handbook". – *Providing evidence and reasoning*

During the middle meetings, the group plans to seek feedback from others outside of the group, or they receive external feedback as they have invited someone external. Furthermore, they monitor the current state and discuss what they want to accomplish. During the last meetings, the group discusses results, for example, about a tool they have created throughout the Learning Community, and they evaluate how things have been going and whether goals have been achieved or problems have been solved, as shown in Excerpt 8. This Excerpt can be found in the last meeting of LC B, lines 701-707.

Excerpt 8 – Evaluating

> Facilitator: Are the things we have talked about, did they contribute to the personal and collective goals, in other words, we have set the agenda together every time. But have those been good ones, where you were present, have those been good conversations? For your feelings? – *Requesting information, opinions or clarifications*
>
> Member: yes, I think so – *Expressing shared ideas and agreement*
>
> Facilitator: and there was room to say everything you thought? – *Requesting information, opinion or clarifications*
>
> Member: in hindsight, I have to say, I would have preferred to have had a few more from the construction team present. – *Providing evidence and reasoning*

Now that these results have clarified which activities mainly occur during the first, middle or last meetings, the results of the facilitator's dialogic move and change over time will be discussed. Together with the results as shown in Table 13, which showed planning and collaborative idea generation occurred more often during the first meetings, these results indicate the facilitator asks more questions to the members to set goals, make plans and collaboratively generate ideas on how to solve the overall problem at the beginning of the LC. This also aligns with the members challenging ideas or refocusing talk ($z = 2.6$) and providing evidence and reasoning ($z = 3.7$) more than expected during the first meetings.

During the middle meetings, the facilitator expressed shared ideas and agreement ($z = 3.0$) and made more positive and supportive contributions ($z = 3.2$) than expected. Table 13 showed that seeking or receiving feedback and monitoring occurred more during the middle meetings. For the members, no dialogic move occurred more than expected. These results indicate the facilitator made positive contributions or expressed shared ideas in the form of a summary or agreement like a ''yes'' when the group (wants to) invite an external member to the meeting or when the group is monitoring where they stand and what they still want to accomplish.

Last, the facilitator provided more evidence and reasoning ($z = 3.0$) and made more positive and supportive contributions ($z = 3.1$) during the last meetings. The members expressed shared ideas and agreement ($z = 2.5$) and made positive and supportive contributions ($z = 4.4$) more than expected. Together with the results in Table 13, which showed that discussing results and evaluating occurred more during the last meetings, the results indicate that both the facilitator and the members encouraged the group to share the results or share their experiences by making supportive contributions. As the facilitator provided more evidence and reasoning than expected during the last meetings, the facilitator also shared their findings and experiences, as shown in Excerpt 9. This excerpt occurred during the last meeting of LC D, line 530. The members agreed or expressed shared ideas when someone shared their findings and experiences. Interestingly, the amount of challenging ideas and refocusing talk did not change significantly over time.

Excerpt 9 – evaluating - providing evidence and reasoning

Facilitator: I very briefly finish my sentence...of that...but you hope, I also hope, that you take something with you from that kind of thing. That you might have done something new. I know, for example, [member] you did that very nice new thing. Because we had been to [Company] and when we were standing outside you said, "hey, I actually just wanted to look in the factory, because I like that". "yes, but that's too late now", you also said immediately.

RQ5: Which interactional sequences of dialogic moves (between members and the facilitator and members amongst themselves) occur during the TL- and TR activities?

In total, 8226 between-person sequences were counted across all activities, of which 3957 sequences were between the facilitator and the members, and 4269 sequences were between two members. The complete results of the sequential analysis are provided in Appendix B. Table 14 shows the unique interactional sequences underlying the TL or TR activities. It is interesting to note that no specific initiating moves are starting TL or TR activities. These results are consistent with earlier findings.

Table 14

Numbers, expected count and adjusted residuals of significant interactional sequences between the facilitator and members' dialogic moves underlying the TL activities or TR activities

Transition	TL activities		TR activities	
	n	*z*	*n*	*z*
DMF – Challenging ideas and refocusing talk → DMP – Making positive and supportive contributions	9 [3]	4.3	1 [1]	0.0
DMF – Expressing shared ideas and agreement → DMP – Expressing shared ideas and agreement	21 [11]	3.4	4 [4]	-0.2
DMF – Making positive and supportive contributions → Activity change	28 [15]	3.9	8 [8]	0.0
DMF – Providing evidence and reasoning → Activity change	17 [10]	2.5	12 [10]	1.0
DMP – Challenging ideas and refocusing talk → DMF - Expressing shared ideas and agreement	8 [3]	2.9	2 [1]	1.0

|	n	z	n	z
DMP – Expressing shared ideas and agreement → DMF – Providing evidence and reasoning	63 [38]	4.9	33 [27]	1.6
DMP – Making positive and supportive contributions → DMF – Providing evidence and reasoning	29 [16]	3.8	8 [6]	1.3
DMP – Challenging ideas and refocusing talk → DMP – Expressing shared ideas and agreement	51 [39.2]	2.1	7 [7]	0.1
DMP – Providing evidence and reasoning → DMP – Challenging ideas and refocusing talk	177 [157]	2.4	26 [21]	1.5
DMP – Providing evidence and reasoning → Activity change	171[136]	4.5	35 [33]	0.4
Transition	*n*	*z*	*n*	*z*
DMF Challenging ideas and refocusing talk → DMP Expressing shared ideas and agreement	10 [8]	0.8	9 [3]	3.5
DMF – Expressing shared ideas and agreement → Activity change	6 [3]	1.7	5 [2]	2.8
DMP – Challenging ideas and refocusing talk → DMF Providing evidence and reasoning	15 [10]	1.8	14 [7]	3.5
DMP – Requesting information, opinion, or clarifications → DMF – Providing evidence and reasoning	14 [9]	1.6	15 [8]	3.0

Note. Formatted as Observed [Expected] and Adjusted residuals, *p <.001*

TL activities

Because we are interested in the differences in interactional sequences underlying the TL- or TR activities, we only explain the unique interactional sequences that occur during the TL activities in this paragraph. The results showed that ten significant sequences occurred in the TL activities that were not present in the TR activities. Thus, these sequences are characteristic of the interactions that occur during TL activities. The sequences are visualised in Figure 2. Each interactional sequence will be discussed in more detail. We will first discuss the preceding moves by the facilitator that lead to a dialogic move of a member or an activity change. Secondly, we will discuss the preceding moves of the members leading to a move by the facilitator, a move by a member or an activity change.

