



Teachers at the zone of proximal development – Collaboration promoting or hindering the development process



Hanna Kuusisaari ^{a, b, *}

协作对于教师在最近发展区中的促进和阻碍作用

^a Department of Teacher Education, University of Helsinki, P.O. Box 8, 00014, Finland

^b Institute of Behavioural Sciences, CRADLE, University of Helsinki, P.O. Box 8, 00014, Finland

HIGHLIGHTS

- Qualitative analysis makes collaborative development visible.
- Trajectories of collaboration differ between differently successful teams.
- Cumulating and accepting of ideas do not develop or create knowledge and practices.
- Accepting as collaborative action in a group level prevents collaborative development.
- Further development of ideas and questioning promote collaborative developing.

本研究着重于协作老师学习在一个支持的在职教育课程教师在创造知识和实践教学。这项研究调查什么类型的活动或多或少支持或阻碍内部协作开发成功的教师团队的小组讨论。研究结果表明,协作支持协作开发由意念,思想的进一步发展和提高的问题。似乎防止过度的协议成功的协作开发。这项研究表明,在对称的对等协作,等于能够创造性的合作通过修改和质疑开发建设的支持和发展过程本身,通过理论知识的应用。

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ABSTRACT

This study focuses on collaborative teacher learning during an in-service education course that supports teachers in creating knowledge and practices for teaching. The study investigates what types of activity support or hinder collaborative development within more-or-less successful teacher teams' group discussions. The findings indicate that collaboration that supports collaborative development consists of ideation, further development of ideas and raising questions. Excessive agreement appears to prevent successful collaborative development. The study suggests that in symmetrical peer-to-peer collaboration, equals are able to support creative collaboration by revising and questioning developed constructions and the developmental process itself, through the application of theoretical knowledge.

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1. Introduction

Maintaining teachers' expertise and good practices are essential for successful education and an international concern (Avalos, 2011). One method that contributes towards that goal is teacher collaboration. Collaboration supports the development of teachers' skills and helps to sustain professional development of teachers in a more across-the-board manner such as facilitating teachers professional growth and development (Day, 1999; Grossman, Wineburg, & Woolwort, 2001; Meirink, Meijer, & Verloop, 2007; Putnam & Borco, 2000). Social support also helps teachers to learn from each other, develop distributed expertise and gives teachers access to a far wider range of ideas than what would have

been possible without collaboration (Fishman & Davis, 2006, p. 542). Teacher collaboration also supports the construction of knowledge (Bereiter, 2002; Day, 1999; Woods, Jefferey, Troman, & Boyle, 1997). However, teachers' opportunities to engage in collaborative learning events are resource-bounded. They rarely have the opportunities to reflect together on their work practices or to review the underlying theoretical knowledge of teaching and learning (Day, 1999, p. 150).

Previous research shows that teams or groups' outcomes or successes in collaboration vary, and collaboration does not always result in innovative teacher learning or generate new knowledge or practices (Kuusisaari, 2010; Meirink, Imants, Meijer, & Verloop, 2010; Tillema & van der Westhuizen, 2006). Collaboration does not necessarily contribute to successful learning of students in 'collaborative groups' in classroom settings (Barron, 2003). Thus, there is much uncertainty with respect to how and when collaborative learning is beneficial.

协作对于教师专业发展非常重要,但教师能够进行专业的合作机会还是很少的。目前的研究显示,合作也不总是能够促进教师的学习,提高教师的实践知识。因此可以说,有诸多因素如如何、何时合作影响这合作学习的有效性。

* Department of Teacher Education, University of Helsinki, P.O. Box 8, 00014, Finland. Tel.: +358 50 4156587.

E-mail address: hanna.kuusisaari@helsinki.fi.

