Unfolding of Team Learning and Team Reflexivity in Micro Learning Communities

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Delighted, I hereby present to you my thesis. What an adventure it was to do research and write this thesis. The thesis period was a process of pushing boundaries and receiving new (personal) insights. I experienced pushing boundaries by making choices I was initially afraid or uncertain of. In this I have experienced to keep going, even if the energy level is low. Due to this I have gained personal insight, becoming aware of my resilience again. In addition, the thesis period lasted longer than I would have liked. At the same time, I am grateful for this period as during this period I not only wrote a thesis but also found a job in which I can put my passion. Therefore, I take this longer thesis period for granted.

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Abstract

Nowadays, the energy transition affects employees in the Dutch installation sector making it important to search for solutions to complex problems that arise due to the energy transition. Micro learning communities (LCs) are seen as promising tool for interprofessional learning as participants with diverse knowledge collaborate interdisciplinary. This has the advantage of providing a broader knowledge perspective, yet it is disadvantageous as knowledge boundaries may arise. To reduce knowledge boundaries, team members go through that ongoing process of action and reflection and engage in so called team learning (TL) activities and team reflexivity (TR) activities. However, literature on the relation of these team activities is limited, especially when it comes to their development over time. This research studies the distribution of TL-activities and TR-activities per micro LC, if a difference of distribution of TL-activities and TR-activities is found per team development (TD) phase and between TD phases and what patterns of TL-activities and TR-activities are found per TD phase in micro LCs. In this research, five micro LCs were analysed. The results indicated firstly that TL-activities and TR-activities based on frequencies and duration of time differed for all micro LCs. Secondly, it was found that TL-activities and TR-activities differed per TD phase. In TD phase 1 the variety of TL-activities and TR-activities was low, whereas in TD phase 2 and 3 this variety was higher. Thirdly, learning patterns were found in TD phases. In TD phase 1, team members mostly shared thoughts and ideas and plan tasks upon that. In TD phase 2, results of the performed planned tasks were discussed which provides input for generating (new) ideas. In TD phase 3, team members focused on reflecting upon their learning by showing more evaluation of the learning process when discussing the results of performed tasks and they monitored the learning process when new tasks are planned. This research is an attempt to provide a better understanding of micro LCs and the TL-activities and TR-activities that take place during the different TD phases. To further expand these insights, and gain better sight on how these processes are supported, future research should consider the role of the facilitator, the content quality of the TL-activities and TR-activities and the TL-activities and TR-activities carried out between meetings.

Keywords: team learning, team reflexivity, interprofessional learning, cross-boundary teaming, micro learning communities

Introduction

Keeping up with the changing labour market is important for companies to stay relevant. Dutch installation companies for instance must adapt to the development and challenges that come with the current energy transition (Topsectoren, 2019). This requires employees to work with new materials and tools and hence asks different skills and knowledge of them. To prepare employees for this transition, it is important that they pursue lifelong learning in their professional development (Corporaal et al., 2020). To achieve this, a learning community (LC) is seen as a promising tool as it shapes employees' professional development and simultaneously promotes innovation in the workplace (Topsectoren, 2019; Van Rees et al., 2022). Specifically, Dutch installation companies draw upon specific form of LCs, so called micro LCs. In a micro LC, six till ten team members with various backgrounds and functions focus on a challenge-based problem in the (installation) company, set a shared goal, and work towards this challenge-based, shared goal in a limited-time frame (Corporaal et al, 2020).

In these micro LCs, team members have different knowledge at their disposal, which they can use to learn from, with and about each other, resulting in interprofessional learning (Mccallin, 2005). Interprofessional learning broadens the possible views and ideas team members can draw upon to innovate (Edmondson & Harvey, 2018). Nonetheless, it is not a given that team members understand each other at first sight (Edmondson & Harvey, 2018). It may be that team members cannot understand each other as they speak a different professional language, can interpret problems differently, or the interest across individuals entering situations is different (Edmondson & Harvey, 2018). Hence, it is required that team members create a shared understanding first. This entails creating a common understanding of the shared goal and how to reach the shared goal (Mulder et al., 2002; Van den Bossche et al., 2006).

To tap into each other's knowledge, team members have to cross knowledge boundaries. These are either physical, mental or organizational (Kazl et al., 1997). Knowledge boundaries can be reduced through the process of cross-boundary teaming. That is, team members from different sectors team up and face interpersonal challenges while working on novel projects (Kerrissey et al., 2021). In other words, teams engage in a team learning (TL) process in which team members share knowledge and reflect on their TL process to see if they still understand each other correctly (Edmondson, 1999; Edmondson et al., 2007; Edmondson & Harvey, 2018; Knapp, 2010). Thus, to reduce knowledge boundaries during interprofessional learning, team members need to interact by engaging in the continuous process of action and reflection. Ultimately with the aim of understanding each other, enabling them to achieve their collective goal (Van den Bossche et al., 2006).

To grasp this complex process, Edmondson & Harvey (2018) created an integrative model of cross-boundary teaming. They stated that the process of boundary crossing consists of emergent states and interaction in reciprocal TL-activities (Edmondson, 1999; Edmondson & Harvey, 2018). However, Edmondson & Harvey (2018) did not define specific TL-activities, did not clarify on the

role of team reflexivity (TR) and did not elaborate how the interaction unfolds over time in their integrative model. Therefore, this study aims to analyse the interaction of TL-activities and TR-activities during interprofessional learning in micro LC.

Additionally, research on team development (TD) provides insights into an in-depth understanding of how TL-activities and TR-activities unfold over time and what learning patterns can be found during the process of interprofessional learning. Gersick (1988) provides a perspective on how teams with limited existence, for example micro LC, evolve alongside three phases in his model. The model, however, remains unconcreted in terms of TL-activities and TR-activities, especially in interprofessional teams.

Therefore, this research aims at shedding light which TL-activities and TR-activities occur during interprofessional learning in micro LCs. This research takes a process-oriented perspective providing insights into learning patterns of TL-activities and TR-activities. Also, gained insights of this study provide suggestions for future research so that ultimately the micro LCs of project 'Hit the Gas!' can even be better facilitated and designed.

Theoretical framework

Learning communities

There is no universal definition for the term LC due to its variety in group size, duration and subject (Knol & Velzing, 2019). In general, LCs are based on the concept of collaborative learning in which members of the LC construct knowledge by working interdependently (Cross, 1998). According to Kilpatrick et al. (2003), LC members have a shared goal, interest or geography in which they collaborate, work in partnership and learn collectively and individually, ultimately enhancing the outcome. Thereby, the shared goal of the LCs contributes to societal issues in which team members with different educational and functional backgrounds learn, work, and innovate together through interdisciplinary collaboration (Dingyloudi & Strijbos, 2019; Hubers et al., 2021; Topsectoren, 2019; Van Rees et al., 2022). Here, learning is a shared process and self-directed (Topsectoren, 2019; Van Rees et al., 2022).

According to Corporaal et al. (2020), there is a specific form of LC, namely micro LCs. In a micro LC, approximately six till ten participants focus on a challenge-based problem in a (installation) company, set a shared goal, and work towards this challenge-based, shared goal in a limited-time frame (Corporaal et al, 2020). Participants of a micro LC are employees of installation companies, teachers form educational institutes and a facilitator. This provides knowledge diversity in the micro LC. In the micro LC, learning and working are integrated and a facilitator supports the TL process and individual learnings (Corporaal et al., 2020).

The characteristics of micro LCs corresponds with those of teams. Salas et al. (1992) for instance defines a team as collection of individuals who are interdependently working to achieve a shared goal. To work towards this shared goal, team members create a shared understanding of the

knowledge at their disposal (Kozlowski & Bell, 2008). Team members may have different knowledge backgrounds which they can use to learn from, with and about each other, resulting in interprofessional learning (Mccallin, 2005). As such, teams that learn and work interdependently towards a common goal fit within this study's conceptualisation of micro LCs. Thus, a micro LC can be considered as a team with team members who have diverse knowledge that they use to learn with, from and about each other through interdisciplinary collaboration while working on a challenge-based, shared goal in a limited time frame (Corporaal et al., 2020). As team members in micro LCs have different educational and functional backgrounds, this is in line with the concept of cross-boundary teaming.

Cross-boundary teaming

In cross-boundary teaming, team members from different sectors team up to work on interpersonal challenges in novel projects (Kerrissey et al., 2021). Cross-boundary teaming gained its popularity as strategy for innovation (Edmondson & Harvey, 2018), as team members have diverse knowledge that expands their views and ideas, which team members can draw upon to innovate. Nevertheless, it is not a given that knowledge diverse team members understand each other at first sight (Edmondson & Harvey, 2018). Team members with diverse knowledge are required to integrate their different perspectives in a shared understanding in order for successful TL and team work (Van den Bossche et al., 2006). In other words, they need to cross knowledge boundaries to create that shared understanding. Boundary crossing can be defined as the process of seeking or giving information, views, and ideas through interaction with other individuals or units (Kazl et al., 1997).

In the integrative model of Edmondson & Harvey (2018), they shed light on the integration process of cross-boundary knowledge and provided insights into which knowledge boundaries exist. Namely, team members may face different 'thicknesses' of knowledge boundaries (Carlile, 2004). Edmondson & Harvey (2018) distinguished knowledge boundaries on three different levels, in sequence of thin to thick: 1) *syntactic*: team members cannot understand each other as they speak a different professional language, 2) *semantic*: team members can interpret problems differently as they see different problems, opportunities and challenges, and 3) *pragmatic*: interest across individuals entering situations is different due to their expertise and organization they work for. For creating a shared understanding in a micro LC, these knowledge boundaries have to be reduced (Edmondson & Harvey, 2018). According to Van den Bossche et al. (2022), sharing knowledge is a crucial process in TL for understanding each other and creating a shared conception of the problem which eventually results in successful learning and team work. To understand the development of a shared understanding, it is required to analyse what team members do and how they process their diverse knowledge (Edmondson & Harvey, 2018).

Team interaction

Team interaction is considered as the process of TL in which team members share knowledge, exchange views and ideas (Decuyper et al., 2010), talk about problems and mistakes (Carmeli &

Gittell, 2009) and reflect on the progress by discussing team goals, processes or outcomes (Schippers et al., 2014). According to the integrative model of Edmondson & Harvey (2018), the process of interaction consists of the reciprocal pattern of emergent states and team interaction. In this process team interaction behaviour are shown, following the definition of Edmondson (1999): "asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors and unexpected outcomes" (Edmondson, 1999, p. 353). These interactions among team members help to adjust or refine the emergent states since individuals clarify their role or creating a shared understanding. The emergent states and interaction among team members happen in reciprocal patterns (Edmondson & Harvey, 2018). However, clarification of specific behaviours for team interaction remains limited in this integrative model. This research focuses on creating a better insight into how team members interact during interprofessional learning in micro LCs. Therefore, it is worthwhile to analyse further what sort of activities are included during team interaction.

Team learning activities

TL-activities concern the notion of 'learning by doing' which implies that team members working together and perform actions to achieve the shared goal (Decuyper et al., 2010). In doing so, team members build shared meaning from existing information, identify what is still unknown for them and explore assumptions (Wiese & Burke, 2019). Activities that help to create that shared meaning are asking questions, seeking feedback, experimenting, and discussing results (Edmondson, 1999; Schippers et al., 2003). These activities correspond with the activities defined for the team interaction process in the integrative model of Edmondson & Harvey (2018). However, the activity 'asking questions' is somewhat limited. By only gathering knowledge by asking questions, it remains difficult to discover how team members actually come up with new ideas using this information to ultimately achieve the shared goal. Therefore, the activity 'collaboratively generating ideas' would suit better as this activity clarifies on creation of ideas that appropriately address existing needs and problems in a way that is new and useful for the work context at hand (Messmann & Mulder, 2020). Also, collaboratively generating ideas is not elaborated in the integrative model of Edmondson & Harvey (2018), but central in micro LCs. Therefore, this activity is included in this research instead of 'asking questions'.

In addition, TR-activities are important to take into account for this research. In the integrative model of cross-boundary teaming from Edmondson & Harvey (2018), no real specific activities for reflexivity were mentioned. Yet it is important to include as reflecting on the team's learning process creates awareness among team members, allowing them to see the discrepancy between current and desired situation (Schippers et al., 2013). In the process of TL, team members acquire, share, and combine knowledge through the experience of one another (Argote et al., 2001). However, to learn effectively and reach the shared goal, team members need to know where they stand, what they want to reach and how they want to reach it (Decuyper et al., 2010; Gabelica et al., 2016). In other words, team members need to reflect upon their learning for reaching the shared goal, so called TR.

Therefore, including TR-activities is considered as important to gain better insights how team members learn interprofessionally in micro LCs.

Team reflexivity activities

TR is defined 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 (West, 2000, p. 296). In other words, TR is about reviewing and reflecting on previous team functioning (Schippers et al., 2013). By reflecting, team members pause and learn from their experiences, which in turn provides new insights they can use to continue learning (Schippers et al., 2018). In doing so, this is helpful for elaborating and revising goals and plans (Baerheim et al., 2023). That is, TR analyses the difference between the current state and desired state, allowing the shared goal to be set (Schippers et al., 2018). It is a discussion-based process which aims evaluating past actions and performance, learn from mistakes and successes and create action plans for better future functioning (Ellis et al., 2014). TR has positive effects on team performance and innovation, indicating that the extent team members reflect on their functioning positively affects their collaboration (Konradt et al., 2016). According to Schippers et al. (2014), TR leads to more information processing which reduces team errors and enhances the ability for teams to adapt to change. This helps for creating that shared understanding which ultimately is helping for reaching the shared goal (Schippers et al., 2018).

In addition, Schippers et al. (2018) indicate that it is important to reflect on strategic points in time as this continues learning, suggesting that this could be before, midway or at the end of the TL process. Since processes of TL and TR support team members reaching their shared goals (Decuyper et al., 2010) and the model of Edmondson & Harvey's (2018) has not analysed the TL-activities and TR-activities over time, this study fills that research gap. To make this analysis possible, it is necessary to examine frameworks of team development (TD) appropriate to the context of this study.