Figure 2

Interactional sequences underlying TL activities
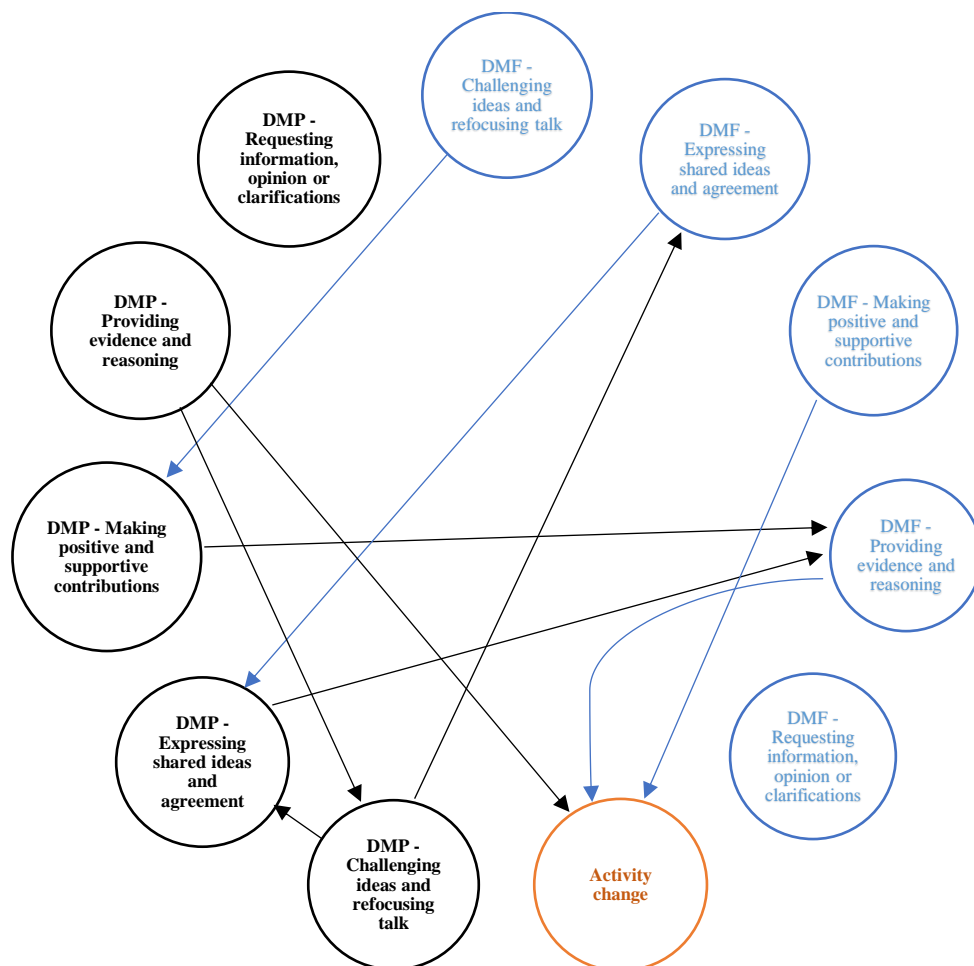
First, when the facilitator challenged ideas or refocused talk, a member mostly reacted by making positive and supportive contributions ($z = 4.3$). Investigation of the data showed that this mainly occurred when the facilitator refocused everyone's attention on the topic they were initially talking

about, ended the discussion or started to discuss a new topic, as shown in Excerpt 10. This excerpt occurred during the first meeting of LC B, lines 926-927.

Excerpt 10 –Collaborative idea generation

Facilitator: Gentlemen, we are going to conclude.

Member: That's fine.

Second, if the facilitator expressed shared ideas and agreement, a member also expressed these shared ideas or agreement ($z = 3.4$). The data showed that it mainly occurred when the facilitator provided a summary of what had been discussed or when the facilitator also agreed with what a member said; a member reacted with agreement, as shown in Excerpt 11. This excerpt occurred during the middle meeting of LC A, lines 115-117.

Excerpt 11 – Discussing results

Member: Yes I can show it, so you have little bit of an idea of how it runs and where I get stuck now – *prviding evidence and reasoning*

Facilitator: Yes you can, I think that it would be a good idea if we look at it briefly   - *expressing shared ideas and agreement*

Member: Okay, then I'll share my screen for a moment – *expressing shared ideas and agreement*

Third, when the facilitator made positive and supportive contributions ($z = 4.9$), it resulted in an activity change. This indicates the TL activities ended with a concluding ''all right'' or ''okay'' by the facilitator.

Fourth, the results also showed that TL activities ended more frequently when the facilitator provided evidence and reasoning ($z = 2.5$). The data showed that activities ended with an argument about the task content to which the group had no further additions, indicating a concluding argument.

Fifth, when a member challenged ideas or refocused talk, the facilitator mostly reacted by expressing shared ideas or showing agreement ($z = 2.9$). Looking at the data, it is frequently shown that when a member challenged someone else's ideas or opinions, the facilitator reacted with a ''yes'' indicating the facilitator accepted the information offered by members.

Sixth, when a member expressed shared ideas and agreement ($z = 4.9$), the facilitator reacted by providing evidence and reasoning. The data showed that when a member showed agreement like a ''yes', the facilitator reacted by giving an additional argument.

Seventh, when a member made positive and supportive contributions ($z = 3.8$), the facilitator reacted by providing evidence and reasoning. The data showed that this primarily occurred when members made a small contribution like a ''yes or ''hmm'', the facilitator continued providing the group with information.

Eight, when a member challenged ideas or refocused talk, another member reacted by expressing shared ideas and agreement ($z = 2.1$). Data suggest it mainly occurred when a member disagreed with the information given and another member agreed with the argument, as shown in Excerpt 12. This excerpt occurred during the first meeting of LC E, lines 107-108.

Excerpt 12 – Collaborative idea generation

Member 1: No, that's us, the BPV supervisor – *Challenging ideas or refocusing talk*

Member 2: Yes – *Expressing shared ideas and agreement*

Ninth, when a member provided evidence and reasoning, another member reacted by challenging ideas or refocused talk ($z = 2.4$). When looking at the data, it was shown that when a member provided the group with information, another member reacted by showing disagreement or opposing ideas.

Last, TL activities ended when a member provided evidence and reasoning ($z = 4.5$). The data showed results similar to when the facilitator ended the activities by providing evidence and reasoning. It was mostly a concluding argument about the content to which the group had no further additions. This is shown in excerpt 13, which occurred during the last meeting of LC C, line 160.

**Excerpt 13 – Collaborative idea generation – Providing evidence and reasoning**

Member: Yes, no, absolutely but this is the direction now. That could change again in two weeks, you never know. Yes, that is a bit of the story.

TR activities

This paragraph only explains the unique interactional sequences that occur during the TR activities. Four significant sequences were found in the TR activities that were not significantly present in the TL activities. Thus, these sequences are characteristic of the interactions between the facilitator and the members during TR activities. The sequences are visualised in Figure 3. Each interactional sequence will be discussed in more depth, starting with the preceding moves by the facilitator, leading to a dialogic move of a member or an activity change. Subsequently, the preceding moves of a member leading to a move by the facilitator will be discussed.