Collaboration as a process of development is an interesting topic for research. The collaborative development process needs to be studied in order to gain more knowledge on how collaboration itself affects more-or-less productive development and how groups collectively bear development in discussion. In this study, I investigate collaborative development processes within three teams of teachers during the actual group discussions. These discussions aimed at the collaborative development of teaching practices. The Vygotskian approach is the theoretical basis of this study, and it emphasizes the importance of collaboration in learning.

Academic teacher education contributes to the excellent and highly reputed sustained results of Finnish students' evaluation in the OECD Programme for International Student Assessment (PISA, 2000, 2003, 2006, 2009, 2012). The Finnish teacher education system relies on research-based education, where all the students graduate as Masters with the scientific abilities for sustaining their professional expertise. However, in Finland and globally, there is a need to develop academic in-service education to sustain teachers' professional development. In-service education of teachers is a necessary part of the teachers' professional development as was highlighted by Day (1999). In-service education and training is a way to bring teachers together and create the social context for collaboration.

In 2005–2006 an academic in-service education course for teachers was implemented in order to help Home Economics teachers to improve their teaching by assisting them to create new knowledge and work practices. The teaching practices and methods in the context of this article entail ways of orchestrating teaching to support and guide students' learning. This includes the learning environment and the role of a teacher in addition to the designed learning task (The Finnish National Board of Education [FNBE], 2004.) The objective of this voluntary course was for participants to respond to the demands of the latest learning theories, constructivism and social-cultural: approaches present in the national curriculum. The curriculum itself is a description of the general goals for teaching and learning; not an exact guide of used practices. Therefore the teachers themselves are responsible for developing and using teaching methods and practices that comply with the latest curriculum. The teachers aimed to integrate these new learning theories into their established practices and insights based on their teaching experience. In this manner participants should have created novel forms of teaching practices through the collaborative process. The focus of this article is to study the process of collaborative development that took place in the abovementioned teachers' group discussions.

This article contributes to the further development of theory in the area of teacher development. Vygotsky's (1978) concept of the zone of proximal development (ZPD) offers a theoretical approach to the research of teacher development in this study. The broad theoretical framework of this research is the use of **ZPD as a tool for understanding the process of collaborative knowledge creation.** According to Vygotsky's (1978, 86) original definition, the ZPD: '... is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers'. This concept is often applied in research that explores facilitated or scaffolded collaboration of children in a classroom setting (Berk & Winsler, 1997; Hedegaard, 2002; Quintana et al. 2004; Wood, Bruner, & Ross, 1976). The focus of interaction research is usually on teacher–student collaboration, in a classroom setting. This research applies Vygotskian ideas to adult learning, namely teacher collaboration, by focusing on the peer-to-peer collaboration of equally capable adults who have the same level of expertise.

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Many researchers within the learning sciences study the role of collaboration in the context of learning by analysing collaborative discourse. Sawyer (2006) argued that the tradition of peer group learning research has hitherto focused on individual outcomes, task structures and incentive structures. However, there have been few studies on the discourse processes in collaborative peer groups and on the features that are associated with the most effective forms of collaboration. Sawyer's (2006) solution is an interaction analysis that identifies specific discourse processes that make collaboration an effective learning environment. **是一个能够交互分析，能够识别使合作有效的特定的话语过程**

When considering the analyses of interaction processes, Sawyer (2006, p. 190) widened the understanding of interaction analysis to refer broadly to all methodologies used to study verbal and non-verbal interactions, including detailed conversation analytical (CA) methods, various coding techniques etc. He only made a distinction between the two extremes of the full range of interaction analysis methods, namely: narrow and broad interaction analyses extremes. The narrow extreme refers to a method that documents the mechanisms whereby learning occurs; transcription detail is CA and qualitative analytical methods are applied. The broad extreme refers to a method able to generalize larger patterns that enable the comparison of data across settings, in which transcription detail is screenplay meaning a word level, and which may combine qualitative and quantitative analytical methods (Sawyer, 2006, p. 200). The methodology adopted in the present study lies somewhere in the middle of these two extremes. **It focuses on peer-to-peer collaboration by presenting data-driven analysis of the content of verbal interaction within teacher groups' discussions.** The present article takes up the challenge of developing both theory and analysis in the area of teacher learning and professional development. **口头互动内容**

2. Collaboration in educational research

2.1. Settings for collaboration in educational research

Collaboration in educational research has been studied in a wide range of settings. The settings for collaboration research vary: between peer-to-peer settings of symmetry and asymmetry; between classroom and work contexts; between children and adults; between the openness of the task and aim of the group.