Team development phases

TL behaviour changes over time (Decuyper et al., 2010). This is confirmed by Mohammed et al. (2009) who indicate that understanding team effectiveness requires an analysis of the processes of TL that unfold over time. There are frameworks that capture TD in linear growth model or in a punctuated equilibrium model (Garfield & Dennis, 2012). A well-known linear TD framework is the IPO-model by McGrath (1964) that describes TD as an input-process-output. However, this framework fails to capture "the emerging consensus about teams as complex, adaptive system" (Ilgen et al., 2005, p. 519). In response, Ilgen et al. (2005) created the input-mediator-output-input (IMOI) model that indicates teams as complex, cyclical, and nonlinear. According to literature, each team has its beginning phase, phase of crisis and end phase (Chidambaram & Bostrom, 1997). The framework of Ilgen et al. (2005) explains TD in three phases: 1) forming, 2) functioning, 3) finishing, in which affective, behavioural and cognitive mechanisms can occur. In this study, focus is on the behavioural mechanisms. The first phase of Ilgen et al. (2005) is 'forming' in which team members work on their

trust and safety, gather information for setting a strategy, work on their collective knowledge (shared understanding) and learn who knows what. The second phase of Ilgen et al. (2005) is 'functioning' in which team members bonding with each other (affective) and learn from each other (behavioural). The third phase of Ilgen et al. (2005) is 'finishing' in which the team adjourns. However, the IMOI model did not include time as a learning trigger as the punctuated equilibrium model does (Gersick, 1988). Therefore, the IPO-model and IMOI-model do not fully fit for an analysis of interprofessional learning in micro LCs.

A third framework is the Punctuated Equilibrium Framework (PEF) of Gersick (1988). The PEF of Gersick (1988) consist out of five segments: three transition points and two work periods between the three transition points. The transition points consist of beginning point, midpoint and end point. The beginning point starts when the first meeting begins, and team members set strategies and approaches for reaching the goal in the first long work period. The team faces the mid-point transition when entering the midpoint of their project time. In this transition point, team members adapt their first strategies and/or shared goal. In other words, goals, procedures, and group strategies are re-examined. Then, the second long work period enters in which focus of team members shifts to the outcome as the team develops and interact over time. During the third transition point, team members finish their task and adjourns (Gersick, 1988, 1989).

This PEF of Gersick (1988) is created for a team project in which each group, irrespective of group structure, tasks, or deadlines, has the same temporal pattern. This framework is suitable for teams who work on a shared goal, time is a learning trigger and use a project management structure to support the process. The PEF of Gersick (1988) fits the context of this study, as this study focuses on micro LCs in which team members cross boundaries to create a shared understanding in order to work collectively on a shared goal within a limited time frame.

Furthermore, it is also interesting to include an analysis if learning patterns of TL-activities and TR-activities can be found during the process of boundary crossing. A learning pattern is a coherent set of learning activities characterised over a period of time (Vermunt & Donche, 2017). In this research, these learning patterns include TL-activities and/or TR-activities which can be either sequential or cyclical. Edmondson & Harvey (2018) stated that there is a reciprocal pattern of emergent states and interaction among team members. However, as Edmondson & Harvey (2018) did not specify what behaviours occur during this interaction process, it is still unknown what learning patterns occur over time and in different phases during the process of boundary crossing. What is known, is that the level of complexity of information that team members are allowed to understand to achieve a shared understanding causes different learning patterns over time (Wiese & Burke, 2019). In addition, it was found that the number of behaviours during TL increases over time, with the least behaviours occurring in the initial stage of a team (Raes, Boon, et al., 2015).

In sum, two research gaps were found. First, it was found that the TL-activities and TR-activities in the process of boundary crossing are not clarified according to the integrative model of

Edmondson & Harvey (2018). Clarification is needed in order to understand how team members in micro LCs learn interprofessionally by crossing knowledge boundaries and create that shared understanding in order for achieving the shared goal. Second, it is unknown how TL-activities and TR-activities unfold over time and what learning patterns may occur during the process of boundary crossing during interprofessional learning. This study will contribute to provide new insights into these two research gaps.

This study

This study took place in the context of the Dutch, national project 'Hit the Gas!' (Corporaal et al., 2020). The aim of this project is to design learning communities in which Dutch companies (mainly installation sector, less than 250 employees) and higher educational institutes collaborate on challenges relating to energy transition and innovation (Corporaal et al., 2020). This includes the criteria for an micro LC. Ultimately, employees will be stimulated to continue learning (upskilling, re-skilling) in order to be able to keep up with the energy transition (Corporaal et al., 2020).

Two gaps in literature were found. For the first research gap, it was found that according to the model of Edmondson & Harvey (2018) it is not clear yet which activities team members in micro LCs use during the process of interprofessional learning. Interaction of TL-activities and TR-activities is needed to create a shared understanding for eventually achieving the shared goal (Van den Bossche et al., 2006). Therefore, there is a need to better understand how TL-activities and TR-activities are distributed in micro LCs. This leads to the first research question:

RQ1: How are team learning activities and team reflexivity activities distributed in micro learning communities?

For the second research gap, it was found that there is no clarity in how TL-activities and TR-activities occur over time. Therefore, it is of interest to analyse if TL-activities and TR-activities differ over time by analysing them per TD phase. This leads to the second research question:

RQ2: Is there a difference in the distribution of team learning activities and team reflexivity activities per team development phase in a micro learning community?

Moreover, learning pattern emerge over time by crossing boundaries during the process of interprofessional leaning. To bring an in-depth understanding of the interprofessional learning process in micro LCs, it is interesting to analyse what patterns of TL-activities and TR-activities are present per TD phase. Therefore, the third research question was formulated:

RQ3: What patterns of showing team learning activities and team reflexivity activities do microlearning communities carry out during the interprofessional learning process in different team development phases?

Method

Research design

In this research, a mixed methods research design was applied in which qualitative and quantitative data were used to answer the research questions. First, the qualitative approach was used for analysing the recorded and transcribed meetings, coding for team interaction process (TL-activities and TR-activities) and TD (TD phase 1, TD phase 2, TD phase 3). Then, the quantitative approach was used to quantify data for further analysis for descriptive and inference statistics. Results from the data analysis were then illustrated and discussed drawing upon the qualitative data.

Participants and context

Five micro LCs of the project 'Hit the Gas!' were used for this study. These micro LCs were purposefully selected to fit the context of this study (Coyne, 1997). This is important as the criteria of a micro LC should be met. These were: a group of approximately ten participants with divers educational and functional backgrounds, including a facilitator and teacher of a higher educational institute in which they collaborate on challenges relating to energy transition and innovation in a limited time frame of approximately ten meetings (Corporaal et al., 2020).

All five micro LCs were conducted in different installation companies and micro LC 2, 3, 4, 6, and 7 were selected for this study. Micro LC 1 and 5 were excluded for this research as micro LC 1 has stopped early and micro LC 5 ran out of time and therefore no longer met the limited time frame criterion. All meetings of micro LC 2, 4, 6, and 7 were on site and occurred at the organization itself. In addition, all meetings of micro LC 3 conducted online as COVID-19 measurements were applied at that time. The composition of the micro LCs are shown in Table 1.

Table 1

Composition of micro LCs

N.	Meetings	Composition	Total time of meetings	Topic
Micro LC 2	8 physical meetings	Total of 11 participants (10 male, 1 female): 3 mechanics, 1 service planner, 2 planning engineers, 1, administrative assistant, 1 contract manager service and maintenance, 1 head of S&O, 1 structural engineering teacher and 1 facilitator.	350 min	Project evaluation

Micro LC 3	8 online meetings via Teams	Total of 10 participants (all male): 1 ICT worker, 2 project leaders, 2 project engineers/ modellers, 3 mechanics, 1 structural engineering teacher and 1 facilitator.	444 min	Integrating BIM360docs into work processes
Micro LC 4	10 physical meetings	Total of 8 participants (all male): 2 project leaders, 2 project engineers/ modellers, 1 mechanic, 1 workshop supervisor, 1 structural engineering teacher and 1 facilitator.	664 min	Pre-manufacturing heat pumps
Micro LC 6	10 physical meetings	Total of 7 participants (6 male, 1 female): 1 head of administration, 1warehouse manager, 1 service and maintenance contract manager, 1 modeller, 1 mechanic, 1 structural engineering teacher and 1 facilitator.	637 min	Enhancing circularity: re using boiler parts
Micro LC 7	10 physical meetings	Total of 7 participants: (5 male, 2 female): 1 operating technician, 1 plumber, 2 mechanic, 1 HR advisor, 1 team manager vocational school, 1 team manager, 1 facilitator.	578 min	Mentoring BBL-students

Across the meetings, the attendance of participants of all micro LCs differed as not each participant was able to attend each (online) meeting – except the facilitator – and for some meetings an external was invited. Also, a researcher from project ‘Hit the Gas!’ was on site to observe the meetings and have the participants complete the questionnaires.

In addition, the ethics committee of University of Twente provided ethical approval for gathering data for project ‘Hit the Gas!’. Also, the researcher signed a contract stating that the researcher will handle the data with care and use the data anonymously and confidentially.

Instrumentation

For this research, Observer XT, a 360-degree camera, the fuzzy miner model in ProM-tool, Excel and the statistical software programme SPSS were used. Observer XT is a software for behavioural research. With Observer XT, video tapes of the recorded meetings of micro LC can be played and paused to code TL-activities and TR-activities as state events and TD as point events. A 360-degree camera was used to record the meetings of micro LCs. In addition, the fuzzy miner model in ProM-tool was used to analyse if patterns of TL-activities and TR-activities can be found. This tool was used as it allowed coding the state events and recording time stamps. Standard parameters were used for the fuzzy miner models. Excel was used to prepare data further from ProM-tool. In addition, software programme SPSS was used to compute statistical tests.

Procedure

In this research, observational data was used. It is beneficial to use observational data rather than interviews and questionnaires when observing the TL-activities and TR-activities as this data allow behaviour to emerge (Raes, Boon, et al., 2015). All micro LCs are hence recorded with a 360-degree camera. Due to these recordings, behaviour of participants in micro LCs was analysed by the researcher. After collecting all recorded meetings, Observer XT, SPSS software and fuzzy miner model in ProM-tool were used to gain more insights into the data.

Coding team learning activities and team reflexivity activities

First, the observational data was used to code the TL-activities and TR-activities as state events in Observer XT. This was done for all meetings per micro LC. The code of an TL-activity or TR-activity started when a team member initiated a TL-activity or TR-activity and stopped when a team member showed another TL-activity or TR-activity. If team members talked about a subject that did not fit any TL-activities or TR-activities, this was coded as an off-task activity and was excluded for this research. The codebook is shown in Table 2. The codes for TL were mainly based upon the definition of TL by Edmondson (1999): asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors and unexpected outcomes. The codes for TR-activities were used from the codebook of van Wijga et al. (2023). Two coders were involved and four meetings of micro LCs were coded for determining the intercoder reliability. The intercoder reliability coding was high at $k = 0.95$.

Table 2

Coding scheme TL-activities and TR-activities

Code	Description	Protocol
TL-collaboratively generating ideas	Idea generation is defined as the creation of ideas that appropriately address existing needs and problems in	Coding within TL will be started when team members discuss the current status of the problem on the work

	a way that is new and useful for the work context at hand (Messmann & Mulder, 2020).	floor, share their thoughts and ideas and approach it from different angels taking into account the different perspectives of the other participants and stopped when this is no longer the case.
TL-seeking/receiving external feedback/input	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.
TL-experimenting	Trying out a new approach; practicing new behaviour; undertaking working activities without an intention to learn but still results in learning (Decuyper et al., 2010; Raes et al., 2017; 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.
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 did not work as planned (Edmondson, 1999).	Will be coded when a team member report back on activities performed outside of the meetings and report their findings and experiences. When team members report on errors in the activities between meetings or when the activity led to unexpected outcomes.
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 in between meeting or when goals are set for the present meeting, next meetings or over the course of the collaboration.
TR-monitoring	Monitoring content understanding, comparing a current state with a	Will be coded when team members talk or ask questions about the

	desired state (goal standard), assessing progress, recognizing what remains to be completed, and monitoring the pace and time remaining (Wijga et al., 2023).	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 where set.
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.

Coding TD phases

The TD phases were coded as point events in Observer XT. The TD phase were coded when a phase ended, coded as followed: *TD phase 1* = starts at first meeting and stops till team members have set their shared goal, *TD phase 2* = starts where TD phase 1 ended and stops when team members adjusted their shared goal, *TD phase 3* = starts where TD phase 2 ended and stops when team members have resulted in an end product/reflecting on results (Gersick, 1988).

After coding the TL-activities and TR-activities, and TD phases in Observer XT, this data was exported to Excel in which data was prepared further. In Excel, off-task activities were removed which left the data file with TL-activities and TR-activities (codes), case (meetings and micro LC), timestamp (hh:mm:ss). Then, parts of the meetings where merged into one meeting as some meetings existed of more videos. If the last code of the first video and the first code of the second video was the same, the stop code in the first video and the start code in the second video was removed. Then, data was split up into TD phase 1, TD phase 2 and TD phase 3 and each phase could contain one or multiple meetings of micro LCs. This could involve that the start code of a TL-activity or TR-activity started in TD phase 1, for example, and the stop code was recorded in TD phase 2. If this happened, the stop code was moved to TD phase 1. Next, the time stamps were aligned so that the time of TL-activities and TR-activities follow each other during a TD phase. Furthermore, the Excel files were saved as CSV files so that this could be uploaded in the process mining tool.

Data analysis

A descriptive analysis was performed for each micro LC which provides insights into their (dis-) similarity despite differences of context (topic, location of meetings, facilitator, invited external professionals). For this analysis, qualitative data were quantified, meaning that the frequency, percentage of frequency, duration of time and percentage of duration of time for all codes of TL-

activities and TR-activities were computed. Frequencies and duration of time were used for performing analyses as this would give a better understanding of how TL-activities and TR-activities unfold in micro LCs. In addition, percentages of duration of time were used for the time span analysis as this allowed for the most appropriate comparison of the micro LCs since each micro LC had a different duration of time per TD phase.

Research question 1

First, a chi-square test is conducted to analyse if a significant difference was found for individual TL-activities and TR-activities in the five micro LCs. Chi-square was computed with data of frequencies and duration of time as this creates the opportunity to find possible differences in these two sorts of data which ultimately creates better insights in the distribution of TL-activities and TR-activities in micro LCs. Then, a time span analysis of the distribution of individual TL-activities and TR-activities was conducted for each micro LC. For this time span analysis, percentage of duration of time was used to be able to compare the micro LCs best. The chi-square and time span analysis allowed to be decisive to aggregate data and perform a joint analysis with inference statistics when similarities in the data were found.