Figure 3

Interactional sequences underlying TR activities
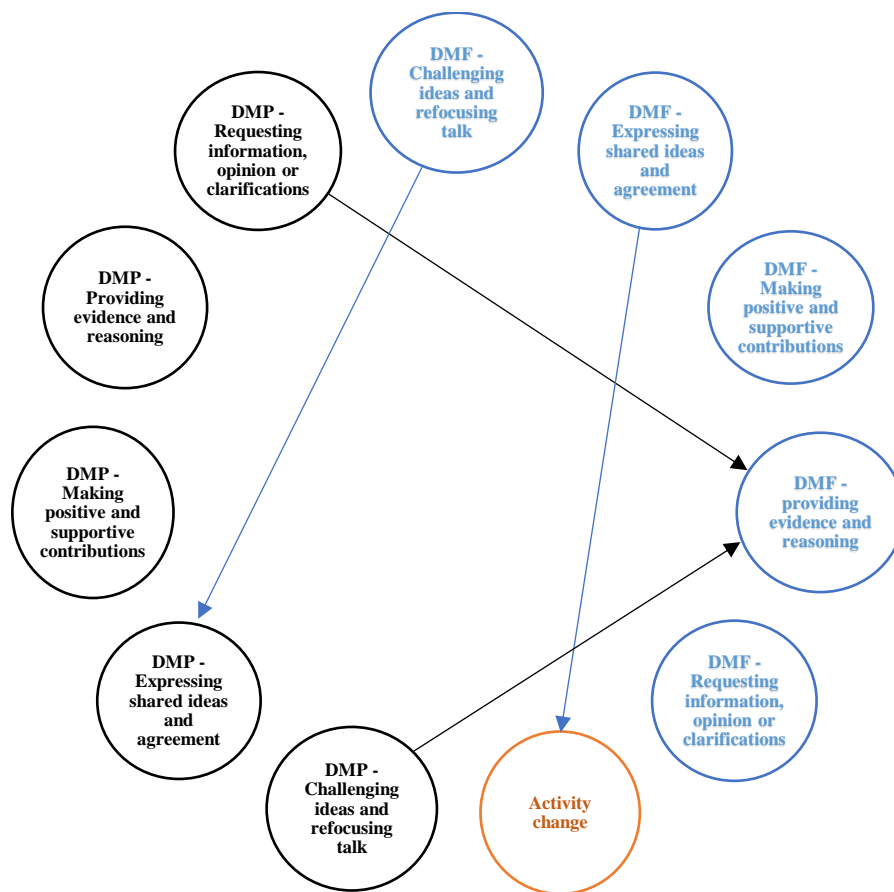
First, if the facilitator challenged ideas or refocused talk, a member reacted by expressing shared ideas and agreement ($z = 3.5$). Investigation of the data showed that when the facilitator refocused the group on making plans, monitoring what still needed to be addressed or evaluating the outcomes, the members accepted the information offered by the facilitator.

Second, if the facilitator expressed shared ideas or agreement, it primarily resulted in an activity change ($z = 2.8$). Indicating a TR activity ended when the facilitator provided an overall summary or showed agreement, for example, about plans that have been discussed.

Third, when a member requested information, opinions or clarifications, the facilitator provided evidence and reasoning ($z = 3.0$), indicating question-answering sequences frequently occurred in which the facilitator gave answers or explanations. The data showed that the facilitator gave explanations, for example, about which steps still need to be taken.

Last, if a member challenged ideas or refocused talk, the facilitator provided evidence and reasoning ($z = 3.5$). Investigation of the data indicated that the facilitator provided the group with an explanation when a member challenged the idea provided, as shown in excerpt 14. This Excerpt occurred during the middle meeting of LC E, lines 23 – 24.

Excerpt 14 – Monitoring

Member: I disagree but yes… - *Challenging ideas and refocusing talk*

Facilitator: In practice, this has proven to be different, based on the needs... that's what we are here for, of course. Where do we stand now based on what we are discussing and what is needed to continue the collaboration after the summer holidays as worked out the first four times. Based on that, I'm going to give an advice, also to [name], about how this learning community should be continued. Because I'd hear from [name] that the intention is absolutely there. Also to be really involved in the presentation with the MT. That's a very important signal. – *Providing evidence and reasoning*

In response to the research question, the sequential analysis results showed that during TL activities, the facilitator mainly shows agreement or gives support with the information, ideas or opinions presented, remains focus on the topic, and provides summaries or concluding arguments. During TR activities, the facilitator mainly provided information to the group based on the questions asked or ideas challenged by the members. Members agreed when the facilitator refocused the group. TR activities ended when the facilitator presented summaries or showed agreement. Interesting to note is that the results show the facilitator is providing more arguments during the TR activities, which is consistent with previous findings.

Discussion

This study aimed to explore the facilitator's behaviour in supporting interprofessional learning. The first findings suggest that the facilitator primarily initiates TR activities, and the members initiate TL activities. For example, the facilitator provides information on remaining tasks so the group becomes engaged in monitoring. These findings are partially consistent with previous research by Van Weeghel (2022), which also showed that the facilitator and the members initiate different BTLPs. Secondly, the outcomes showed a trend that the facilitator initiated TR activities more than expected by providing evidence and reasoning and the TL activities by requesting information, opinions or clarifications. For example, by asking what others think about refurbished parts in a boiler. These results partially align with the previous research, as the results showed that asking questions leads to co-construction, and giving information leads to sharing (Van Weeghel, 2022). These results thus indicate a difference in behaviour, but no other findings were observed. Third, the results suggested a difference in the facilitator´s behaviour during the TL and TR activities. For example, the facilitator provided evidence and reasoning about what everyone should work on in the coming period during planning, and made supportive contributions like a ´aha´ while discussing results. Fourth, the results show a trend that the facilitator mainly initiated the activities in the first meetings, whereas the activities in the middle and last meetings were initiated in almost equal amounts. This is contrary to the research of Van Weeghel (2022), as these results showed that the initiating behaviour of the facilitator did not change over time. Fourth, the results indicate that the type of dialogic move of the facilitator initiating the TL or TR activities does not change over time. This is partially contrary to the previous research, as the results showed that the content of the facilitator's behaviour when initiating did change over time (Van Weeghel, 2022). However, the previous study neither showed a change over time in the nature of the initiating behaviour of the facilitator. Fifth, the outcomes have indicated that the facilitators' behaviour during the TL or TR activities changes over time. For example, expressing shared ideas and agreement occurred more than expected during the middle meetings. Last, the findings showed four interactional sequences characterising the TR activities and ten interactional sequences characterising the TL activities.