Collaborative learning, problem solving, and development, have been studied in two different group configurations: symmetrical or asymmetrical arrangements. In the context of this study, asymmetry in collaboration occurs in the following situations: peer-to-peer collaboration where an authoritative figure such as a teacher, or adult or some other figure provides mentoring and is also involved in group discussion or in a shared learning situation that often takes place in the classroom context. In other words, asymmetrical collaboration involves a scaffolded setting that contains different levels of support or facilitation within group. For example, a scaffolded setting occurs when, a facilitator with a higher level of expertise is present and takes part in the discussion or supports finding a solution (e.g. Hmelo-Silver, 2003; Jenlink & Kinnuncan-Welsch, 2001; Orland-Barak, 2006). In contrast, symmetrical peer-to-peer collaboration refers to team-work by which all the group participants work as equals, and their expertise is at the same level. Of course, their expertise need not be similar because individuals' experiences, knowledge and skills do vary (Dillenbourg, 1999, pp. 7–8.). In symmetrical collaboration, there is not a 'more competent' or authoritative facilitator present in the group in contrast to asymmetrical collaboration. Symmetrical peer-to-peer collaboration has been investigated by Barron (2003) in the school context of 6th year students' joint problem-solving and Kumpulainen and Mutanen (1999) among 12-year old students in a

context of solving a mathematically designed task; the context in these was a classroom with a teacher present, but she or he did not facilitate the problem solving.

Peer collaboration in classroom research settings is emphasized in over 20 years of educational research. The results have shown that collaboration improves students' learning (Sawyer, 2006, 2013). In contrast to traditional transmission and acquisition style of teaching, learning sciences research emphasizes such learning in which the teacher works with the students, and provides appropriate scaffolds to groups as they build knowledge together (Sawyer, 2006, p. 187). This kind of facilitated and therefore asymmetrical peer-to-peer classroom collaboration has been researched by Hmelo-Silver among post-secondary level medical students (2003), and Goos, Galbraith, and Renshaw (2002) in small group mathematics problem solving context. In classroom contexts, a teacher is always present and usually facilitates the discussion, even though she or he does not dominate it (Sawyer, 2006, p. 187).

The difference between openness of a task and aim of the peer group varies in collaboration research contexts. In classroom research settings, the aim or task is typically fixed, which implies the (existence of the) desired or 'right' answer such as in science teaching (e.g. Goos et al., 2002). However, a task can be designed so as to require inquiry-based learning, solving design problems or the development of conceptual thinking (Kumpulainen & Mutanen, 1999). In professional work related contexts, the aim of a group is open. In concrete terms this often entails some kind of developmental challenge being set. Examples of this are the studies of peer-to-peer collaboration that focus upon inquiry study groups of teaching professionals producing solutions to work related issues (Tillema & van der Westhuizen, 2006). Another example is the meetings that are set in a context of professional discussions of an in-service project for mentors who aim at collaboratively constructing knowledge on mentoring (Orland-Barak, 2006). In this example, the aim of the collaboration constitutes an open-ended development challenge. The contexts for these studies were provided by professional discussions in adult groups.