Research question 2

Depending on the outcome of research question 1, data of all micro LCs were aggregated per TD phase for research question 2. This allowed to perform a better analysis as now more data could be included so that a general impression of a micro LC could be provided. To analyse if differences of individual TL-activities and TR-activities were found per TD phase, chi-square test was conducted. Also for this research question, chi-square test was computed with data based on frequencies and duration of time to create better insights in the distribution of TL-activities and TR-activities per TD phase in a micro LC. Chi-square was used if assumptions of interdependence were met: no expected values of less than one, and not more than 20% of expected values were lower than five (Bewick et al., 2003). If assumptions of chi-square were not met, Fisher Exact Test was used instead. If values of Fisher Exact Test were not shown, Monte Carlo was used for the exact test. In addition, post hoc test was conducted with chi-square. Post hoc test was used to indicate where the significant difference was located in individual TL-activities and TR-activities per TD phase. To locate the significant difference with post hoc test, the adjusted residual values were analysed. If the adjusted residual value was lower than -1.96 or higher than 1.96, this indicates that there was a significant difference (Sharpe, 2015). Also, a time span analysis of individual TL-activities and TR-activities per TD phase was conducted and data of percentage of duration of time was used to visualize the distribution of TL-activities and TR-activities per TD phase of a micro LC.

Research question 3

The fuzzy miner algorithm was used to analyse patterns of TL-activities and TR-activities for each TD phase. The aggregated data in research question 2 was also used for this research question.

Using aggregated data helped to create a good fuzzy model as the more data the better. With process mining, frequencies and duration of time were taken into account. The work processes were analysed by nodes and edges. *Nodes* represented the individual activity and *edges* were the arrows indicating a relation between two activities. Using process mining, a comprehensive model of large amount of data was created that reduced the inevitable noise present in large datasets. As this research contained a lot of data (n = 465, *time* = 2519 minutes) process mining tool was of great help.

Using the process mining tool, different miners werechosen for analysing the data. Fuzzy miner model was used for this research, as it makes sense out of unstructured data and works with two fundamental metrics: significance and correlation. The *node significance* was based on the frequency and its importance in routing the process (Bron, 2022). The *edge significance* represented an enhanced derivative of the frequency with which two activities directly followed each other. This also may involved an activity continuing itself, which was indicated by a self-loop. The *edge correlation* gave insights into how closely two activities followed each other in time. The closer the activities followed each other, the higher the correlation. For this research, the standard parameters were used as with these parameters, fuzzy models gave a good fit for all the cases. For example, by cutting of the node filter at 0.000, this ment that all activities shown in the cases were included in the fuzzy model. By cutting of the edge filter on 0.200 this created a nice overview of the relations between nodes. Therefore, the standard parameters were used in process mining tool. In addition, the rule of thumb of Bannert et al. (2014) was applied in this study to retain nodes and edges in the process model: node significance ≥ .25, edge value ≥ .2. The edge value was calculated by aggregating the edge significance and edge correlation divided by utility ratio = .75. For interpreting the aggregated edge significance and edge correlation, the following rule of thumb (Bron, 2022) was used: < .3 = weak edge (dotted light grey arrow), .3 - .4 = moderate edge (grey arrow), .4 - .5 = strong edge (black arrow), ≥ .5 = very strong edge (bold black arrow). Edge values of TD phase 1 are shown in Table 3, edge values of TD phase 2 are shown in Table 4, and edge values of TD phase 3 are shown in Table 5, see Appendix A.

Results

The present study aimed to create a better understanding of the interaction of TL-activities and TR-activities during interprofessional learning in micro LCs. In this section, the results of conducted analyses were presented. In addition, the descriptives were presented in Appendix B. Descriptive of micro LC 2 was shown in Table 6. Descriptive of micro LC 3 was shown in Table 7. Descriptive of micro LC 4 was shown in Table 8. Descriptive of micro LC 6 was shown in Table 9. Descriptive of micro LC 7 was shown in Table 10. These descriptive described what TL-activities and TR-activities occurred per TD phase in each micro LC and were presented in frequencies, percentage of frequencies, duration of time and percentage of duration of time.

Descriptive

In Table 11, frequencies of TL-activities and TR-activities were shown per micro LC, as well as the corresponding percentages of TL-activities and TR-activities and adjusted residuals.

Table 11

Frequencies of TL-activities and TR-activities per micro LC

		Micro LC 2	Micro LC 3	Micro LC 4	Micro LC 6	Micro LC 7
TL-collaboratively generating ideas	*n*	20[21]	36[34]	33[32]	40[41]	23[25]
	%	32	35	34	32	30
	Adjusted residual	-.2	.5	.2	-.1	-.5
TL-seeking/ receiving external feedback/ input	*n*	4[5]	0[9]	13[8]	15[11]	8[7]
	%	6	0	13	12	11
	Adjusted residual	-.7	**-3.6**	1.9	1.6	.7
TL-experimenting	*n*	1[0]	0[1]	0[1]	2[1]	0[1]
	%	2	0	0	2	0
	Adjusted residual	1	-.9	-.9	1.6	-.8
TL-discussing results	*n*	14[10]	25[17]	9[16]	19[21]	10[13]
	%	22	24	9	15	13
	Adjusted residual	1.3	**2.3**	**-2.2**	-.4	-.9
TR-planning	*n*	18[18]	27[29]	29[28]	31[35]	26[21]
	%	29	26	30	25	34
	Adjusted residual	.1	-.6	.4	-.9	1.3
TR-monitoring	*n*	5[6]	11[10]	12[10]	12[12]	6[8]
	%	8	11	12	10	8
	Adjusted residual	-.6	.3	.9	-.1	-.6
TR-evaluating	*n*	1[2]	5[4]	2[3]	5[4]	3[3]
	%	2	5	2	4	4
	Adjusted residual	-.9	.9	-.9	.4	.3

Note. Formatted as Observed[Expected]. Adjusted residuals in bold are those that exceed +/- 1.96.

In Table 12, duration of time of TL-activities and TR-activities were shown per micro LC, as well as the corresponding percentages of TL-activities and TR-activities and adjusted residuals.

Table 12

Duration of time of TL-activities and TR-activities per micro LC

		Micro LC 2	Micro LC 3	Micro LC 4	Micro LC 6	Micro LC 7
TL-collaboratively generating ideas	*n*	181[190]	133[161]	373[362]	352[382]	392[335]
	%	54	47	59	52	67
	Adjusted residual	-1.1	**-3.6**	1.0	**-2.8**	**5.5**
TL-seeking/ receiving external feedback/ input	*n*	9[29]	0[25]	49[55]	119[58]	41[51]
	%	3	0	8	18	7
	Adjusted residual	**-4.2**	**-5.5**	-1.0	**9.7**	-1.7
TL-experimenting	*n*	2[1]	0[1]	0[2]	4[2]	0[1]
	%	1	0	0	1	0
	Adjusted residual	1.4	-.9	-1.4	**2.2**	-1.4
TL-discussing results	*n*	60[52]	68[44]	110[99]	81[104]	71[91]
	%	18	24	17	12	12
	Adjusted residual	1.3	**4.2**	1.4	**-2.9**	**-2.6**
TR-planning	*n*	62[38]	38[33]	63[73]	72[77]	53[67]
	%	19	13	10	11	9
	Adjusted residual	**4.4**	1.1	-1.4	-.7	**-2.1**
TR-monitoring	*n*	17[14]	26[12]	27[27]	16[29]	22[25]
	%	5	9	4	2	4
	Adjusted residual	.8	**4.3**	-.1	**-2.9**	-.8
TR-evaluating	*n*	4[10]	19[9]	16[20]	29[21]	10[18]
	%	1	7	3	4	2
	Adjusted residual	**-2.2**	**3.7**	-1.0	**2.1**	**-2.2**

Note. Formatted as Observed[Expected]. Adjusted residuals in bold are those that exceed +/- 1.96.

RQ1: How are team learning activities and team reflexivity activities distributed in micro learning communities?

A significant difference was found in frequencies of TL-activities and TR-activities in micro LCs (Fisher's exact value(24) = 35.985, $p = .031$). The observed, expected numbers, corresponding percentages and adjusted residuals were shown in Table 11. In micro LC 3, it was expected that TL-seeking/ receiving external feedback/ input would occur more frequently and TL-discussing results would occur less frequent. In micro LC 4, it was expected that TL-discussing results would occur more frequently. The corresponding percentages indicated that for all micro LCs, team members showed more frequently TL-activities than TR-activities.

A significant difference was found in duration of time of TL-activities and TR-activities in micro LCs ($\chi 2$ (24) = 222.750, $p < .001$). The observed, expected numbers, corresponding percentages and adjusted residuals were shown in Table 12. In micro LC 2, it was expected that TL-seeking/ receiving external feedback would last longer and TR-planning would take less time. In micro LC 3, it was expected that TL-collaboratively generating ideas and TL-seeking/ receiving external feedback would last longer and TL-discussing results, TR-monitoring and TR-evaluating would take less time. In micro LC 6, it was expected that TL-collaboratively generating ideas, TL-discussing results and TR-monitoring would last longer and TL- seeking/ receiving external feedback, TL-experimenting, and TR-evaluating would take less time. In micro LC 7, it was expected that TL-discussing results, TR-planning and TR-evaluating would last longer and TL-collaboratively generating ideas would take less time. The corresponding percentages indicated that for all micro LCs, team members spent more time on TL-activities than TR-activities.

In Figure 1, the distribution of TL-activities and TR-activities were shown in percentage of duration of time over TD phases. It was found that TL-activities are dominant in all phases for all micro LCs, except for micro LC 2 and micro LC 3 in TD phase 1. Namely, 100% of the time was spent on TR-activity in micro LC 2 (n= 1) and 87% of time was spent on TR-activity in micro LC 3 (n= 3). This difference can be explained by the number of meetings of the micro LCs (8 compared to 10), and therefore team members had less time for their interprofessional learning and achieving the shared goal. Team members spent more time on immediately planning tasks and setting the shared goal, instead of first taking time to discuss the micro LC topic, exchange thoughts and ideas and discuss it from different perspectives when setting the shared goal.

When analyzing the distribution of TL-activities and TR-activities over TD phases per micro LC in Figure 1, it was found that the percentage of time spent on all TL-activities increased in TD phase 2, compared to TD phase 1 (for micro LC 2, 3, 6, 7) and decreased in TD phase 3 compared to TD phase 2 (for micro LC 3, 4, 6 and 7). It was found that the percentage of time spent on all TR-activities decreased in TD phase 2 compared to TD phase 1 (for micro LC 2, 3, 6, 7) and increased in TD phase 3 compared to TD phase 2 (for micro LC 3, 4, 6, 7). For micro LC 4, the percentage of time spent on all TL-activities differed just 1% between TD phase 1 (85%) and TD phase 2 (84%).

However, this decrease was very minimal which indicated that this difference found was very small. For micro LC 2, the percentage of time spent on all TL-activities in TD phase 2 (69%) increased in TD phase 3 (83%). This can be explained as team members planned to continue their learning after the micro LCs ends. In doing so, they continue in sharing thoughts and ideas and planning tasks for achieving the shared goal or setting a new shared goal. An example of this is shown in Example 1 in which the facilitator puts this into words.

Example 1

F: So far I think this LC, there is still plenty of work to do to eventually make sure everyone will show this behaviour. We do think this is really going to give us something. I think it is useful if we are going to have another meeting on this whether that is a follow-up in this form or completely different. For now, I think this LC now stops at suggesting ideas and brainstorming with everyone who is in such a process. And that you guys get to work on these forms.

When analysing the TL-activities and TR-activities individually in Figure 1, it stood out that in micro LC 6 TD phase 2, more time was spent on seeking external feedback compared to other micro LCs. This confirmed the adjusted residual in Table 12 which expected that this activity would take less time compared to the observed duration of time. In micro LC 6, team members invited an external professional to receive external input which helped them adjusting the shared goal. An example of this is shown in Example 2.

Example 2

LC6p194: What do you do at most installation companies because without a container ...
External professional: Well, we offer those. Most installation companies think it's a very nice idea, because you have everything together. But in the end, these companies then take it back to the warehouse because there are costs involved. In the end, it doesn't matter either, as long as you furnish it. Even stronger, you are obliged to do so - apart from that I am not the law maker here or anything - but officially you are supposed to have a chemical corner.

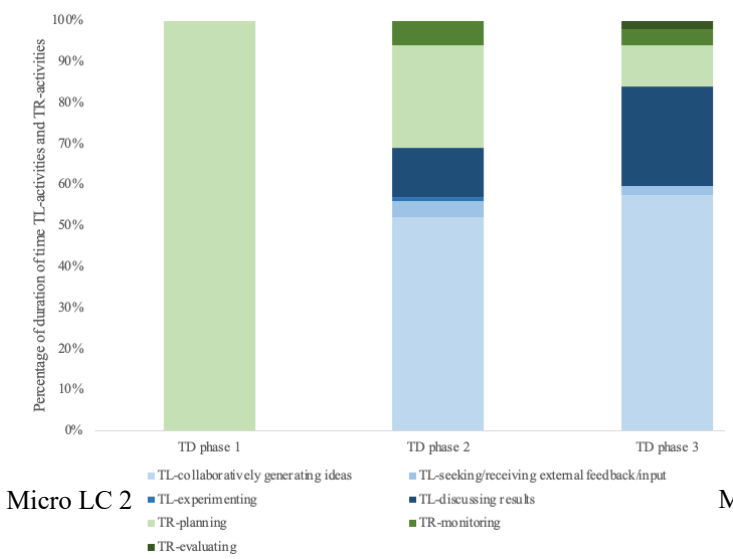
In sum, a significant difference was found for the frequencies and the duration of time of TL-activities and TR-activities. Also, differences were found in the distribution of percentage of duration of time spent on TL-activities and TR-activities over TD phases. In addition, it was found that the distribution of percentage of duration of all TL-activities and TR-activities over TD phases was the same for almost all micro LCs. This indicates that in each micro LC the total TL-activities and TR-activities are relatively similar distributed.

In order to aggregate and jointly analyse the data, it was important to highlight the context of this study in addition to the found significant differences. Each micro LC progresses through the same

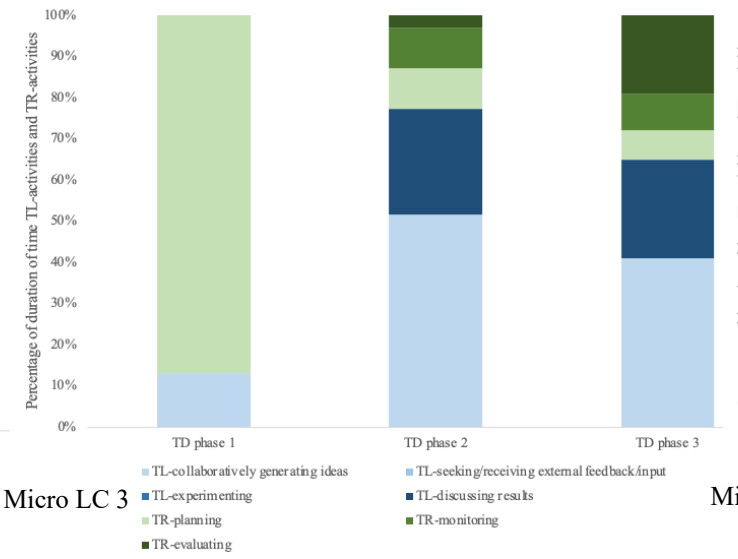
TD phases, based on PEF of Gersick (1988). In addition, each micro LC had a similar composition including a facilitator, a teacher and employees with different education and functional backgrounds that work towards the shared goal through interprofessional learning. In doing so, they had a limited time frame of about 10 meetings. Each micro LC was thus observed in the same context. This gave reason to aggregate and jointly analyse the data, to investigate the difference of TL and TR between phases. Subsequently, an in-depth analysis was conducted in which the aggregated data were analysed to see how TL-activities and TR-activities related per TD phase and between TD phases.