Facilitator behaviour in TR activities

Schippers et al. (2008) suggested that individuals or teams rarely reflect spontaneously, as this behaviour is not habitual. A feeling of interpersonal risk or the fear of being perceived as negative could limit members' collective reflection. This might prevent them from critically reflecting on individuals' or groups' performances (Edmondson, 2002, Chapter 13, p. 255). Consequently, this reluctance among team members may explain why facilitators are more likely to initiate TR activities. Because reflection does not happen automatically, team members must learn and develop their reflection skills, especially in newly formed teams where team members are unfamiliar with each other. Therefore, the facilitator is essential in building a psychologically safe environment characterised by mutual trust and respect

(Edmondson, 2003b). When feeling psychologically safe, members dare to take the risk of being honest or critical when interacting with others. Even if they face change and uncertainty, not knowing whether things will work out as expected (Edmondson, 2002, Chapter 12, p. 255). Another explanation could be that reflexivity is associated with investing time and effort that could be used more effectively elsewhere (Carter & West, 1998, as cited in Konradt et al., 2016; Hackman et al., 1976). Therefore, it is more likely that the facilitator initiates TR activities. Team members might find it too time-consuming and want to spend their time on solving the problem. Additionally, as they work under time pressure, it might be that the team works as much as possible to deliver results (Carroll & Rosson, 1987, as cited in Gurtner et al., 2007). Thus, they may become so engaged in debating the task content that they forget to consider reflections. As a result, the facilitator initiates TR activities so the team stays in the right direction when trying to solve the problem.

Nonetheless, these explanations relating to the initiating behaviour must be interpreted cautiously, as the results showed a trend. Additional research is necessary to explain the relationship between the facilitator's behaviour initiating the TR activities. It could be possible that there is no change in the initiation behaviour. Several studies (Margalef & Roblin, 2016; Savin-Baden, 2003; van der Want & Meirink, 2023) suggest facilitators must be flexible and responsive to the group's needs and dynamics, adjusting their behaviour accordingly. The facilitator should master various techniques and select the most suitable one to encourage the group to progress (Kolmos et al., 2008). In addition, the facilitator should be ready to adapt to the situation at hand and decide at the moment whether, when and how to intervene in group discussions (Hunter et al., 2009; Shaw et al., 2010). Therefore, it could be explained why there is no specific difference in the facilitator's initiating behaviour or a change over time.

A possible explanation for the control of the facilitator during the TR activities could be that it is the facilitator's responsibility to focus on reflections, as they need to guide and steer the group in the right direction (Nelson & McFadzean, 1998; Savin-Baden, 2003; Schuman, 1996). The research of Kolb & Rothwell (2002) also showed that the facilitator should, among others, be able to maintain focus, stick to agreed timeframes, and help clarify the meeting's objectives. Thus, the facilitator plays a crucial role in directing focus during team reflexivity, giving information about goals, processes and strategies, and concluding these reflections with final arguments. In contrast, during evaluation, the facilitator provides more supportive contributions than expected, urging members to share their experiences, what they have learned or how things can be improved in the future. Input from members is critical during the evaluation, as this demonstrates their ability to be self-aware of their own behaviours and the need for improvements on tasks and team processes (Gabelica et al., 2014). Sharing these thoughts, feelings, or experiences openly enhances openness and trust (Edmondson, 1999), which is essential in these interprofessional teams as this results in improved collaborations among the members (Goleman, 1998, as cited in Slater, 2005). Therefore, the facilitator should avoid providing too much evidence and reasoning themselves, as this is essential for team members to do so.

Facilitator behaviour in TL activities

The facilitator is external and lacks specific knowledge of the task content (Van Rees et al., 2022). In their role, the facilitator is expected to remain neutral in the actual decision-making processes of the group (Kolb et al., 2008). This might clarify why the members are more likely to initiate TL activities and the facilitator mainly asks questions or makes supportive contributions when discussing task-related topics. This aligns with the study of Bostrom et al. (1993), who states that members should be primarily concerned with task-related discussions. Meanwhile, the facilitator must remain objective and avoid becoming actively involved in providing arguments or insights about the task content (Bostrom et al., 1993; Nelson & McFadzean, 1998; Schuman, 1996). Given the facilitators' lack of content knowledge, they were relatively unable to give arguments during content discussions. Furthermore, if the facilitator becomes overly involved in the task content, they can risk becoming highly influential (Miranda & Bostrom, 1999). This can subsequently hinder the involvement of other group members as they rely on the facilitator as an important source of meaning or ideas (Miranda & Bostrom, 1999). Therefore, allowing members to focus on the task content may encourage equal participation (Miranda & Bostrom, 1999). Nonetheless, even though the task content is primarily the group's responsibility, it should be recognised that a facilitator could still contribute by giving arguments related to the task's content especially as they gain more knowledge on the subject throughout the LC. However, they must do so cautiously to maintain objectivity (Kolb et al., 2008; Miranda & Bostrom, 1999).

Given the facilitator´s limited knowledge of the content, they may ask for more clarifications, explanations or information during the TL activities to gain a better understanding (Van Rees et al., 2022). Additionally, asking questions encourages members to share, explain and discuss more implicit knowledge. This is crucial for breaking down knowledge boundaries as members have different viewpoints and expertise. Asking questions allows for a deeper exploration of different perspectives, potentially leading to a more comprehensive understanding of the content by all members. The facilitator could also ask questions that others do not dare to ask, being a role model for psychological safety. By asking questions or making small, supportive contributions, the facilitator can move the conversation forward. This is consistent with the findings of Bjuland and Helgevold (2018), who argued that the facilitator plays an essential role in creating a dialogic space among the members and moving the dialogue forward towards a collaborative learning experience. It is worth noting that while the study of Bjuland and Helgevold (2018) highlighted the effectiveness of content-knowledgeable facilitators in creating a dialogic space among the members, our results showed that this is possible even when content-knowledge by the facilitator is limited.

In addition, it is the facilitator's role to ensure that the group remains focused on the topic (Kolb & Rothwell, 2002). Since the group had limited time during a meeting, and it is the facilitators' responsibility to manage time effectively, the facilitator could also finalise the discussion of a specific topic (Allen & Rogelberg, 2013; Kolb & Rothwell, 2002). For example by providing a small concluding

contribution, such as 'alright' or 'okay'. Additionally, when the facilitator expresses shared ideas or agreement, it may foster a feeling of recognition among the members, potentially increasing their involvement and engagement during interaction (Bostrom et al., 1993; Schuman, 1996). The facilitator should foster an environment where members are encouraged to continue sharing and discussing information, even when there is a conflicting argument (Bjuland & Helgevold, 2018; Kolb et al., 2008). Encouraging members to provide opposing arguments can help overcome knowledge boundaries as it promotes an open and diverse exchange of ideas. When members challenge ideas such as expressing disagreement or opposing viewpoints, it aligns with the basic team learning process of 'constructive conflict'. This involves conflict or discussion between team members that arise from open communication and diversity in knowledge, identity or opinion (De Cuyper et al., 2010; Raes et al., 2017). Members are more likely to take interpersonal risks (e.g. being more critical) as they possess a deeper understanding of a specific topic based on their expertise (Edmondson, 2002, Chapter 13, p. 255). Consequently, they may feel more comfortable and confident in challenging ideas when talking about the task content, contributing to constructive conflict.