Hmelo-Silver (2003) used mixed-methods to study collaborative interactions and Kumpulainen and Mutanen (1999) developed a framework for analysing peer-group interaction. Both of these studies were conducted in the classroom context and were interested in individual level learning and in the group's interaction in addition to the internal discussion in all of its aspects. Moreover, Barron (2003) developed detailed analysis of how micro interacting processes between collaborators influence collective achievements and what individuals learn from their interactions. Although the focus in Barron's research was about the learning of individuals, she found that the quality of interaction between peers was an important factor in the quality and success of learning in 6th grade triads problem-solving discussions.

van Kruiningen's (2013) study demonstrated that common ground is built in an incremental way in a collaborative setting. She found that in a meeting setting four university lecturers built accounts, made assertions and developed new teaching concepts in a goal oriented incremental manner in a series of consecutive turns by means of agreement, alignment, modification, refinement and transformation. Participants made their teaching experiences, thoughts and implicit theories more explicit and transformed them into new or richer collaboratively constructed ideas about the design of a future course. In van Kruiningen's study, the participating teachers had varying educational backgrounds and duties. Their expertise also differed, as two of the participants acted as facilitators. For these reasons, the collaboration was asymmetrical.

In the following section, I sum up the setting and focus in relation the openness of the task, the peer-to-peer setting and the aim of the group. The three teacher teams considered in the present

study were set the open-ended developmental challenge of coming up with new teaching methods and practices by utilizing specific learning theories, namely constructivism and socio-cultural approach. The extent of teachers' expertise was symmetrical (Dillenbourg, 1999, pp. 7–8) in terms of teacher qualifications, the duties of teachers in secondary schools, and they all had the same groundwork in this in-service education course. No facilitators were present during the peer-to-peer group collaborative discussions. There was no pre-set distribution of work during the collaboration. The roles of participating teachers could be adapted when required. The aim of the three teams was to meet the shared developmental challenge by coming up with new practices of teaching; in contrast to that of constructing common ground.

The present article traces what implications the quality of collaboration has for learning and development, and is similar in approach to Barron's (2003) research. Unlike Hmelo-Silver (2003) and Kumpulainen and Mutanen (1999) who studied how individuals create new knowledge or peer-group interaction dynamics or mechanisms of learning and achievements on the individual or collective level, in this study I focused on finding any patterns of collaboration at the group level that support or hinder the development of new teaching practices.

2.2. Products and processes of collaboration

As discussed above, the settings in researching collaboration vary widely. Regardless of these variations, collaboration can be viewed through results or processes. Orland-Barak & Tillema (2006) argued that from a global perspective there appears to be two differing tracks in collaborative enquiry: one that focuses on process and another that focuses on the product. **The process track stresses the dynamics of knowledge, as it changes and evolves, whereas the product track focuses on the implications of collaborative activity for understanding and knowledge building.** Among the already mentioned research articles, Barron's research touched on the process of collaboration. Similarly, the study by Orland-Barak (2006) focused on the process of professional dialogue by analysing the dialogue itself. This present study also clearly took the process track approach as it focuses on the collaborative development in close detail. 因此本文也是过程跟踪

2.3. Individual and collective learning

The crucial foci of Vygotsky's ZPD theory are (1) collaboration between capable peers, (2) fruitful interconnection of theoretical concepts and everyday experience, and (3) meeting the goal of change in a collaborative process. (Kuusisaari, 2010, 2013; 根据ZPD的概念,学习是一种社会过程,学习者可以超越他或她目前的能力 that human action is mediated by tools and signs, mainly that of language (Moll, 1990; Vygotsky, 1978; Wertsch, 1991, p. 19). In his writings on unit of analysis and relation between thought and speech, Vygotsky (1986, pp. 210–217) unites word and thought together appear in word meanings. The use of language as a mediating tool enables one to investigate collaboration.