Figure 1

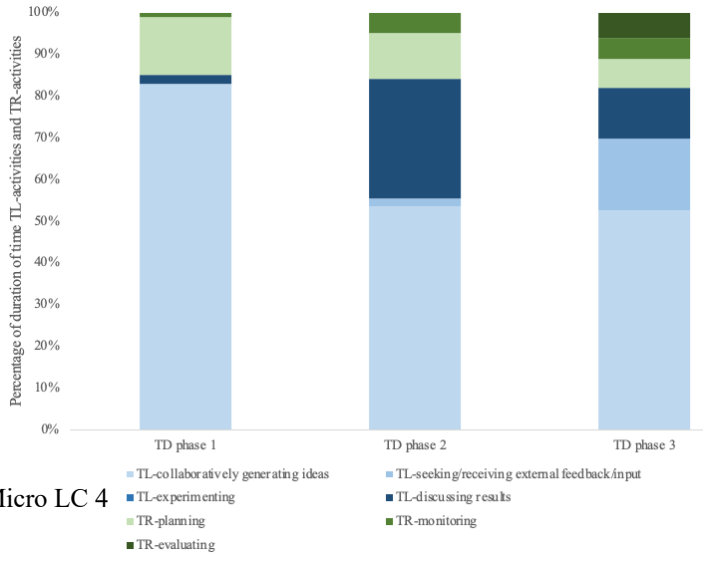
Time span analysis percentage of duration of time of TL-activities and TR-activities of micro LC 2, 3, 4, 6, and 7



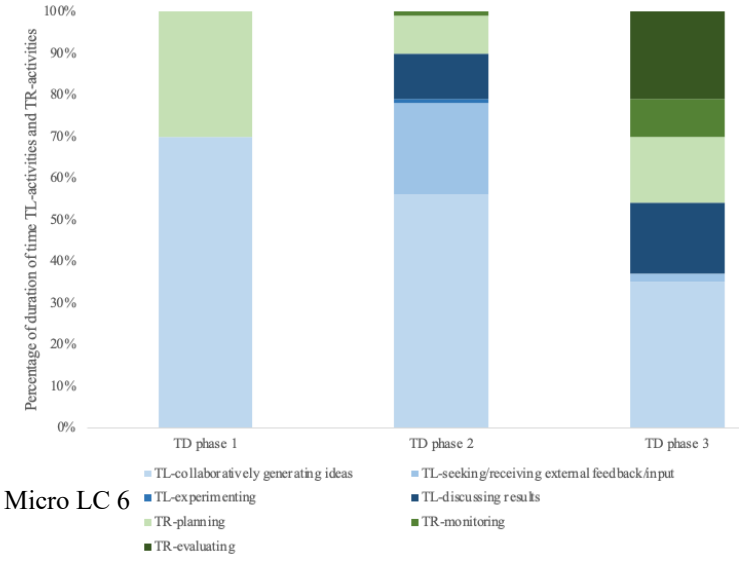
Micro LC 2



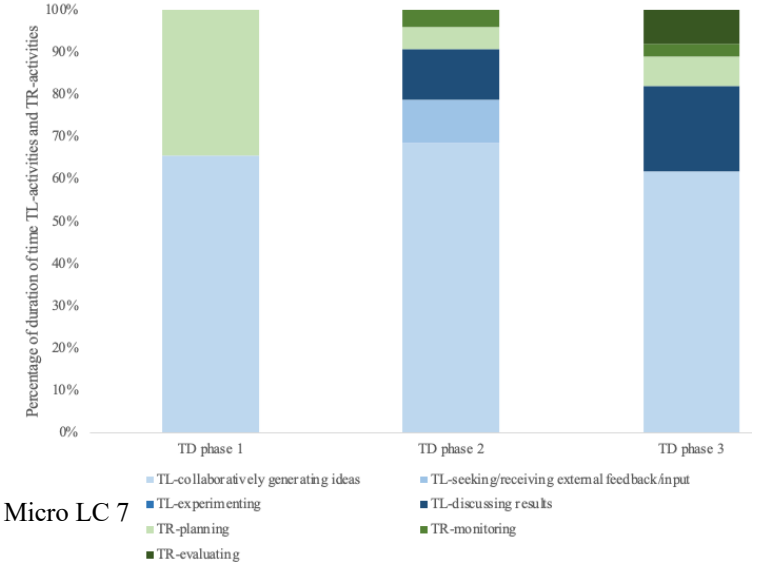
Micro LC 3



Micro LC 4



Micro LC 6



Micro LC 7

RQ2: Is there a difference in the distribution of team learning activities and team reflexivity activities per team development phase in a micro learning community?

There was no significant difference found in the distribution of TL-activities and TR-activities based on frequencies per TD phase in micro LC ($\chi 2$ (2) = 3.191, p = .203). The observed, expected numbers and corresponding percentages are shown in Table 13. It was observed that TR showed up more frequently than TL in TD phase 1. However, it was expected that TL would have shown up more frequently than TR in TD phase 1. As no significant difference is found, this expected difference was treated with care. For TD phase 2 and TD phase 3, it was found that TL showed up more frequently than TR.

Table 13

Distribution based on frequency of all TL-activities and TR-activities

		TD phase 1	TD phase 2	TD phase 3
TL-activities	*n*	18[22]	171[163]	83[87]
	%	47	61	56
TR-activities	*n*	20[16]	108[116]	65[61]
	%	53	39	44

Note. Formatted as Observed[Expected].

In addition, a significant difference was found in the frequencies' distribution of individual TL-activities and TR-activities per TD phase in a micro LC ($\chi 2$ (12) = 42.465, $p < .001$). The observed, expected numbers, corresponding percentages and adjusted residuals are shown in Table 14.

In TD phase 1, two negative adjusted residuals were found, indicating that TL-seeking/ receiving external feedback/ input and TL-discussing results were found less frequently than expected. Also, one positive adjusted residual value was found, indicating that TR-planning was found more frequently than expected. In other words, it was expected that team members would seek more input from external professionals and discuss the results of their performed tasks and plan fewer new tasks. This can be explained as during TD phase 1, team members are setting a shared goal for which it is needed to plan tasks to formulate the goal more clearly. In doing so, it is not yet needed to invite an external professional for this purpose.

In TD phase 2, one negative adjusted residual was found, indicating that TR-evaluating was found less frequently than expected. In other words, it was expected that team members would comment more frequent about the achievement of the shared goal and how they could achieve the shared goal more effectively. This can be explained as during TD phase 2, team members are still performing activities to eventually get a shared understanding from the knowledge gained to adjust the shared goal appropriately.

In TD phase 3, one negative adjusted residual was found, indicating that TL-collaboratively generating ideas was found less frequently than expected. Also, one positive adjusted residual was found, indicating that TR-evaluating was found more frequently than expected. In other words, it was expected that team members would share their thoughts and ideas more frequently and would evaluate less on how the shared goal could be achieved. This could be clarified as team members in micro LCs did not evaluate their learning process as frequently as was expected in TD phase 2, but they evaluated their learning process more frequently in TD phase 3. This was due to the limited time framework of micro LCs. Namely, it was possibly that team members did not feel the time pressure yet in TD phase 2 to evaluate their learning but they felt the time pressure in TD phase 3. This could also explain why team members spent less time on sharing thoughts and generating ideas during this phase, as they spent more time on evaluating.

Table 14

Distribution based on frequency individual TL-activities and TR-activities

		TD phase 1	TD phase 2	TD phase 3
TL-collaboratively generating ideas	n	17[12]	97[91]	38[48]
	%	45	35	26
	Adjusted residual	1.7	1.2	**-2.2**
TL-seeking/ receiving external feedback/ input	n	0[3]	26[24]	14[13]
	%	0	9	10
	Adjusted residual	**-2.0**	.7	.5
TL-experimenting	n	0[0]	3[2]	0[1]
	%	0	1	0
	Adjusted residual	-.5	1.4	-1.2
TL-discussing results	n	1[6]	45[46]	31[25]
	%	3	16	21
	Adjusted residual	**-2.4**	-.3	1.7
TR-planning	n	19[11]	79[79]	33[42]
	%	50	28	22
	Adjusted residual	**3.1**	.1	-1.9
TR-monitoring	n	1[4]	25[28]	20[15]
	%	3	9	14
	Adjusted residual	-1.6	-.8	1.8
TR-evaluating	n	0[1]	4[10]	12[5]
	%	0	1	8
	Adjusted residual	-1.2	**-2.9**	**3.8**

Note. Formatted as Observed[Expected]. Adjusted residuals in bold are those that exceed +/- 1.96.

There was a significant difference found in the duration of time distribution of the total TL-activities and TR-activities per TD phase in a micro LC ($\chi 2$ (2) = 44.807, $p < .001$). The observed, expected numbers, corresponding percentages, and adjusted residuals are shown in Table 15.

In TD phase 1, a negative adjusted residual was found, indicating that TL was found for less time than expected. Also, a positive adjusted residual was found, indicating that TR was found for more time than expected. In other words, it was expected that team members would spend more time on TL and spend less time on TR for setting the shared goal. In TD phase 2, a positive adjusted residual was found, indicating that TL was found for more time than expected. Also, a negative adjusted residual was found, indicating that TR was found less time than expected. In other words, it was expected that team members spend more time on TR and less time on TL for adjusting the shared goal. In TD phase 3, a negative adjusted residual was found, indicating that TL was found for less time than expected. Also, a positive adjusted residual was found, indicating that TR was found for more time than expected. In other words, it was expected that team members spend more time on TL and spend less time on TR for completing their collaboration. Even though a significant difference between TD phases were found, in all TD phases team members spent more time on TL-activities than TR-activities.

Table 15

Distribution based on duration of time of all TL-activities and TR-activities

		TD phase 1	TD phase 2	TD phase 3
TL-activities	*n*	157[178]	1321[1258]	567[609]
	%	72	85	76
	Adjusted residual	**-3.8**	**6.6**	**-4.7**
TR-activities	*n*	62[41]	229[292]	183[141]
	%	28	15	24
	Adjusted residual	**3.8**	**-6.6**	**4.7**

Note. Formatted as Observed[Expected]. Adjusted residuals in bold are those that exceed +/- 1.96.

In addition, significant differences were found in the duration of time of individual TL-activities and TR-activities per TD phase in a micro LC ($\chi 2$ (12) = 288.870, $p < .001$). The observed, expected numbers, corresponding percentages and adjusted residuals are shown in Table 16.

In TD phase 1, two positive adjusted residual were found, indicating that TL-collaboratively generating ideas and TR-planning were found for more time than expected. Also, four negative adjusted residuals were found, indicating that TL-seeking/ receiving external feedback/ input, TL-discussing results, TR-monitoring and TR-evaluating were found for less time than expected. In other words, it was expected that team members would spend less time on sharing thoughts and ideas and

planning tasks and spend more time on seeking external input, discussing results, and monitoring and evaluating their learning. The clarification of why team members spent more time on collaboratively generating ideas and planning tasks as was expected was that team members in TD phase 1 first started to get to know each other, orientated what they already knew about the micro LCs' topic and what problems they faced during their work related to this topic. During this orientation, team members shared their experience and knowledge about this topic and approached the topic from different angles. So, they collaboratively generated ideas. By sharing their ideas and views, this helped to plan tasks for ultimately set the shared goal in TD phase 1. A possibility is that team members might have been afraid to open up by showing other learning activities as not all team members understood and knew each other yet. Therefore, team members spent most time on collaboratively generating ideas and planning tasks in TD phase 1 as they first spent time on getting to know each other and to understand each other for ultimately agreeing on the shared goal they set.

In addition, TL-discussing results occurred during this phase. At first sight, this seemed a bit odd as the observed data showed that in most micro LCs team members did not yet perform tasks before the shared goal was established. However, team members lacked certain knowledge before setting the shared goal. For example, a teacher still had little knowledge of heat pumps. Therefore, a task was planned that a work planner went to the workplace with the teacher and shared knowledge of certain materials of heat pumps. An example is given in Example 3. This explains that team members were already performing certain tasks to each other's understanding which contributed to setting the shared goal.

Example 3

LC4pR: And at one point then I still ask the silly question what is prefabrication and then we went across and looked in the work place and mentioned examples of those meter box signs and things like that. And also actually the 3D setup, it is board with a prefabricated finishing floor in a corner setup eh. LC4pE: Yes. LC4pJ: Yes, also depends on how you look at it.

In TD phase 2, a positive adjusted residual was found for TL-seeking/ receiving external feedback/ input, indicating that this activity was found for more time than expected. Also, two negative adjusted residuals were found, indicating that TR-planning and TR-evaluating were found for less time than expected. In other words, it was expected that team members would spent less time on seeking external input and more time on planning tasks and evaluating their learning process. As also shown in Table 15, TL is the dominant activity during adjusting the shard goal. However, it was expected that team members would spend more time on reflecting their learning process by planning tasks and evaluate the achievement of the shared goal. This could be clarified as team members in a

micro LC do not feel the need to reflect on their learning. Instead, they mostly shared thoughts and ideas in order to refine and adjust the shared goal. So, during this process, team members did not spent much time on planning tasks and evaluate their learning process since their focus is at adjusting the shared goal.

In TD phase 3, three negative adjusted residuals were found for TL-collaboratively generating ideas, TL-seeking/ receiving external feedback/ input, and TR-planning, indicating that these activities were found for more time than expected. Also, three positive adjusted residuals were found for TL-discussing results, TR-monitoring, and TR-evaluating, indicating that these activities were found for less time. In other words, it was expected that more time would be spend on collaboratively generating ideas, seeking/receiving external feedback/ input, and planning and less time on discussing results, and monitoring and evaluating the learning process. Clarification for these founded significant differences was in line with the clarification in TD phase 2. Here, it was explained that team members did not feel the need to reflect on their learning as they still focussing on adjusting the shared goal. In TD phase 3 team members faced the end of their collaboration, which possibily resulted in them feeling the need to spend more time on reflecting their learning by monitoring and evaluating their learning process. The distribution of percentage of time of TL-activities and TR-activities is shown in Figure 2.