Who initiates the TL or TR activities changes over time

Our results indicate that members slightly become more self-regulated in their learning, which partially aligns with the findings of Bentley (1994) and Macneil (2001), who argued that members should take their own control and responsibilities in the learning process. One possible explanation could be that when the group becomes more familiar with each other and the group process, they experience psychological safety and feel confident enough to become more self-regulated (Edmondson, 2002, Chapter 13, p. 255). Another explanation could be that there has been a shared responsibility between the facilitator and the members, as the initiation occurred almost equally during the middle and last meetings (Vermunt & Verloop, 1999). During this shared control, the facilitator remains responsible but should assign more autonomy to members (Deci & Ryan, 2000; Endedijk et al., 2023). Since members work and learn together for the first time in an LC, shared control or so-called 'coregulation' might be the best option. They may still need the encouragement of the facilitator as a supportive other to try new forms of learning or additional skill development when engaging in specific learning activities (Hadwin & Oshige, 2011; Vermunt & Verloop, 1999). However, these indications should be interpreted cautiously, as these results showed a trend and a complex interplay exists between members' self-regulation and facilitators' regulation (Vermunt & Verloop, 1999). Follow-up research is necessary to investigate this relationship further, as previous research indicated that the initiation does not change over time. One possible explanation could be that according to Edmondson (2002, Chapter 13, p. 255), action and reflection should occur in a timely and efficient manner. Therefore, the facilitator must provide structure and guidance, which can be achieved by initiating TL and TR activities. Furthermore, it could be that the facilitator wants to maintain control as they feel responsible for guiding the process, which may hinder self-regulation by members (Savin-Baden, 2003; Vermunt & Verloop, 1999).

The facilitators' behaviour changes over time during the TL and TR activities

According to Decuyper et al. (2010), teams tend to evolve over a similar structure consisting of a beginning, middle and end phase. Ilgen et al. (2005) defined these phases as forming, functioning and finishing. Konradt et al. (2016) also considered team reflexivity within the framework of Ilgen et al. (2005) and explained that team development consists of transition and action phases. During the forming or transition phase, the team must gather information and use this information to develop a plan to achieve their goals (Ilgen et al., 2005; Konradt et al., 2016; Marks et al., 2001; Wijga et al., 2023). According to our study, collaborative idea generation and planning were the most common activities during the first meetings. Therefore, it can be clarified that the facilitator asks more questions at the start of the LC, which helps overcome knowledge boundaries and directs members to set goals, make plans, and collaboratively generate ideas on how they want to solve the overall problem. Another possible explanation could be that the group requires some time to build familiarity and establish trust (Decuyper et al., 2010; Ilgen et al., 2005). Therefore, the facilitator asks more questions to create a psychologically safe environment, as members might not immediately start sharing information by themselves (Edmondson, 2002, Chapter 13, p. 255).

During the functioning or action phase, teams work on accomplishing the tasks and monitoring their progress (Ilgen et al., 2005; Konradt et al., 2016; Marks et al., 2001; Wijga et al., 2023). Our study also reflected this, as seeking or receiving external feedback and monitoring occurred more than expected during the middle meetings. Thus, our findings suggest that throughout the middle meetings, the facilitator made positive contributions or expressed shared ideas by summarising and showing agreement, especially when the group sought information from an external member or monitored the progress. Additionally, it might be possible that the group has developed a higher level of familiarity as they have worked together for a more extended period. Therefore, the facilitator should only step in and support the group when necessary (Viller, 1991). This also aligns with the theory of Vermunt & Verloop (1999), as the facilitator could expect members to be able to handle the content matter. Therefore, the facilitator needs to take less control.

During the finishing phase, which can be referred to as a transition phase, the team closes the process and evaluates their past performances and the accomplishment of goals (Ilgen et al., 2005; Konradt et al., 2016; Marks et al., 2001; Wijga et al., 2023). In our study, discussing results and evaluation occurred more than expected during the last meetings. Hence, our results indicate that the facilitator encouraged the group to continue sharing their results and evaluations through supportive contributions. As the facilitator provided more evidence and reasoning than expected during the last meetings, this implies they also shared their findings and experiences. An alternative explanation could be that when the group nears its end, the facilitator's role becomes more critical, as the facilitator should help close the process by providing more information (Viller, 1991). Additionally, as evaluation might be a relatively new learning activity for members, it might be possible that the facilitator needs to take more control (Vermunt & Verloop, 1999). Thus, shared control is best suited when members need

further development. Moreover, given that the group has been collaborating over an extended period up till the finishing phase, they may have developed enough interpersonal trust to share their opinions or feelings openly. Consequently, the facilitator mainly needs to provide small, supportive contributions. However, this should be handled cautiously, as this study did not explore the concept of team psychological safety. It could be reversed that team members need supportive moves by the facilitator because they do not feel safe enough to share their opinions independently. Especially since providing honest feedback during evaluation requires more interpersonal risk-taking (Edmondson, 2002, Chapter 13, p. 255). Therefore, investigating the perceived psychological safety among the team members and facilitators in future research could be interesting.

Limitations and directions for future research

The discussion has already made some references to the study's limitations and directions for future research. This section elaborates on the study´s limitations and provides suggestions for future research.

Coding process of initiation

During the coding process, the coders discussed how to establish an agreement in applying the codebooks. After the data was coded entirely, the inter-rater agreement score was established. It appeared that the inter-rater agreement score of the activities (binary $\alpha = 0.667$) and moment of initiation (binary $\alpha = 0.681$) was on the lower edge to infer reliability. However, as the data was already coded entirely and Krippendorff's Alpha implied some level of agreement, the coders did not further adjust this data. However, tentative conclusions should be made with the data when binary α is between 0.667 and 0.800. Additionally, even though our dataset consisted of 7304 dialogic moves in total, the amount of initiating dialogic moves of the facilitator ($n = 220$) might not have been substantial enough to draw a firm generalizability of the results. It is, therefore, important that the results related to the initiating behaviour need to be interpreted with caution. In future research, larger samples should be investigated by including more LCs and more LC meetings, and coders should have a higher level of agreement when assigning activities.

Absence of analysis

We could not compare changes in interactional sequences across TL and TR activities over time. This is because our sample size did not consist of a sufficient amount of dialogic moves to meet the chi-square test assumptions. Nevertheless, it might be interesting in future research to investigate the change over time in interactional sequences. This might provide interesting insights for facilitators in supporting interactions and whether or not this changes over time.

Coding of dialogic moves

It was observed that the dialogic moves of ''making positive and supportive contributions'' and ''expressing shared ideas and agreement'' were not typical to initiate a new activity. As a result, only three types of initiating dialogic moves with a total of 217 initiating moves remained. Therefore, it is suggested to conduct a follow-up study by examining a larger dataset and using an extended or inductive codebook to capture more specific types of behaviours. Furthermore, several dialogic moves consisted of multiple moves. In future research, it could be interesting to split the moves so utterances can be assigned more specifically. When separating and specifying moves, it would become more apparent when discussing and interpreting the results. For example, challenging ideas or refocusing talk could be separated in the dialogic move ´´challenging ideas´´ and the dialogic move ´´refocusing talk´´. In this respect, it will become apparent that facilitators mostly refocus talk and members challenge ideas. This also applies, for example, to expressing shared ideas and agreement. This dialogic move could be separated into ''expressing shared ideas'' and ''showing agreement''. When someone shows agreement with a ''yes'', it can be more easily distinguished from a supportive ''yes''.