According to the concept of ZPD, learning is a social process which a learner can go beyond her or his present capabilities using mediation mechanisms. The focus is on the collaborative use of mediational means in order to create and communicate meanings. Vygotsky's sociocultural approach emphasizes that the individual's mental functioning of the individual has social origins, and that human action is mediated by tools and signs, mainly that of language (Moll, 1990; Vygotsky, 1978; Wertsch, 1991, p. 19). In his writings on unit of analysis and relation between thought and speech, Vygotsky (1986, pp. 210–217) unites word and thought together appear in word meanings. The use of language as a mediating tool enables one to investigate collaboration.

Collaborative learning does not entail learning through social interaction alone; instead it involves collective learning whereby the group as a whole strives towards the shared aim. Simons and Ruiters (2001, pp. 14–15) make a clear distinction between learning through the medium of social interactions with and from

other individuals, and collective learning whereby all the members of a group consciously strive in unison for common learning or common outcomes. They prefer to use the term ‘collective learning’ by which the intended outcomes are collective, and they cautiously suggest that the processes of learning might also be collective.

In a language teaching setting, Oxford (1997) offered the following distinctions among three strands of communication in a team or a group: interaction, cooperative learning, and collaborative learning. According to Oxford, ‘collaborative learning’ has taken on the connotation of social constructivism, which holds that learning is the acculturation into knowledge communities. ‘Collaborative learning’ views learning as the construction of knowledge within a social context in which a learner engages with ‘more capable others’ (Oxford, 1997, pp. 443–444). This idea of capable others originates from Vygotsky’s (1978) work on ZPD. Vygotsky recognized that ideas have social origins: ‘they are constructed through communicating with others’ (Oxford, 1997, p. 448).

Educational researchers that have used interaction analysis to study collaboration have focused on different aspects of conversation that contribute to learning. Nevertheless, Sawyer (2006, 2013) reported the existence of a consensus between different traditions; specifically that interaction is the mediating mechanism whereby collaboration contributes to learning. Researchers who work within a Vygotskian or sociocultural framework emphasize how participants build upon each other’s ideas to jointly construct a new understanding. The consensus of opinions of the researchers is that, knowledge is co-constructed in social settings (Sawyer, 2006, pp. 190–191, 2013, p. 128). Collaboration is often explored in relation to individual learning. In contrast to this, the theory and data-driven analysis presented in the present article are based on a Vygotskian approach. I therefore introduce my own illustrations of micro level interaction analysis of collaboration. The focus is on analysing collaboration that supports development at a group level within professional discussions of teachers. In the previous phase of this study entity based on the Vygotskian theory, I studied this same in-service education course with an aim to find out how theoretical knowledge and practical experience were interconnected within the teacher teams’ processes of collaborative knowledge creation (Kuusisaari, 2010, 2013). The present study focuses on the collaboration of the same groups by analysing teachers’ professional group discussion in order to discover what elements support or hinder creative development in a group discussion setting. 在教师的讨论中促进或阻碍创造性发展的元素

2.4. The aim of the study

旧知识到新知识的达到过程存在差别

In analysing the interconnections of the new knowledge and previous practices in the teacher teams’ innovative knowledge creating process (Kuusisaari, 2010, 2013), I discovered that there were differences between the groups in achieving this goal. Therefore, in this research I ask whether the reason for the differences between the teacher teams’ success lie in the quality of interaction during group discussion. I analysed the interaction of the same groups in an attempt to find out if there are some aspects in collaboration that support or hinder the development of new knowledge and practices.

3. Methods

The data of this article consist of videotaped and transcribed record from group discussions of three teacher teams denoted A, B and C, during the first 2-day meeting of an in-service education course. The teacher participants of this course had originally

organized themselves into six groups on an entirely voluntary basis. The three groups were selected from the original six groups using the criterion of the varying levels of their success in combining learning theories and practical experience by creating novel knowledge and practices. The in-service education course consisted of four working meetings during an interval of one year in the 2005–2006 period. These four meetings comprised three 2-day and one 1-day meeting. Working methods for the implemented course as a whole were lectures, independent learning, group work and discussions and developmental tasks between meetings. The teachers participated in the course on a voluntarily basis. The aim of this course, as presented to the applicants, was to develop teaching on the basis of learning theories. The specific group task given to teachers during the first meeting was to create new experimental ideas and develop new teaching methods and practices based on learning theories reflected in the 2004 curriculum.