Table 16

Distribution based on duration of time of individual TL-activities and TR-activities

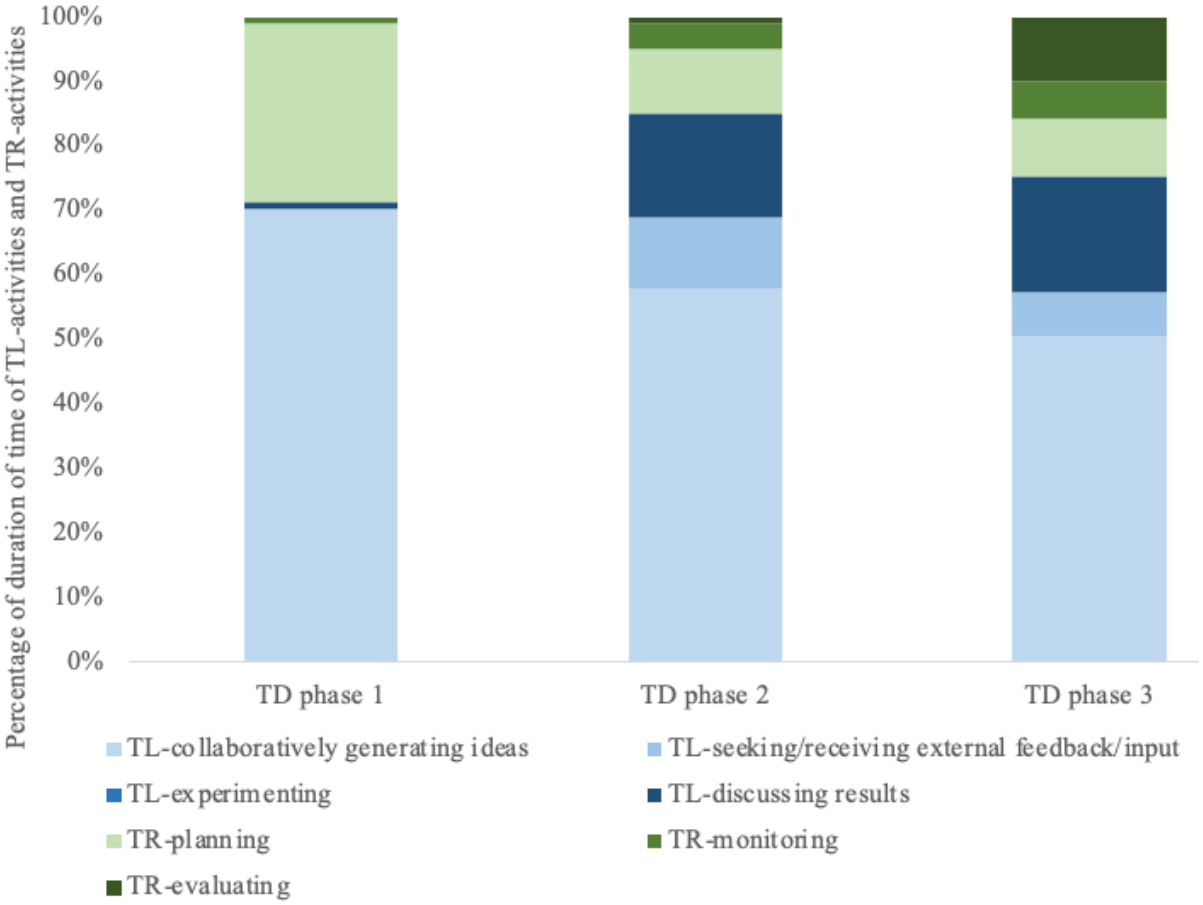
		TD phase 1	TD phase 2	TD phase 3
TL-collaboratively generating ideas	*n*	155[124]	896[881]	380[426]
	%	71	58	51
	Adjusted residual	**4.4**	1.3	**-4.1**
TL-seeking/ receiving external feedback/ input	*n*	0[19]	167[134]	51[65]
	%	0	11	7
	Adjusted residual	**-4.8**	**4.8**	**-2.2**
TL-experimenting	*n*	0[1]	6[4]	0[2]
	%	0	0	0
	Adjusted residual	-.8	1.9	-1.6
TL-discussing results	*n*	2[34]	252[240]	136[116]
	%	1	16	18
	Adjusted residual	**-6.2**	1.4	**2.4**
TR-planning	*n*	61[25]	158[177]	69[86]
	%	28	10	9
	Adjusted residual	**8**	**-2.5**	**-2.3**

TR-monitoring	*n*	1[9]	64[67]	43[32]
	%	1	4	6
	Adjusted residual	**-2.9**	-.5	**2.3**
TR-evaluating	*n*	0[7]	7[48]	71[23]
	%	0	1	10
	Adjusted residual	**-2.8**	**-9.7**	**12**

Note. Formatted as Observed[Expected]. Adjusted residuals in bold are those that exceed +/- 1.96.

Figure 2

Distribution of individual TL-activities and TR-activities in percentage of duration of time per TD phase



RQ3: What patterns of showing team learning activities and team reflexivity activities do micro learning communities carry out during the interprofessional learning process in different team development phases?

For this research question, patterns of TL-activities and TR-activities were analysed per TD phase. This was done by analysing the node values and edge values for each activity. The node value identified the importance of an TL-activity or TR-activity in the interprofessional learning process. The edge values included the edge significance and edge correlation, indicating how strong TL-

activities and TR-activities followed each other. The stronger the edge value, the more TL-activities and TR-activities followed each other.

For TD phase 1, one learning pattern was found, called *learning pattern 1*: TL-collaboratively generating ideas – TR-planning. This learning pattern indicated that team members in a micro LC gather input for setting the collective goal by collaboratively generating ideas and planning tasks. In TD phase 1, team members orientated what they already know about the micro LCs' topic and what problems they faced during their work related to this topic. During this orientation, team members shared their experience and knowledge about this topic and approached the topic from different angles. This helped them generate ideas. By sharing their ideas and views, this helped them formulating a shared goal and discuss which tasks should be performed for setting the shared goal. This again was alternated with gaining ideas, exchanging knowledge and learning from each other's experiences so that new tasks were planned or the shared goal was formulated more clearly. Also, both activities had a self-loop. In case of TL-collaboratively generating ideas, team members built upon their shared thoughts and ideas which ultimately leads to generating new ideas. The self-loop for TR planning indicated that team members planned tasks and built on them by planning other tasks needed to gather more input for ultimately setting the shared goal. Pattern of these activities were illustrated in Example 4 and shown in Figure 3.

What stood out is that TR-monitoring (.832) and TL-discussing results (.660) had a relatively high node significance but analysing the frequency of TR-monitoring (n = 1) and TL-discussing results (n = 1) this was relatively low. This indicated that TR-monitoring and TL-discussing result were important of routing the process however not as a stand-alone activity. During TD phase 1, some team members lacked certain knowledge to set the shared goal. As a result, a task was planned so that team members could gain this knowledge. Then, the result of this task was discussed in the micro LC so that other team members gained this knowledge. In this way, team members were able to understand each other better, which ultimately helped them to set the shared goal. An example of TL-discussing results was shown in Example 3.

In addition, the facilitator monitored the process of setting the shared goal. In doing so, the facilitator asked supportive questions as to whether team members had gathered sufficient ideas and knowledge to set the collective goal. An example for TR-monitoring in the process was shown in Example 5.

Example 4

TD phase 1 showing learning pattern 1: TL-collaboratively generating ideas – TR-planning

Activity		Team member	Utterance
TL-collaboratively	3	Facilitator	What do we need to do now to better answer that main question? So in other words, in what ways can [company LC4] work smarter using prefab, what can we standardise

generating ideas			from prefab? I actually hear you a lot about the prefab process.
	4	Peter	At the very beginning, with the calculation, there has to be clarity of what do we have in terms of space in terms of working hours
	5	Jos	Yes, I'm all for that too. The way it is now, we make prices for work preparation, I find that ridiculous. We are a business, I want to get hours from work preparation. At some point it is decided, that and that will be prefabricated. Well, there's so many hours for that, well here Jos here you have your work hours. You have to do it with that. Or well, we consulted on that. But if we can stay within those hours, there is nothing wrong, and if we go very much over, there is something wrong. So, then we have to mention it. As it is now, we can estimate pretty well what it will cost, in terms of hours (...) But now you're dealing with prices, and I'm scared out of my mind when they come up with prices for the prefab at work preparation.
	6	Martijn	Yes, but we often wait a week for those prices, and in that time you can't determine that either. Look, submit a construction drawing, that's made first, then they often estimate how much working time will be in this. Well and then a week later we get a price. But often we are too late by then.
	7	Jos	You then also have to work much faster. And that's why I say if you get hours at the front, there's nothing to worry about. Then you can get straight to work. Then he doesn't have to worry and I don't have to worry.
	8	Facilitator	Roy is that going to help us if we make that work process clear?
	9	Roy	That's an insightful process to start looking at that, yes.
TR-planning	10	Facilitator	So, what information do we need to take a good look next week, for example, or the time after that, of what all took place in that project in terms of working hours? How do we get that information?
	11	Jos	I think we can get those.
	12	Facilitator	Yes. So, you do want to prepare something in that?
	13	Jos	Yes, I do want to prepare something in that.
	14	Facilitator	Well, that would be a nice assignment for next week.

Example 5

F: Allright, do we still miss aspects, price, quality, sustainability, availability, logistics processes expertise? Of course, we talked about a shortage of technical staff. Communication internally. Ehm.

In TD phase 2, the same TL-activities and TR-activities of TD phase 1 occurred which ment that learning pattern 1 was also found in this phase. This indicated that after team members had set the shared goal, they continued to collaboratively generate ideas and planned tasks for it while adjusting the shared goal. Where TL-discussing results in TD phase 1 was only important for routing the process of learning pattern 1, in TD phase 2 it was considered a component of the learning pattern. This

indicated that in TD phase 2, learning pattern 1 was observed with an addition to the pattern. This results in two learning patterns found in TD phase 2: the existing learning pattern 1 and a new learning pattern, called *learning pattern 2*: TL-collaboratively generating ideas – TR-planning – TL-discussing results. The node significance (.332) and edge value (.3200) of TL-discussing results in TD phase 2 indicated that this activity was more important to routing the process than the activity itself. In other words, by discussing the results of the planned tasks team members were stimulated to collaboratively generate (new) ideas. Namely, discussing the results of the performed tasks had allowed team members to gain new knowledge, which in turn allowed this knowledge to serve as input to generate (new) ideas. Ultimately, discussing the results of performed tasks, generating ideas and planning new tasks helped to adjust the shared goal. Example of learning pattern 2 is illustrated in Example 6. Learning pattern 1 and 2 in TD phase 2 were shown in Figure 4.

In addition, what stood out was that activities TL-experimenting and TR-evaluating were more of important to routing the learning process in TD phase 2, but these activities were not included in learning pattern 2 as they did not show up that frequently and did not spent much time on interprofessional learning. In other words, these two activities stimulated team members to discuss the results of their performed tasks. TL-experimenting indicated that team members conducting tasks using new approaches which then stimulated them to discuss the results of these new approaches. Ultimately, this provided new input for generating new ideas, planning new tasks and adjusting the shared goal. An example of TL-experimenting was shown in Example 7. TR-evaluating indicated that a team member or facilitator commented on the achievement of the shared goal, asked what could be done differently to approach the shared goal more effectively. These comments then encouraged team members to continue in discussing the results of the performed tasks. Ultimately, this helped generate new ideas, plan tasks accordingly and adjust the shared goal. An example of TR-evaluating is shown in Example 8.

Also, TL-seeking/receiving external feedback/input was shown in the model, indicating that it contributes to learning pattern 2. However, the contribution of this activity to learning pattern 2 was very limited. Team members for example invited an external professional to the meeting in which they received new external input. Accordingly, this stimulated team members to experiment so that they can test if this new gathered external input also contributed to the shared goal. Accordingly, this stimulated team members discussing the results of these experiments.

Example 6

TD phase 2 showing learning pattern 2: TL-discussing results – TL-collaboratively generating ideas – TR-planning

Activity		Team member	Utterance
TL-discussing results	1	Facilitator	Yes, okay. What other things have been tested and did they work well?

	2	Rolf	Yes, say creating those roles that I think works well, that now several people can make a notification at the same time.
	3	Facilitator	Yes.
	4	Rolf	So, I think that is working properly now.
TL-collaboratively generating ideas	5	Facilitator	Yes, okay. (...) So you can now open, you can make comments, you can make changes, you have now noticed that something needs to be changed to make those changes visible to others. What actions are you still jointly wanting to practice or try out to further test things for usability and be able to make agreements?
	6	Rolf	Yes I think anyway the connection between Volt and BIM360 and then especially how that runs and whether that documentation stays the same.
	7	Facilitator	Yes.
	8	Rolf	That the documents from Volt also come into Bim360 and vice versa actually.
	9	Facilitator	And how would you like to test that next week?
	10	Rolf	Actually by looking from, because Volt now also works, the documents that we check in there, or files that you check in there, whether those are then also put into BIM360 by the job server.
TR-planning	11	Facilitator	And who could do that? Or try it out?
	12	Rolf	Yes anyone who can in Volt can test that then.
	13	Jan	So everyone from the office.
	14	Jasper	We have already tested one thing today, we haven't quite finished testing, but that is, do we as project managers have to start inserting files in Volt, or do we have to start entering files in BIM360? And that's also a possibility, and, only that's a bit cumbersome, so I think there's going to be some testing of is that necessary for us to be able to do that or will BIM360 suffice. That's something that we can test in the office and that has to go towards the mechanics, as say the receivers.
	15	Facilitator	Is that something you can test in the coming week?
	16	Jasper	Yes
	17	Rolf	Yes
	18	Facilitator	(…) So you're basically just saying for the next few weeks at least, test the connection between Volt and Bim360, so see where you have to enter the drawing as a project manager. And also see how that is received by the mechanincs.

Example 7

LC6p197: You can also see if there is a refurbished option.

LC6p192: If it's right then you see that there are other suppliers listed as well.

LC6p194: No, but he does it via the web selection and not those other ones. The question is how do [names colleagues] do it? So, he visits the website of [name company], but you can also choose to look in our system because if you do it via [name programme] you will see that the item is cheaper at [name company], for example.