Additionally, the current study only focused on between-person interactions. However, it might be interesting to investigate within-person interactions in future research. The reason is that the dialogic moves of the facilitator sometimes consisted of multiple moves. However, within this research, we only assigned one dialogic move based on how the facilitator ended the utterance. For example, the facilitator started by summarising and ending this utterance by asking the group a question. Investigating within-person sequences might provide a deeper understanding of the facilitator's behaviour. Additionally, as the facilitators did not have content knowledge, it could provide research with more insights when creating dialogic moves that fit this aspect. For example, by creating separate moves for ´providing evidence and reasoning about team reflexivity´ and ´providing evidence and reasoning about team learning´.

Assigning team learning activities

When the group was talking about seeking external feedback or when an external member was attending the meeting and provided the group with information, these activities were assigned as 'seeking or receiving external feedback'. Nonetheless, the groups were also collaboratively generating ideas or discussing results with the external members. Secondly, experimenting did not occur within the learning community meetings. However, as this is an important learning activity that mainly occurs outside the meetings, these codes may need to be reconsidered in further research.

Aggregation of facilitators

The current research aggregated the facilitators and provided the results and conclusions if there is one facilitator. The choice was made to aggregate the facilitators as they received the same training on how to guide LCs and as they were external to the group. Despite that, the facilitators differ in their

experience in guiding groups and their affinity for the subject. Therefore, it might be interesting in future research to include distinctions between facilitators, allowing their behaviours to be connected to their experience level or received training.

Underlying basic team learning behaviours

This study built on the research of Van Weeghel (2022). However, Van Weeghel used the basic team learning processes of sharing, co-construction and constructive conflict, whereas our research used TL and TR activities. It could be stated that the TL-activities and TR-activities shape the conditions under which the basic team learning behaviours occur (Decuyper et al., 2010). Therefore, it might be interesting in future research to include the basic team learning processes underlying the TL-activities and TR-activities to gain a more in-depth understanding. For example, a TL activity consisting of multiple utterances with the dialogic move ''challenging ideas and refocusing talk'' could indicate episodes of constructive conflict.

Context and method of the current study

Since learning communities in the installation sector are a relatively new phenomenon, this specific context might limit the generalizability of the results. As the groups were inexperienced in collaborating, the members in our study might have behaved differently compared to team members who worked together for a more extended period. This might have resulted in the members not becoming more self-regulated over time. For this reason, it might be interesting for further research to investigate (follow-up) learning communities that are more experienced in working, learning and innovating together.

This also applies to the fact that only one woman participated in the current sample, which may not reflect the current reality that women are more represented in the workplace (van Doorne-Huiskes & Schippers, 2010). In this light, however, it should be considered that women are still underrepresented in the technical sector (Swafford & Anderson, 2020). Additionally, as the current research is exploratory, it makes it difficult to generalise the results. Only 15 meetings were analysed, and the use of the codebook by Warwick et al. (2016) was the first time in this context. By considering these limitations of the current research, future research could create more developed codebooks and analyse a greater number of meetings and LCs to draw more general conclusions.

Time perspective

The current research only investigated the first, middle, and last meetings of the LCs. However, as teams are complex, dynamic and non-linear systems that change and develop over time (Decuyper et al., 2010; Ilgen et al., 2005), this study might not have captured the full complexity of teams as we only looked into snapshots and specific moments in time. Therefore, it could be interesting for follow-up research to delve deeper into the relationship between facilitation, team dynamics, and developmental

phases over time (Delice et al., 2019). The insights from Koekkoek's research (2023) can be used for this purpose, as she investigated the development over time across all meetings in multiple LCs.

Practical implications

Ensuring clarity on the expectations for facilitators becomes crucial when organisations seek to involve them in LCs or interprofessional teams. For example by the use of a facilitator manual that provides instructions on how to effectively guide and support interprofessional learning. Second, it is essential that the facilitator focuses on guiding and supporting the group towards their goals, rather than becoming overly involved with the content. Therefore, it is crucial that facilitators receive proper training on their role and the corresponding behaviours to fulfil it effectively. These training could specifically address the distinct responsibilities and behaviours of the facilitator during TL or TR activities, emphasising the importance of the ability of the facilitator to adapt their behaviour based on the activity and maturity of the group. Within this training, specific strategies or practice cases could be provided, for example, on how to reaming focus or providing summaries to stay in the right direction. Third, as the members should overcome knowledge boundaries, the facilitator must ensure everyone provides relevant input by sharing their knowledge and experiences. In doing so, it is important the facilitator asks questions or makes supportive contributions. Therefore, facilitators should receive training on how to exhibit these behaviours appropriately. For example, by practicing which types of questions can effectively elicit members sharing their knowledge and experiences. Fourth, the facilitator should receive training on when and how to use certain behaviours to encourage members to become more self-regulated. As groups go through different development phases, and team members can differ in their level of experience performing learning or reflexivity activities, the facilitator must learn how to adapt their behaviour accordingly to assign the group with more autonomy and shared responsibility. Fifth, as psychological safety is a reoccurring explanation in our discussion, it could be relevant for the facilitator to verify with the members to what extent they feel psychologically safe and dare to take interpersonal risks during the meetings. This can be accomplished, for example, by talking to each member separately for a short moment after every one or two meetings or asking members to fill in a questionnaire in which they answer questions about their perceived psychological safety. Last, it could be helpful for the facilitators to receive feedback from the members or the researcher regularly. For example, by having a feedback round at the end of every meeting, or the members and researcher filling in a short questionnaire to provide the facilitator with feedback. This feedback can be constructive for the facilitators to reflect on their own practices and becoming aware of their potential blind spots and adjust their way of guiding and supporting the group if necessary.

Conclusion

The current research investigated how the facilitator initiates and supports TL- and TR activities in interprofessional teams that must overcome knowledge boundaries. The facilitator tends to have more responsibility and control when initiating TR activities and during the TR activities. There is a trend that the facilitators' behaviour differs when initiating TL- or TR activities. When initiating TL activities, they ask questions, as they have no content knowledge and induce members to share and explain their knowledge. When initiating TR activities, they provide information as they might feel responsible for reflections about processes, goals or strategies. Nonetheless, these conclusions must be drawn with caution. Furthermore, there is a trend that the amount of initiation by the facilitator and the members changes over time towards shared responsibility, but further research is necessary. The facilitators' behaviour does not change over time when initiating a TL- or TR activity, but it does change over time during interaction with the group. This is probably due to the activities that predominantly occur in a given moment and as the group builds familiarity and trust. There is a difference in interactional sequences during TL- and TR activities. During the TL activities, the facilitators support the activities by remaining focus on the topic or increasing the involvement of all members by asking questions, providing summaries or giving agreement. During the TR activities, the facilitator carries responsibility for guiding reflections by refocusing the group, providing information, giving summaries or showing agreement. These preliminary findings build further on exploring and understanding the facilitators' behaviour relating to interprofessional learning. Additional research could help to confirm, improve or expand our research findings and implications, which could contribute to training for facilitators and the design of the facilitators' manual in guiding interprofessional learning.