Team A consisted of four participants; team B had two participants and team C, three participants. The durations of these group discussions were 1 h 10 min (Team A), 1 h 5 min (Team B) and 1 h 3 min (Team C), respectively. All of the teachers in these selected groups were women; they had Masters-level education with a major or minor in Education, which gave them the basis to understand new theoretical concepts. They all worked as secondary school teachers in the subject of Home Economics. Their respective ages and years of work experience varied but such background information on the participants was not collected because the individual learning or development as such fell outside the scope of this study.

These data are the same that were used in my previous studies (Kuusisaari, 2010, 2013) in which the success of the groups were evaluated in terms of the interconnections of new theoretical concepts and practical experiences of developing new teaching practices. The criterion for success was that participants were able to create new knowledge and work practices by integrating new theoretical knowledge and practical experience, thus achieving progress in the ZPD (Kuusisaari, 2010). The results of the previous article were used as the basis for analysis in this present article, therefore I will give a short summary of previous analysis and findings.

The following brief descriptions of the teams show the differences between the three teams’ processes of collaborative knowledge creation as partly reported previously (Kuusisaari, 2010). I have attached a descriptive label identified by letter to each team in order to follow the analysis of the research more easily. **Team A’s** approach may be summarized as **experience-based**. They uncritically used their existing, mainly behaviouristic teaching practices as the basis for trying to develop their teaching and did not manage to create any new innovative practices in their teaching work. They constructed a teaching theme unit related to a berry trip based on their existing practices. **Team B** used a **theory-based** approach that reflected on their existing practices. However, team B rejected these practices then reflected upon theoretical knowledge from learning theories and used this knowledge as the basis for developing their teaching: thus they successfully created new teaching methods. They created problem-based real life laundry problems for students to explore in a cooperative classroom setting. **Team C** had **no-new-practices** and failed to create any new teaching methods, even on the basis of their existing practices. They only concentrated on ideating the contents of their teaching. For instance, they discussed the importance of the purchasing and the cleaning of kitchen utensils in Home Economics education, but excluded teaching methods. Thus, team C was unsuccessful in connecting learning theories to the development of new teaching practices.

In summary, the three teacher teams' collaborative processes resulted in different degrees of success in the development of new knowledge and work practices. Team B was the most successful in terms of the aims assigned to the groups. Teams A and C were less successful (unsuccessful in relation to the criteria) but they differed from each other as described above.

3.1. Data of the present study

In my previous research (Kuusisaari, 2010, 2013), the transcribed group discussion data were divided into *episodes of topic talk* by data driven systematic qualitative analysis of the contents of the discussion episodes. An episode of topic talk is a unit for which the topic of discussion stays the same as described by Rainio (2003, p. 82). During further data driven analysis of episodes of topic talk, I found and defined six 'meaning types' according to the content of discussion created in the process, namely: developing talk, procedure talk, experience talk, teaching experiment talk, learning theory talk and other talk.

In this present study I also analysed the content of discussions of the three groups, but from different points of view. The focus of the present paper is to explore the quality of collaboration within each of the three teacher teams. The quality of interaction conducive to learning must be defined in context, as pointed out by Kumpulainen and Mutanen (1999) in their study of peer-group interaction. Those authors argued that the need for situational definitions also apply to the development of analytical categories that aim at describing the specific social activity under investigation.