LC6p193: I think that is slightly less likely to be done because if you do the web selection then you can see if it is also in stock. In service, it's also fault today, fix tomorrow.

Example 8

F: Just a quick recap. I don't know if everybody has to say something, but this is the idea, right? So, we try things out in practice, you experimented yourself. It could also be that an expert comes to share his experience and knowledge about BIM360 or that we visit a company that also uses BIM360 or that we observe each other in dyads while working so that we can learn from each other. And then we come back here in the meeting and start discussing hey, what have we learnt and what can we use from that? Can we move forward with it, should we make new agreements, or should we try different things? How is this working for you at the moment? Would you like it to work differently? Or is this approach working for you?

In TD phase 3, learning pattern 1, learning pattern 2 including an extension of TR-monitoring and a new learning pattern was found, called *learning pattern 3*: TR-evaluating – TL-discussing results. New in this pattern is that TR-monitoring and TR-evaluating now were included. The extension found for learning pattern 2, TR-monitoring, indicates that while team members completed their collaboration, they also monitored their learning process. In TD phase 3, team members now started talking about how far they were in the process of achieving the shared goal and wondered what still needed to be done and assessed if there was sufficient time for reaching the shared goal. After team members monitored their learning, they proceeded to plan tasks that helped them gather new inputs to ultimately achieve the shared goal and complete their collaboration. An example of this extension to TR-planning in learning pattern 2 is shown in Example 9. In addition, TR-evaluating was now included in learning pattern 3. Similar to TR-evaluating conribution to TL-discussing results in learning pattern 2 in TD phase 2, TR-evaluating was important in the learning process as it was considered part of the learning pattern 3 in TD phase 3. This learning pattern indicated that team members now commented on the achievement of the shared goal and discussed to what extent the results contributed to the achievement of the shared goal. Accordingly, team members discussed what can be done to achieve the shared goal more effectively. Furthermore, learning pattern 3 connected with learning pattern 2, indicating that after team members evaluated the learning process and discussed to what extent the results contribute to the achievement of the shared goal, they continued in generating ideas and planning tasks for achieving the shared goal. An example of learning pattern 3 was shown in Example 10. Learning pattern 1, 2, and 3 were shown in Figure 5.

The exclusion of TL-experimenting in TD phase 3 stood out, indicating that team members did not experiment anymore before completing their collaboration and achieving the shared goal. Also, this maked experimenting no longer an incentive for team members to discuss results (as found in TD phase 2). In addition, the node value of TL-seeking/receiving external feedback/input increased

in TD phase 3 (.588) compared to TD phase 2 (.189), indicating that this activity became more important in TD phase 3 and was now related to TR-evaluating. However, the contribution of this activity was still very limited, indicating that when team members received external input it did not stimulate them to afterwards evaluate their learning.

Example 9

TD phase 3 showing extension on learning pattern 2: TR-monitoring and TR-planning

Activity		Team member	Utterance
TR-monitoring	1	Facilitator	Okay, just another point, um Roy, the question you formulated within this LC was that you would like to know more about the communication function within BIM360 docs. Did you take that any further, did you have any new contacts about that? Or is that another question that is still open for you.
	2	Roy	I had a meeting about that with Jaap and (…).
	3	Facilitator	Okay great. So then we could hear a bit more about that too, in a fortnight.
	4	Roy	Yes.
	5	Facilitator	Perfect, so that's running smoothly in itself. (...)
TR-planning	6	Facilitator	Then I would say, in two weeks we will see each other again,
	7	Jaap	Yeah.
	8	Facilitator	So then we have all done that check of your own function, of which cross goes with which actions, is that correct and can I actually perform those actions or is that still difficult or unknown. The second point is that we are clear on what is the question we have to ask the management and even what has the management decided. And the last point is for Roy to give some feedback on his finding to visiting Jaap, what conclusions he draws about the communication capabilities of BIM360.
	9	Jaap	Yeah.
	10	Facilitator	And then at that point we have to take a look at what is the state of affairs, what is the logical move then, or completion.
	11	Rolf	Yes.
	12	Facilitator	Yes?
	13	Jasper	Agree.
	14	Facilitator	Well, then we can wrap it up for now, and at least we'll meet in two weeks. Good luck in the meantime with all the figuring out and checking!

Example 10

TD phase 3 showing learning pattern 3: TL-discussing results and TR-evaluating alternates

Activity		Team member	Utterance
TL-discussing results	1	Rob	So that basically sums up what I learnt from bim360. Well, I got to know the programme better. I know some limitations of the programme. Well, the benefit for education is making a good division of roles. If teachers are good at it, also towards students. From BIM360, you can actually monitor that just fine. And maybe steer it. To discuss things in that as well.

	2	Facilitator	Yes, nice and concrete too, so you can start working on that right away, including with your colleagues.
	3	Rob	Yes, that actually also gives, we now assess a lot of end pieces. But now the way is also open to assess the process as well.
TR-evaluating	4	Facilitator	Nice nice. Looking at the process now for a moment. Ultimately, we had said to each other, what we want is to get to the point where when a new project starts up later, we can then work with each other, possibly with new colleagues, using Bim 360. What is currently not yet in place, what is currently not arranged to be able to do that? Or are we that far? Are you guys that far? That you can in fact just start at the next project?
	5	Rolf	You can start in BIM360, only that intermediate step to Volt has to be made. Yes, as far as that is concerned, you can just share documents to the construction, only that intermediate step to really get it right in volt, to automatically link those documents properly. That still has to be ready.
	6	Niek	We can just use the programme BIM360. But it is the link from Volt, or actually from the office, to the work floor. Right now, that is not an automatic operation, but a manual one.
	7	Rolf	And that should become automatic.
	8	Niek	And the step now is that that also becomes automatic. And we had actually hoped to achieve that in this trajectory already. But so that hasn't been achieved yet.
	9	Facilitator	(…) Okay, so I actually hear you say at the next project you can just start with BIM360?
	10	Rolf	Yes.
	11	Facilitator	And say the link to Volt. That's something that actually goes to the management about how that will be tackled.
	12	Rolf	Yes, that's why we already have a back up in the folder structure. So that is just fine. So once that link is just right and it can be automated, yes, the whole thing will be complete. But we can just start subsequent projects in BIM360.
	13	Facilitator	yes, nice, nice. Then, with all sorts of bumps and ifs and buts, we still achieved that goal together.
	14	Niek	Yes
	15	Rolf	Definitely
	16	Facilitator	Then when you look back at the process, so working on such an issue in this way. And seeing if you can formulate an approach together and get through how it works, what to do yourself and so on. So what is then when you try to bring that together like that for a while? What has been the outcome of those eight meetings like that? What is it as far as you think, Ruud?
	17	Ruud	Well. What has been the output? Yes, I think you can, how should I put it? With the bottlenecks that we face, that you can talk about that all together. Also with the action points making what we constantly do now then. Of such little things all. So that you hear the external voices a bit. And not only from internally, because maybe they have it all wrong, so then you also learn it wrong. Yes and from how you tackle things and prepare In the folder structure and bla bla. So yeah.
	18	Facilitator	So that you immediately connect the experiences that you are having, at that moment, with the experiences that are being had inside. That you keep the lines of communication short?

19	Ruud	Yes, and what I also say with those meetings. Then you hear what you're up against in the office. Some things are a bit abracadabra for me. The whole volt thing, I have exactly zero influence on that anyway. That is purely ICT technical. So then I honestly feel a bit lost. So. Yes, we obviously work here in practice. And that information is super important to me. And how they do it internally, yes, I have no influence on that.
20	Facilitator	No clear, clear. Good to hear. Engineers, how's that for you Niek and Jasper?

Figure 3

Fuzzy model TD phase 1

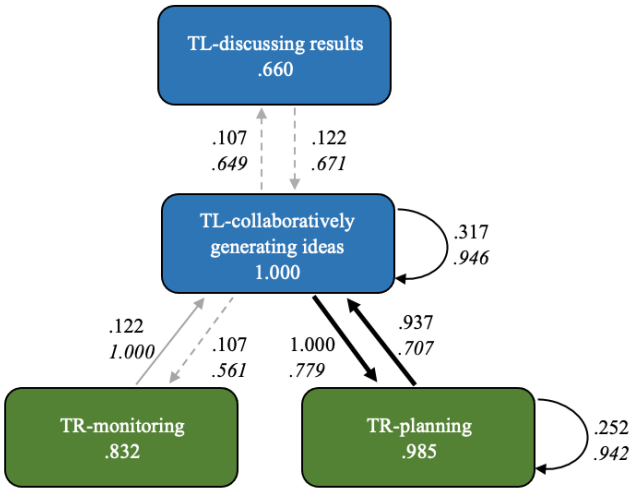


Figure 4

Fuzzy model TD phase 2

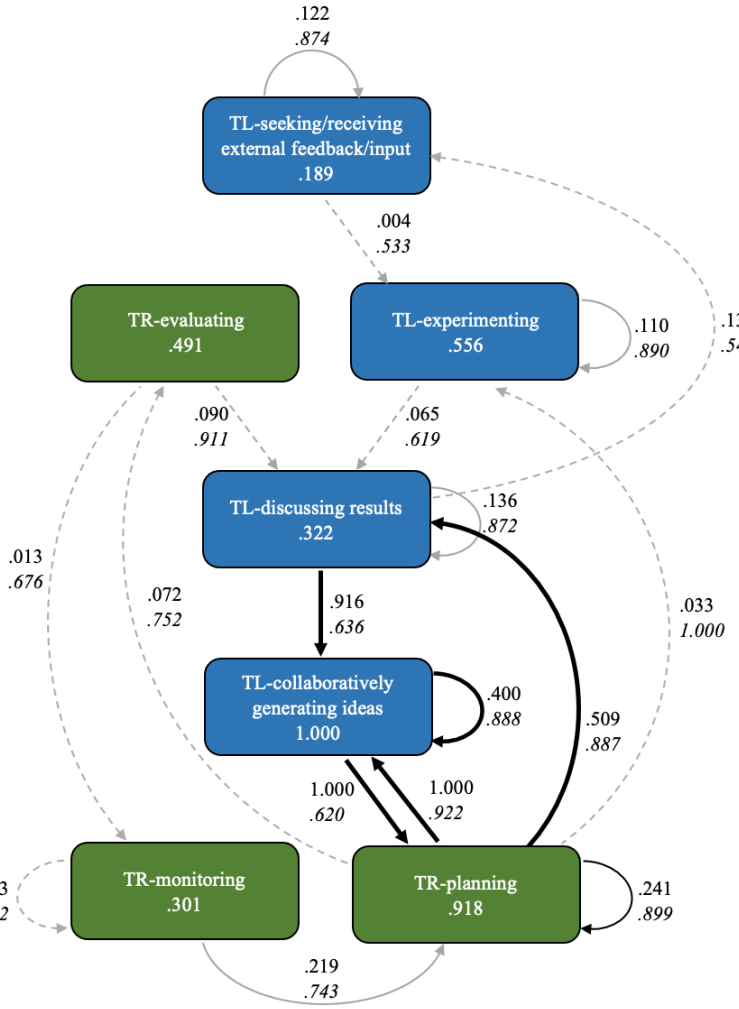
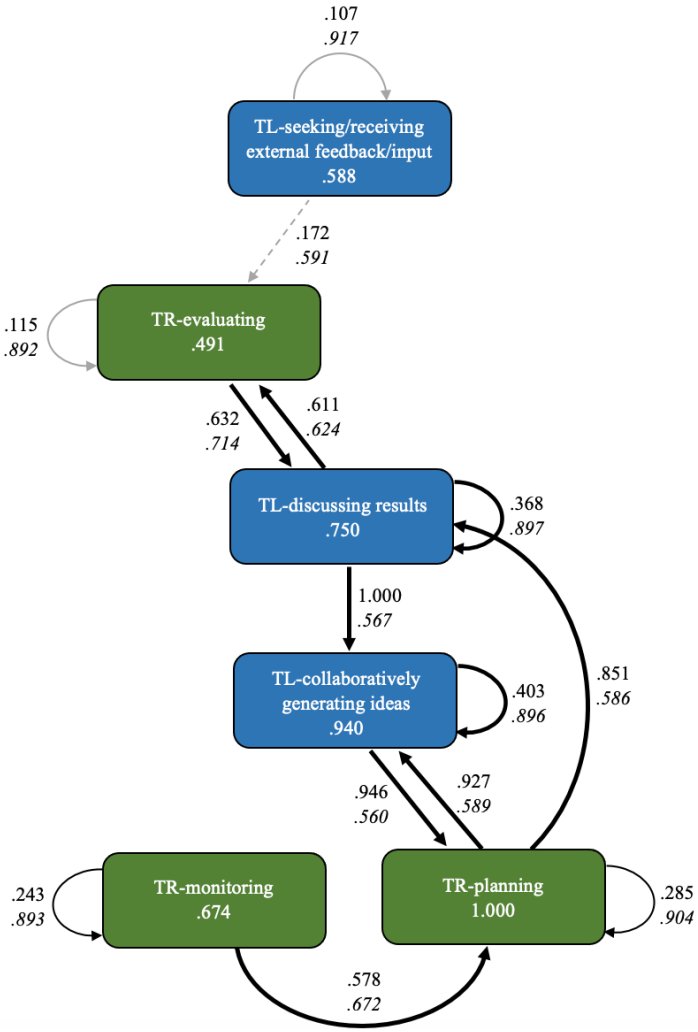


Figure 5

Fuzzy model TD phase 3



Discussion

This study aimed to create a better understanding of how TL-activities and TR-activities unfold over time during interprofessional learning in micro LCs. First, it appeared that there are differences found in frequencies and duration of time of TL-activities and TR-activities. In addition, the distribution of percentage of duration of time of all TL-activities and all TR-activities over TD phases per micro LC are approximately the same for all micro LCs. Second, a significant difference was found in the distribution of total TL-activities and TR-activities in duration of time per TD phase in micro LC. Also, a significant difference was found in the distribution of individual TL-activities and TR-activities in frequencies and duration of time per TD phase in micro LC. Third, learning patterns of TL-activities and TR-activities were found per TD phase in micro LCs. Outcomes of this study are discussed in more detail.

Distribution of TL-activities and TR-activities over time in micro LCs

From the data, a significant difference is found in frequencies and duration of time of TL-activities and TR-activities in micro LCs. Also, the percentage of duration of time spend on individual TL-activities and TR-activities differed per micro LC. In addition, it is found that the distribution of percentage of duration of all TL-activities and TR-activities over TD phases was the same for almost all micro LCs. This indicates that in each micro LC all TL-activities and TR-activities are relatively similar distributed.