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Appendix A

Dialogic moves of members when initiating the TL- and TR activities

The results of the chi-square test show there is no significant difference in the use of dialogic moves of

the members when initiating the TL and TR activities ($\chi2$ (8) = 3.452, *p* = 0.178).

	Activities		
	TL Activities	TR Activities	Total
Initiating Dialogic moves members	*n*	*n*	*n*
Challenging ideas or refocusing talk	51 [53] (-1.1)	8 [6] (1.1)	59
Providing Evidence and Reasoning	74 [70] (1.9)	5 [8] (-1.9)	79
Requesting information, opinion or clarifications	54 [56] (-0.9)	8 [6] (0.9)	62
Total	179	20	120

Note. Formatted as observed [expected] and (Adjusted Residual).

Dialogic moves of members during the TL- and TR activities

The chi-square test shows there is a significant difference in the use of dialogic moves of the members during the TL and TR activities ($\chi 2$ (20) = 120.831, $p < .001$).

	Activities						
	Collaborative idea generation	Discussing Results	Seeking or receiving external feedback	Planning	Monitoring	Evaluating	Total
Dialogic moves members	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	215 [181] (3.9)	33 [59] (-3.8)	34 [38] (-0.6)	26 [18] (2.1)	8 [9] (-0.3)	13 [25] (-2.6)	329
Expressing shared ideas and agreement	475 [508] (-2.4)	164 [165] (-0.1)	83 [106] (-2.6)	77 [50] (4.3)	23 [25] (-0.5)	102 [70] (4.3)	924
Making positive and supportive contributions	227 [264] (-3.6)	124 [86] (4.8)	78 [55] (3.5)	10 [26] (-3.4)	10 [13] (-0.9)	32 [37] (-0.8)	481
Providing evidence and reasoning	1746 [1700] (2.5)	537 [551] (-1.0)	342 [354] (-1.0)	148 [167] (-2.4)	85 [84] (0.2)	234 [236] (-0.2)	3092
Requesting information, opinion or clarifications	280 [289] (-0.9)	96 [94] (0.3)	75 [60] (2.1)	29[28] (0.1)	19 [14] (1.3)	27 [40] (-2.3)	526
Total	2943	954	612	408	145	290	5352

Note. Formatted as observed [expected] and (Adjusted Residual).

Dialogic moves of members initiating TL and TR activities and change over time

The chi-square test shows there is no significant difference in the initiating dialogic moves of the members during the TL- and TR activities and the change over time ($\chi2$ (4) = 7.563, p =.109).

	Type of meeting			
	First	Middle	Last	Total
Initiating dialogic moves members	*n*	*n*	*n*	*n*
Challenging ideas or refocusing talk	14 [13] (0.4)	16 [22] (-2.0)	29[24] (1.6)	59
Providing Evidence and Reasoning	20 [17] (0.9)	35 [30] (1.6)	24 [32] (-2.4)	79
Requesting information, opinion or clarifications	10 [14] (-1.3)	24 [23] (0.2)	28 [25] (0.9)	62
Total	44	75	81	200

Note. Formatted as observed [expected] and (Adjusted Residual).

Dialogic moves members and the change over time during the TL- and TR activities

The chi-square test shows there is a significant difference in the use of dialogic moves of the members

during the TL and TR activities and the change over time ($\chi 2$ (8) = 51.679, $p < .001$).

	Type of meeting			
	First	Middle	Last	Total
Dialogic moves members	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	91 [72] (2.6)	104 [107] (-0.4)	134 [150] (-1.8)	329
Expressing shared ideas and agreement	183 [202] (-1.7)	286 [301] (-1.1)	455 [421] (2.5)	924
Making positive and supportive contributions	58 [105] (-5.5)	158 [156] (0.2)	265 [219] (4.4)	481
Providing evidence and reasoning	733 [678] (3.7)	1008 [1007] (0.0)	1356 [1411] (-3.1)	3097
Requesting information, opinions or clarifications	108 [115] (-0.8)	187 [171] (1.5)	232 [240] (-0.8)	527
	1173	1743	2442	5358

Note. Formatted as observed [expected] and (Adjusted Residual).

Appendix B

Team learning activities

	Following dialogic moves facilitator						
	Challenging ideas and refocusing talk	Expressing shared ideas and agreement	Making positive and supportive contributions	Providing Evidence and reasoning	Requesting information, opinion or clarifications	Activity change	Total
Preceding dialogic moves members	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	1[2] (-0.8)	8 [3] (2.9)	15 [15] 0.0	15 [10] (1.8)	11 [22] (-3.0)	13 [11] (-0.8)	63
Expressing shared ideas and agreement	8 [8] (-0.1)	11 [12] (-0.2)	41 [57] (-2.6)	63 [38] (4.9)	63 [84] (-3.1)	54 [41] (2.5)	240
Making positive and supportive contributions	1 [4] (-0.1)	0 [5] (-2.3)	13 [24] (-2.6)	29 [16] (3.8)	37 [35] (0.4)	20 [17] (0.8)	100
Providing Evidence and reasoning	26 [33] (-2.0)	49 [46] (0.6)	290 [226] (7.8)	106 [150] (-6.2)	308 [334] (-2.8)	171 [161] (1.4)	950
Requesting information, opinion or clarifications	1 [2] (-0.8)	7 [3] (2.5)	9 [14] (-1.6)	14 [9] (1.6)	23 [21] (0.5)	6 [10] (-1.5)	60
Activity change	17 [5] (5.8)	1 [7] (-2.4)	2[34] (-6.6)	18 [23] (-1.1)	105 [50] (10.1)	0 [24] (-5.7)	143
Total	54	76	370	245	547	264	1556

Note. Formatted as observed [expected] and below (Adjusted Residual).

	Following dialogic moves members						
	Challenging ideas and refocusing talk	Expressing shared ideas and agreement	Making positive and supportive contributions	Providing Evidence and reasoning	Requesting information, opinion or clarifications	Activity change	Total
Preceding dialogic moves facilitator	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	1 [3] (-1.2)	10 [8] (0.8)	9 [3] (4.3)	27 [35] (-2.1)	5 [5] (-0.1)	3 [2] (0.5)	55
Expressing shared ideas and agreement	2 [4] (-1.1)	21 [11] (3.4)	4 [3] (0.3)	40 [48] (-1.9)	3 [7] (-1.5)	6 [3] (1.7)	76
Making positive and supportive contributions	14 [20] (-1.6)	18 [53] (-6.0)	14 [17] (-0.8)	271 [232] (4.9)	24 [32] (-1.8)	28 [15] (3.9)	369
Providing Evidence and reasoning	5 [13] (-2.6)	84 [35] (9.8)	25 [11] (4.7)	102 [153] (-7.4)	11 [21] (-2.6)	17 [10] (2.5)	244
Requesting information, opinion or clarifications	7 [30] (-5.4)	76 [79] (-0.4)	14 [25] (-2.8)	412 [344] (7.6)	32 [48] (-3.0)	6 [22] (-4.4)	547
Activity change	51 [10] (14.5)	2 [26] (-5.4)	1 [8] (-2.7)	72 [113] (-6.8)	54 [16] (10.7)	0 [7] (-3.0)	180
Total	80	211	67	924	129	60	1471

Note. Formatted as observed [expected] and below (Adjusted Residual).

	Following dialogic moves members						
	Challenging ideas and refocusing talk	Expressing shared ideas and agreement	Making positive and supportive contributions	Providing Evidence and reasoning	Requesting information, opinion or clarifications	Activity change	Total
Preceding dialogic moves members	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	12 [23] (-2.5)	51 [39] (2.1)	33 [28] 1.0	155 [141] (1.8)	20 [33] (-2.5)	13 [20] (-1.7)	284
Expressing shared ideas and agreement	32 [44] (-2.0)	78 [74] (0.5)	19 [53] (-5.3)	297 [266] (2.9)	58 [62] (-0.6)	54 [38] (2.9)	538
Making positive and supportive contributions	21 [29] (-1.6)	7 [49] (-6.8)	23 [35] (-2.2)	240 [175] (7.2)	43 [41] (0.4)	20 [15] (-1.1)	354
Providing Evidence and reasoning	177 [157] (2.4)	322 [265] (5.4)	258 [190] (7.5)	772 [951] (-11.7)	221 [222] (-0.1)	171 [136] (4.5)	1921
Requesting information, opinion or clarifications	12 [37] (-4.6)	55 [62] (-1.1)	34 [45] (-1.8)	310 [229] (8.7)	35 [52] (-2.7)	6 [32] (-5.1)	452
Activity change	51 [15] (10.1)	2 [25] (-5.1)	1[18] (-4.3)	72 [89] (-2.6)	54 [21] (7.9)	0 [13] (-3.8)	180
Total	305	515	368	1846	431	264	3729

Note. Formatted as observed [expected] and below (Adjusted Residual).

Team reflexivity activities

	Following dialogic moves facilitator						
	Challenging ideas and refocusing talk	Expressing shared ideas and agreement	Making positive and supportive contributions	Providing Evidence and reasoning	Requesting information, opinion or clarifications	Activity change	Total
Preceding dialogic moves members	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	1 [1] (0.1)	2 [1] (1.0)	2 [6] (-1.8)	14 [7] (3.5)	4 [8] (-1.6)	2 [3] (-0.8)	25
Expressing shared ideas and agreement	1 [4] (-1.6)	1 [4] (-1.8)	16 [23] (-1.8)	33 [27] (1.6)	27 [31] (-0.9)	24 [14] (3.3)	102
Making positive and supportive contributions	2 [1] (1.4)	0 [1] (-1.0)	3 [5] (-0.9)	8 [6] (1.3)	6 [6] (-0.2)	2 [3] (-0.6)	21
Providing Evidence and reasoning	3 [9] (-2.7)	13 [10] (1.6)	84 [51] (7.1)	40 [61] (-4.3)	57 [70] (-2.6)	35 [31] (0.9)	232
Requesting information, opinion or clarifications	0 [1] (-1.1)	4 [1] (2.6)	3 [7] (-1.7)	15 [8] (3.0)	5 [9] (-1.7)	3 [4] (-0.6)	30
Activity change	11 [3] (5.4)	0 [3] (-2.0)	0 [17] (-5.1)	18 [20] (-0.6)	48 [23] (6.7)	0 [10] (-3.8)	77
Total	18	20	108	128	147	66	487

Note. Formatted as observed [expected] and (Adjusted Residual).

	Following dialogic moves members						
	Challenging ideas and refocusing talk	Expressing shared ideas and agreement	Making positive and supportive contributions	Providing Evidence and reasoning	Requesting information, opinion or clarifications	Activity change	Total
Preceding dialogic moves facilitator	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	0 [1] (-0.9)	9 [3] (3.5)	1 [1] (0.0)	2 [9] (-3.5)	3 [2] (1.3)	2 [1] (0.7)	17
Expressing shared ideas and agreement	0 [1] (-1.1)	4 [4] (-0.2)	1[1] (-0.2)	10 [12] (-0.8)	2 [2] (0.0)	5 [2] (2.8)	22
Making positive and supportive contributions	2 [5] (-1.6)	10 [21] (-3.0)	6 [6] (0.0)	78 [57] (4.7)	2 [9] (-2.9)	8 [8] (0.0)	106
Providing Evidence and reasoning	7 [6] (0.5)	35 [25] (2.6)	13 [7] (2.6)	49 [69] (-4.2)	12 [11] (0.3)	12 [10] (1.0)	138
Requesting information, opinion or clarifications	4 [7] (-1.4)	29 [29] (-0.1)	4 [8] (-1.9)	94 [80] (2.8)	12 [13] (-0.4)	6 [11] (-2.0)	149
Activity change	8 [1] (7.4)	0 [4] (-2.3)	0 [1] (-1.1)	5 [11] (-2.8)	8 [2] (4.9)	0 [2] (-1.3)	21
Total	21	87	25	238	39	33	443

Note. Formatted as observed [expected] and (Adjusted Residual).

	Following dialogic moves members						
	Challenging ideas and refocusing talk	Expressing shared ideas and agreement	Making positive and supportive contributions	Providing Evidence and reasoning	Requesting information, opinion or clarifications	Activity change	Total
Preceding dialogic moves members	*n*	*n*	*n*	*n*	*n*	*n*	*n*
Challenging ideas and refocusing talk	2[3] (-0.3)	7 [7] (0.1)	1 [2] (-0.5)	19 [14] (1.8)	1 [3] (-1.3)	2 [4] (-1.1)	32
Expressing shared ideas and agreement	5 [10] (-1.8)	12 [26] (-3.6)	6 [6] (-0.1)	65 [55] (2.1)	12 [12] (0.0)	24 [15] (2.8)	124
Making positive and supportive contributions	1 [3] (-1.1)	0 [7] (-3.1)	1 [2] (-0.5)	29 [15] (5.2)	0 [3] (-1.9)	2 [4] (-1.1)	33
Providing Evidence and reasoning	26 [21] (1.5)	82 [58] (5.0)	19 [14] (2.1)	86 [121] (-6.0)	26 [26] (-0.1)	35 [33] (0.4)	274
Requesting information, opinion or clarifications	0 [4] (-2.3)	14 [12] (0.7)	0 [3] (-1.8)	34 [25] (2.6)	5 [5] (-0.2)	3 [7] (-1.7)	56
Activity change	8 [2] (5.3)	0 [4.5] (-2.4)	0 [1] (-1.1)	5 [9] (-1.9)	8 [2] (4.5)	0 [3] (-1.7)	21
Total	42	115	27	238	52	66	540

Note. Formatted as observed [expected] and (Adjusted Residual).