A possible explanation of the similar distribution of all TL-activities and TR-activities is that each micro LC has the same set up. According to project ‘Hit the Gas’ each micro LC is relatively the same as each micro LC consist out of six till ten team members that work on a challenge-based problem in a (installation) company within a limited-time frame (Corporaal et al., 2020). This explanation of the same set up is confirmed by the PEF of Gersick (1988). According to Gersick (1988), groups may change their way of learning at a phase, but they do not change their fundamental approach to the task when they are the same team type. As each micro LC has the same fundamental goal which is contributing to societal issues (Hubers et al., 2021), and has the same characteristics. Thus, potentially clarifying the corresponding distribution of the total TL-activities and TR-activities of the five micro LCs over time.

Another explanation of the similar distribution of all TL-activities and TR-activities is the influence of the facilitator on the process of interprofessional learning in micro LCs. Namely, for each micro LC session there was a facilitator present that supported the interprofessional learning among team members. Facilitators from project ‘Hit the Gas!’ received a briefing in which they are taught how to facilitate the interprofessional learning process of team members in a micro LC. Because of this, facilitators may ensure that in each micro LC the distribution of all TL-activities and TR-activities is the same. In previous research, it is concluded that the facilitator initiates most TL behaviour (Van Weeghel, 2022). This may explain why the same distribution of TL-activities and TR-

activities is found in each micro LC. However, the research of Van Weeghel (2022) used the basic team learning process from Decuyper et al. (2010) analysing who initiated TL (facilitator vs participants). As this research focused on TL-activities and TR-activities and not the basic team learning processes from Decuyper et al. (2010), and did not include who initiated TL, this clarification should be treated with care.

Differences in the distribution of TL-activities and TR-activities in TD phases in micro LC

The second research question focused on the difference in the distribution of TL-activities and TR-activities per TD phase in micro LC. According to the frequency data, no significant difference is found for the number of all TL-activities and TR-activities per TD phase. However, a significant difference is found for the number of individual TL-activities and TR-activities per TD phase. Moreover, the data that investigated the duration of time spent on TL-activites and TR-activites showed a significant difference for both all TL-activities and TR-activities as well as the individual TL-activities and TR-activities.

For TD phase 1, it is observed that team members show more frequently TR-activities than TL-activities and it is expected that team members spend more time on TL-activities and less time on TR-activities to set the shared goal in micro LCs. When zooming into the significant differences for the individual TL-activities and TR-activities in TD phase 1, it is expected that team members would seek external feedback and discuss results more frequently and would plan tasks less frequently. In addition, it is expected that team members would spend less time on TL-collaboratively generating ideas and TR-planning and more time on TR-seeking/ receiving external feedback/ input, TL-discussing results, TR-monitoring and TR-evaluating. So, the expectation is that team members would show more frequently and spend more time on other TL-activities and TR-activities than mainly TL-collaboratively generating ideas and TR-planning when setting the shared goal.

A possible explanation for showing mostly TL-collaboratively generating ideas and TR-planning is that team members in TD phase 1 first start to get to know each other, orientate what they already know about the micro LCs' topic and what problems they face during their work related to this topic. During this orientation, team members may share their experience and knowledge about this topic and approach the topic from different angles. So, they spend much time on collaboratively generating ideas. By sharing their ideas and views, this helps to plan tasks in order to set the shared goal in TD phase 1. Moreover, setting a shared goal does not add value to inviting an external professional or conducting an experiment, as the team members themselves are aware of what problems they face in the workplace and therefore what the shared goal should be (no external professional needed). Thereby, the shared goal will have to be defined first before team members can do experiments. So, this clarifies why team members mainly collaboratively generating ideas and planning tasks to set the shared goal.

According to literature it is confirmed that in the beginning phase of teams' maturity, low amount of TL behaviour is shown and as the team matures, this leads to more TL behaviour (Raes,

Boon, et al., 2015). So, TL behaviour increase when the team matures over time (Raes, Boon, et al., 2015). Low variety of TL-activities and TR-activities in TD phase 1 can be explained by the fact that team members are first concerned with creating team psychological safety. Team psychological safety is an emergent state and means that team members dare to take interpersonal risk (Decuyper et al., 2010; Edmondson, 1999; Edmondson & Harvey, 2018). Literature indicates that when team members have the shared feeling of feeling safe to take interpersonal risks in a team, team members show more TL behaviour (Edmondson, 1999; Van den Bossche, 2006). This is also confirmed by research of Van Rees et al. (2022): "Participants will only demonstrate learning behaviour if they are given the room to make mistakes outside of the meetings and feel trusted by the organisation." (Van Rees et al., 2022, p. 6). As team members in TD phase 1 are first getting to know each other and spend time on orientating the micro LC's topic, it may also indicate that not all team members dare to take interpersonal risks as they do not have this team psychological safety yet. So, the low diversity of TL-activities and TR-activities in TD phase 1 can be explained by the fact that team members have not yet created that team psychological safety.

For TD phase 2, it iss expected that team member would spend more time on TR-activities and less time on TL-activities during adjusting the shared goal. Nevertheless, it is expected that most time was spend on TL-activities than TR-activities. When zooming in into the significant differences of the individual TL-activities and TR-activities, it is expected that team members in a micro LC would evaluate more frequently their learning and spend less time on seeking external feedback and more time on planning and evaluating their learning.

A possible explanation for spending most time on TL-activities in TD phase 2 is that team members still spend much time on understanding each other by sharing their views and ideas and ask clarifying questions (collaboratively generating ideas) for creating that shared understanding and team psychological safety during their interprofessional learning. Also, they now spend more time on gathering new information by discussing results of the performed tasks and receiving external input. Here, team members might have not felt time pressure as the end of the micro LC entered (Gersick, 1988). Time pressure may trigger team members to reflect upon their learning and to monitor and evaluate their learning process whether they still going to achieve the shared goal within the limited time frame or need to adjust the shared goal. This also may clarify why team members spent less time on TR-activities than was expected. Also, it could be that team members in micro LCs spend time on learning outside the micro LCs. So, in practice it could be that team members spent more time on reflecting the learning process outside the micro LCs and that these TR-activities could not be observed as they took place outside the micro LCs. However, as this research did not observe TL-activities and TR-activities outside the micro LCs as well, this explanation should be treated with care.

In addition, it is noticed that in TD phase 2, the variety of TL-activities and TR-activities increased compared to TD phase 1. In this phase, team members start to reflect upon their learning by showing the activities planning, monitoring and evaluating which helps them to eventually adjust the

shared goal (Schippers et al., 2018). Also, reflecting on the learning process helps to create a shared understanding (Van Ginkel et al., 2009). The increase in variety of TL-activities and TR-activities can be clarified as the team matures over time (Decuyper et al, 2010; Raes et al., 2017) which may imply that team members feel more safe to take interpersonal risks and created that shared understanding and therefore show more TL-activities and TR-activities (Edmondson, 1999; Van den Bossche et al., 2006). However, this explanation should be handled with care as this research did not investigate whether team members felt safer for taking interpersonal risks. Also, it cannot be confirmed in this study if team members created a shared understanding as this was not a goal in this research.

For TD phase 3, it is expected that team members in micro LCs spend more time on TL-activities and less time on TR-activities towards the end of the collaboration in micro LCs. There were a few discrepancies between the expected and observed results regarding individual TL-activities and TR-activities. There were a few activities on which team members spent a lower duration of time than expected, these were: 1) TL-collaboratively generating ideas, 2) TL-seeking/ receiving external input, and 3) TR-planning. On the other hand, there were also activities on which team members spent a higher duration of time than expected, these activities include: 1) TL-discussing results, 2) TR-monitoring, 3) TR-evaluating.

A possible explanation for a higher duration of time for TL-activities than TR-activities and collaboratively generating ideas, seeking external input and plannint tasks is that it was noticed in the observations that team members intend to continue their interprofessional learning for achieving the shared goal after the micro LC ends. In doing so, team members continue their learning by setting a new shared goal after the micro LC ends. Therefore, gathering new input performing the activities discussing results, experimenting, seeking/receiving for external feedback and generating ideas will help for ultimately setting the new shared goal. In addition, it is expected that team members spend less time evaluating their learning than is observed at the end of their collaboration. This is confirmed in the study from Stray et al. (2011), as this research stated that team members spend little time evaluating their work. So, the finding of Stray et al. (2011) is confirmed in this study.

In addition, the variety in TL-activities and TR-activities is also found in TD phase 3. So, when analyzing the distribution of all the TD phases, a low variety of TL-activities and TR-activities was found for TD phase 1 and higher variety of TL-activities and TR-activities was found for TD phase 2 and 3. This is confirmed by Decuyper et al. (2010) who stated that TL behaviour increased over time. On the contrary, study of Raes et al. (2017) did not find differences in team interaction activities (basic team learning behaviour & facilitating team learning behaviour) activities over time. This is also confirmed by Van Weeghel (2022) in which differences in team interaction activities was only studied with basic team learning behaviour. On first sight, this contradicts the findings of this study. However, Raes et al. (2017) used frequencies to analyse differences between activities over time and coded activities according to the basic and facilitating team learning behaviour from Decuyper et al. (2010). In addition, the study of Van Weeghel only used the basic team learning

behaviour from Decuyper et al. (2010) for coding the activities during TL and coded on episode level. This research highlighted the importance of TR and included TR-activities to study the interaction of TL and TR in interprofessional learning in micro LCs. Also, this study coded TL-activities and TR-activities which differed from the basic an facilitating team learning behaviour, included data of duration of time and frequencies and code an TL-activity or TR-activity when a team member started showing a TL-activity or TR-activity and stopped when a team member showed another TL-activity or TR-activity. Therefore, the study of Raes et al. (2017) and Van Weeghel (2022) resulted in a different amount of data and ultimately different results compared to this study. In addition, when performing the chi-square test for the frequencies of all TL-activities and TR-activities in this study, no significant difference was found either. So, based on frequencies, this study confirms the outcome of the study by Raes et al. (2017) and Van Weeghel (2022).

Additionally, the increase of individual TL-activities and TR-activities in TD phase 2 and 3 can be explained by the fact that team members may become more aware of their collective knowledge by sharing knowledge, generating ideas, and setting the shared goal in TD phase 1. In other words, team member create a shared understanding and feel more safe to show other TL-activities and TR-activities. Having a shared understanding helps to achieve the shared goal as team members are aware of their current knowledge, their collective goal and how to realize that collective goal from the current reality (Decuyper et al., 2010; Van den Bossche et al., 2006). So, the higher variety in individual TL-activities and TR-activities in TD phase 2 and 3 may thus be due to team members creating a team psychological safety and a shared understanding. However, the concepts team psychological safety and shared understanding are not analysed in this study, so this explanation should be treated with care.

Multiple patterns of TL-activities and TR-activities found for each TD phase

For TD phase 1, a pattern of activities is found for TR-planning and TL-collaboratively generating ideas (learning pattern 1). In this learning pattern, mainly team members collaboratively generate idea by sharing their views and ideas, elaborate on that and plan activities and set a collective goal based on the insights of generating ideas.

A possible explanation for showing mainly TL-collaboratively generating ideas and TR planning is that team members in TD phase 1 first become aware of the knowledge each team member possess in the micro LC by sharing their views and ideas and thus generate ideas. After generating ideas, team members plan tasks for that for ultimately setting the shared goal.

Literature comfirms that TL-collaboratively generating ideas is a main activitiy in TD phase 1. According to Wiese and Burke (2019), team members become aware of their current collective knowledge in the beginning of their learning process. So, team members become aware of each other's knowledge (Wiese & Burke, 2019). Becoming aware of the current knowledge among team members will help for eventually creating a shared understanding (Van den Bossche et al., 2006).

For TD phase 2, learning pattern 1 and learning pattern 2 were found. In learning pattern 2, team members mainly discuss their result and use this as input to collaboratively generate new ideas. Then, after generating those ideas they plan new tasks. The outcomes of these tasks can be discussed and be used as new input to set new tasks or adjust the collective goal.

Learning pattern 2 is also recognised by Lei et al. (2015) in which they stated that during the team interaction process, 'planning-in-process' occurs, which involves an iterative process of recognising problems, collecting data, generating ideas and evaluating and choosing a course of action. In the context of this study, team members demonstrate this iterative process by performing tasks, discuss the results of these performed tasks and use this discussion as input for generating new ideas. These new ideas in turn let team members plan new tasks or adjust the shared goal. Lei et al. (2015) also indicate evaluation is part of this process. However, this study found that team members do evaluate during adjusting the shared goal, yet this is not an element of a learning pattern.

In addition, it was expected that TR-monitoring and TR-evaluating would be included. The displayed high variety of TL-activities and TR-activities in this TD phase indicate that team psychological safety and a shared understanding was created, in order to reach that reflecting upon tasks is needed (Raes, Kyndt, et al., 2015; Schippers et al., 2018; Van den Bossche et al., 2006). On the other hand, the fact that these activities were not discovered could have been because there was no need or that the team members were set on following the plan as they had determined in the beginning. Another explanation could be that team members experienced little or no learning trigger or did not create a shared understanding yet. Learning triggers occur when new information comes up, when there is a change in task demands, when team members adjust the shared goal or when an external individual gives new information to the team (Wiese and Burke, 2019). However, if team members are not aware that new information came up, they also cannot reflect upon their current state, desired state and what is still missing, so they can adjust the shared goal. In other words, due to the lack of shared understanding the team members are not aware of what is still missing for adjusting the shared goal. Thus, explaining why TR-monitoring and TR-evaluating are excluded in the learning patterns.

For TD phase 3, learning pattern 1, learning pattern 2, an addition for learning pattern 2 (TR-monitoring) and learning pattern 3 (TR-evaluating - TL-discussing results) were found. This indicates that team members still generate ideas, plan tasks upon that, discuss the results of the planned tasks and use this as new input for generating (new) ideas. In addition, team members now will also evaluate their process in reaching the shared goal as input for discussing results and vice versa so that this also helps to generate ideas. Also, team members will now monitor their process and use this for designating new tasks for ultimately reaching the collective goal. Furthermore, it is noticed that in this TD phase, all three TR-activities are included spread over the three learning patterns.

A possible explanation for this learning pattern is that team members felt time constraints as they were nearing the end of the micro LCs (Gersick, 1988). This may trigger team members to reflect upon their learning and to monitor and evaluate their learning process whether they still going to

achieve the adjusted, shared goal within the limited time frame or not. This reflecting upon learning can help team members to create that shared understanding which helps them ultimately to achieve the adjusted, shared goal (Van den Bossche et al., 2006). Also, what stands out is that TL-collaboratively generating ideas still occurs during this phase. This may seem a bit odd as gaining (new) ideas make sense when the LC ends at this stage. However, if team members have not yet achieved the goal after the last meeting of the LC and learning has been considered an ongoing process (Edmondson, 1999), this may explain why team members continue their interprofessional learning after the micro LC ends. Another explanation of why TL-collaboratively generating ideas is included in the learning pattern is that team members now not focus on generating new ideas, but focus more on their current, existing knowledge. This is confirmed by literature, stating that when team members face the end of the learning process, they will more refine their existing knowledge more than generating new ideas (Jones & Bearly, 2001).

So, this research may indicate that team members continue their interprofessional learning after the micro LC ends. However, this indication should be handled with care as the content of TL-activities and TR-activities are not analysed in this research.

Limitations and future research

In addition to this empirical research sharing outcomes, it is worth considering the limitations of this research and what future research can do to enrich a better understanding of the boundary crossing process during interprofessional learning in micro LCs. The discussion has already touched lightly on limitations of the study. This section elaborates on the limitations of this study and suggestions for future research.

Aggregation in this study

In this study, the data was aggregated and distinguished into TD phases based on the PEF of Gersick (1988). Instead, data could be aggregated and distinguished based on the meeting level. As each micro LC had the same set-up, this is possible. Aggregating the data based on meetings would impact the resulting learning patterns. Since there were more meetings (10 on average) than phases (3 TD phases), aggregating data at the meeting level would give a more specific insight into the distribution of TL and TR over time. Aggregation of data based on meeting level was not done in this study, as this was not considered up front.

Coding in this study

In this study, data was not coded on episode level, instead coding was done when a TL-activity or TR-activity started and the coding stopped when team members stopped showing this activity. This is done as this would reduce the self-loops in proces mining, allowing for better analysis of learning patterns. However, this way of coding yields less data. This limits the validation of the outcomes of this research as the more data, the more reliable the analyses will be.

Initiation of TL-activities and TR-activities

This research focused on TL-activities and TR-activities performed by team members in micro LCs. However, this research did not focus explicitly on the role of the facilitator. As suggested in the discussion, the facilitator might influenced the process of interprofessional learning in micro LCs. Namely, the facilitator was able to provide support that allowed team members to move on by, for example, asking clarifying questions, come up with possible tasks or monitor the process. The TL-activities and TR-activities carried out could occur differently if the facilitator gave team members more space to initiate TL-activities and TR-activities themselves instead of initiating TL-activities and TR-activities by himself. In addition, Van Rees et al. (2022) argued that each facilitator had their own way of guiding the micro LCs, which influenced the learning process in micro LCs. Another study showed that the facilitator initiated more TL-activities than team members (Van Weeghel, 2022). However, this study only focused on the basic team learning processes of Decuyper et al. (2010) and thus did not focus on TR. Also, in the study of Van Weeghel (2022) data was coded on episode level. In addition, study of Van Rees et al. (2022) suggest to train facilitators so that they will have a baseline of guidance. Future research could focus on if there is a difference in the initiation of TL-activities and TR-activities among facilitator and team members in micro LCs after the facilitator was trained.

Including an observation of TL-activities and TR-activities outside the meetings

This study focused on TL-activities and TR-activities performed in the meetings of micro LCs. However, during the observation by the researcher it was noticed that team members learned both within and between the LC meetings. Because this study focused only on the TL-activities and TR-activities during the micro LCs, this study may provided an incomplete understanding of the boundary crossing process during interprofessional learning in micro LCs. Future research should observe what TL-activities and TR-activities team members show outside the meetings of micro LC. This will gain more insights into the process of boundary crossing during interprofessional learning in micro LCs.

Content quality of TL-activities and TR-activities

To compare micro LCs best, percentages of duration of time were used in this research. However, this research did not focus on the content quality of TL-activities and TR-activities. This limits making statements about the pattern of activities. For now, this research state that there are patterns of TL-activities and TR-activities found in TD phases, but it cannot yet be suggested if these are effective patterns as the qualification of the outcomes were not included. Future research should include the content of TL-activities and TR-activities in order to assess the quality of micro LC outcomes. This will create a more in-depth understanding which will extend the understanding of the boundary crossing process in micro LCs. To analyze the content quality of TL-activities and TR-activities, future research could observe facial expressions and attitudes of participants.

Practical implication

Even though the team members may have created a shared understanding in a micro LC, colleagues outside the micro LC do not have this same shared understanding. So, when team members from the micro LC want to perform follow-up actions for achieving the goal after the micro LC ends, and may include colleagues outside the team, they may experience new knowledge boundaries as they do not have this same shared understanding (Akkerman & Bakker, 2011). So, team members in a micro LC may experience knowledge boundaries when including colleagues outside the micro LC when starting with the follow-up actions after micro LC. To reduce knowledge boundaries, team members go through that ongoing process of action and reflection (Edmondson, 1999; Edmondson & Harvey, 2018). However, in this research it was expected that during adjusting the shared goal, team members would spend more time on reflecting their learning (TR) than performing actions (TL). Team members need to be stimulated to reflect their learning as reflecting on learning create a shared understanding (Van Ginkel et al., 2009). Ultimately, this will reduce the knowledge boundaries between team members from the micro LCs and colleagues outside the micro LC.

Stimulating reflecting upon learning could be done by training facilitators to stimulate more TR-activities among team members in micro LCs. Here, project members of 'Hit the Gas!' could use these insights for developing a training for facilitators. Also, HRD professionals in the (installation) companies may use these insights for developing a training as well if team members of the micro LC intend to continue their learning in the micro LC in the organization after the micro LC ends of project 'Hit the Gas!'.

Conclusion

This research focused on how TL-activities and TR-activities in interprofessional learning process unfold over time in micro LCs. It appeared that all micro LCs have differend frequencies and duration of time in performed TL-activitites and TR-activities. In addition, similarities in the distribution of all TL-activities and TR-activities in the five micro LCs were found. Secondly, it was found that TL-activities and TR-activities differ per TD phase. In TD phase 1 the variety of TL-activities and TR-activities was low and higher in TD phase 2 and 3. This indicates that a TD phase affects the TL-activities and TR-activities performed by the team. Thirdly, learning patterns are found per TD phase. It appeared that team members mainly focus on generating ideas and planning activities for setting the shared goal (TD phase 1). To adjust the goal, team members mainly discuss results, generate ideas and plan tasks (TD phase 2). For ending the collaboration, team members now also willl evaluate their learning when discussing the results and monitor their learning process which helps for planning new tasks (TD phase 3). The proposed future research could create a more in-depth understanding of process of interprofessional learning in micro LCs. Ultimately, this will add value to designing a micro LC in which effective interprofessional learning can be encouraged among team members.

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Appendix A – Edge values

Table 3

Edge value calculating the edge significance + edge correlation TD phase 1

Relation activities	Edge value
TL-collaboratively generating ideas – TL-discussing results	0.2425
TL-discussing results – TL-collaboratively generating ideas	0.2593
Self-loop TL-collaboratively generating ideas	0.4743
TR-monitoring - TL-collaboratively generating ideas	0.3415
TL-collaboratively generating ideas – TR-monitoring	0.2205
TL-collaboratively generating ideas – TR-planning	0.9448
TR-planning - TL-collaboratively generating ideas	0.8795
Self-loop TR-planning	0.4245

Table 4

Edge value calculating the edge significance + edge correlation TD phase 2

Relation activities	Edge value
Self-loop TL-seeking/receiving external feedback/input	0.3100
TL-seeking/receiving external feedback/input – TL-experimenting	0.1412
Self-loop TL-experimenting	0.3050
TL-experimenting – TL-discussing results	0.2035
TR-evaluating – TL-discussing results	0.2953
Self-loop TL-discussing results	0.3200
TL-discussing results – TL-seeking/receiving external feedback/input	0.2360
TL-discussing results – TL-collaboratively generating ideas	0.8460
Self-loop TL-collaboratively generating ideas	0.5220
TL-collaboratively generating ideas – TR-planning	0.9050
TR-planning - TL-collaboratively generating ideas	0.9805
TR-planning – TL-discussing results	0.6035
Self-loop TR-planning	0.4055
TR-planning – TL-experimenting	0.2748
TR-planning – TR-evaluating	0.2420
TR-evaluating – TR-monitoring	0.1788
Self-loop TR-monitoring	0.2528
TR-monitoring – TR-planning	0.3500

Table 5

Edge value calculating the edge significance + edge correlation TD phase 3

Relation activities	**Edge value**
TL-seeking/receiving external feedback/input	0.3095
TL-seeking/receiving external feedback/input – TR-evaluating	0.2768
Self-loop TR-evaluating	0.3093
TR-evaluating – TL-discussing results	0.6525
TL-discussing results – TR-evaluating	0.6143
Self-loop TL-discussing results	0.5003
TL-discussing results – TL-collaboratively generating ideas	0.8918
Self-loop TL-collaboratively generating ideas	0.5263
TL-collaboratively generating ideas – TR-planning	0.8495
TR-planning - TL-collaboratively generating ideas	0.8425
Self-loop TR-planning	0.4398
TR-planning – TL-discussing results	0.7848
Self-loop TR-monitoring	0.4055
TR-monitoring – TR-planning	0.6015

Appendix B – Descriptive

Table 6

Frequencies and duration in time of TL-activities and TR-activities in micro LC 2

Micro LC 2	TD phase 1				TD phase 2				TD phase 3			
	n	%	Time	%	*n*	%	Time	%	*n*	%	Time	%
TL-collaboratively generating ideas	-	-	-	-	9	32	89	52	11	32	92	57
TL-seeking/receiving external feedback	-	-	-	-	2	7	6	4	2	6	3	2
TL-experimenting	-	-	-	-	1	4	2	1	-	-	-	-
TL-discussing results	-	-	-	-	4	14	21	12	10	29	39	24
TR-planning	1	100	3	100	9	32	43	25	8	24	16	10
TR-monitoring	-	-	-	-	3	11	10	6	2	6	7	4
TR-evaluating	-	-	-	-	-	-	-	-	1	3	4	2
Total TL-activities	-	-	-	-	16	57	118	69	23	68	134	83
Total TR-activities	1	100	3	100	12	43	53	31	11	32	27	17
Total TLTR-activities	1	100	3	100	28	100	171	100	34	100	161	100

Note. Time is calculated and presented in minutes.

Table 7

Frequencies and duration in time of TL-activities and TR-activities in micro LC 3

Micro LC 3	TD phase 1				TD phase 2				TD phase 3			
	n	%	Time	%	*n*	%	Time	%	*n*	%	Time	%
TL-collaboratively generating ideas	2	40	2	13	28	36	101	52	6	27	30	41
TL-seeking/receiving external feedback	-	-	-	-	-	-	-	-	-	-	-	-
TL-experimenting	-	-	-	-	-	-	-	-	-	-	-	-
TL-discussing results	-	-	-	-	19	25	50	26	6	27	18	24
TR-planning	3	60	13	87	19	25	20	10	5	23	5	7
TR-monitoring	-	-	-	-	8	10	19	10	3	14	7	9
TR-evaluating	-	-	-	-	3	4	5	3	2	9	14	19
Total TL-activities	2	40	2	13	47	61	151	77	12	55	48	65
Total TR-activities	3	60	13	87	30	39	44	23	10	45	26	35
Total TLTR-activities	5	100	15	100	77	100	195	100	22	100	74	100

Note. Time is calculated and presented in minutes.

Table 8

Frequencies and duration in time of TL-activities and TR-activities in micro LC 4

Micro LC 4	TD phase 1				TD phase 2				TD phase 3			
	n	%	Time	%	*n*	%	Time	%	*n*	%	Time	%
TL-collaboratively generating ideas	10	50	96	83	12	35	137	54	11	25	140	52
TL-seeking/receiving external feedback	-	-	-	-	4	12	4	2	9	20	45	17
TL-experimenting	-	-	-	-	-	-	-	-	-	-	-	-
TL-discussing results	1	5	2	2	4	12	75	29	4	9	33	12
TR-planning	8	40	16	14	12	35	28	11	9	20	19	7
TR-monitoring	1	5	1	1	2	6	12	5	9	20	14	5
TR-evaluating	-	-	-	-	-	-	-	-	2	5	16	6
Total TL-activities	11	55	98	85	20	59	216	84	24	55	218	82
Total TR-activities	9	45	17	15	14	41	40	16	20	45	49	18
Total TLTR-activities	20	100	115	100	34	100	256	100	44	100	267	100

Note. Time is calculated and presented in minutes.

Table 9

Frequencies and duration in time of TL-activities and TR-activities in micro LC 6

Micro LC 6	TD phase 1				TD phase 2				TD phase 3			
	n	%	Time	%	*n*	%	Time	%	*n*	%	Time	%
TL-collaboratively generating ideas	2	50	16	70	31	36	292	56	7	21	44	35
TL-seeking/receiving external feedback	-	-	-	-	12	14	116	22	3	9	3	2
TL-experimenting	-	-	-	-	2	2	4	1	-	-	-	-
TL-discussing results	-	-	-	-	12	14	59	11	7	21	22	17
TR-planning	2	50	7	30	22	25	45	9	7	21	20	16
TR-monitoring	-	-	-	-	7	8	5	1	5	15	11	9
TR-evaluating	-	-	-	-	1	1	2	0	4	12	27	21
Total TL-activities	2	50	16	70	57	66	471	90	17	52	69	54
Total TR-activities	2	50	7	30	30	34	52	10	16	48	58	46
Total TLTR-activities	4	100	23	100	87	100	523	100	33	100	127	100

Note. Time is calculated and presented in minutes.

Table 10

Frequencies and duration in time of TL-activities and TR-activities in micro LC 7

Micro LC 7	TD phase 1				TD phase 2				TD phase 3			
	n	%	Time	%	*n*	%	Time	%	*n*	%	Time	%
TL-collaboratively generating ideas	3	38	41	65	17	32	277	68	3	20	74	62
TL-seeking/receiving external feedback	-	-	-	-	8	15	41	10	-	-	-	-
TL-experimenting	-	-	-	-	-	-	-	-	-	-	-	-
TL-discussing results	-	-	-	-	6	11	47	12	4	27	24	20
TR-planning	5	63	22	34	17	32	22	5	4	27	9	7
TR-monitoring	-	-	-	-	5	9	18	4	1	7	4	3
TR-evaluating	-	-	-	-	-	-	-	-	3	20	10	8
Total TL-activities	3	38	41	65	31	58	365	90	7	47	98	81
Total TR-activities	5	63	22	35	22	42	40	10	8	53	23	19
Total TLTR-activities	8	100	63	100	53	100	405	100	15	100	121	100

Note. Time is calculated and presented in minutes.