The analysis of the teams' collaborative discussions in this study focused on those episodes of topic talk that were defined in previous research as either **developing talk** or **procedure talk** because these episodes dealt with innovative actions. 'Developing talk includes all talk that develops teaching and aims to develop something new connected to teaching. Developing talk involves collaborative considerations, constructions and solution findings' (Kuusisaari, 2013, p. 56). 'Procedure talk is the talk in which group participants discuss practical things concerning how to organize the group work on a practical level, meaning working orders or rules of procedure. ... [During procedure talk,] participants revise the given task instructions, talk about the working schedule and participants' distribution of work' (Kuusisaari, 2013, p. 55).

3.2. Qualitative content analysis

3.2.1. Collaborative actions of development in teacher teams' discussion

In order to find out the possible differences between the teacher teams' developmental interaction, and to discover if the quality of group interaction affect teacher teams' success, I concentrated on analysing what kind of elements construct the content of collaborative development.

First, I reorganized the data in order to study how the teacher groups' collaboration enables the development of teaching practices. I coded (Chi, 1997; Saldaña, 2009, pp. 7–8) the developing talk and procedure talk episodes into *turn chains*, or in other words, *passages* of turns by building data driven systematic qualitative content analysis (e.g. Chi, 1997; Saldaña, 2009, pp. 7–8) with a discursive approach and by carefully re-reading the data. A passage expands as far as the prevailing content of collaborative development proceeds. The next phase or passage begins when the content of the collaborative development changes.

Next, I constructed seven categories of collaborative actions of development based on the content of the verbal data by analysing the passages. The categorization (Saldaña, 2009, pp. 7–8) was

made by analysing how the development of teaching practices was supported in the turn taking chain in relation to the content of the previous passage. This categorization showed how effectively the discussion achieved (or did not achieve) the development process. These analytical choices allowed the focus of analysis to stay specifically on the collective actions at group level, instead of any individual actions taken during collaboration. Therefore, these collaborative actions of development were later referred collectively as 'collaborative actions'.

The seven categories constructed from the collaborative action passages in group discussion are: 1) presenting an idea, 2) accepting the idea 3) developing the idea further, 4) questioning, 5) ignoring, 6) suppressing of development, and 7) reifying. These defined categories correspond with previous passage(s). Table 1 presents definitions of the categories and gives data examples.

Categorization of collaborative actions gave only a general overview of different types of actions that took place during the innovative working processes. I determined which of them were supporting or hindering innovative development by counting the number of collaborative actions in each group alongside team's success (see pp. 15–16). However, this type of description is too general and does not alone indicate the interconnections or sequences of different actions that might be meaningful in an innovative process.

Therefore, I analysed the sequential pairs of collaborative actions that indicate what types of collaborative action leads to what type of resulting outcomes. In this way I tried to find out what type of combinations of actions are fruitful or unfruitful in innovative interaction. The results of the analysis of the frequencies and sequential pairs of collaborative action categories are combined in Table 2 in the following section.

This kind of description also resulted in rather fragmented views of groups' actions, however. Consequently, I conducted even more detailed analysis by constructing and comparing chronological paths, trajectories, between different collaborative actions. I attempted to determine the elements of interaction that supported or hindered innovative development by comparing different groups according to the previously described methods of analysing collaborative actions. The results of the analysis of the teacher teams' trajectories of developing collaboration are presented in the following section.

4. Results

I compared the differences of collaborative actions between the teams to explain what types of collaboration supports or hinders innovative development. First, I present the results of the analysis of the frequencies of collaborative action categories in Section 4.1.1. Second, the sequential pairs of collaborative action categories analysis data are described in Section 4.1.2. The results of the both analyses are combined in Table 2, thereby giving an overview of developing collaboration through collaborative actions. Third, I present the results of the analysis of the teacher teams' trajectories of developing collaboration, in Section 4.2 (Fig. 1).

4.1. Differences between the teacher teams' collaborative actions

4.1.1. Frequencies of collaborative action categories

In the following, I will highlight the most significant results of the three teacher teams. I compared the total numbers of various collaborative action categories between the teacher teams, which presented in the lowest row of Table 2.

Table 1
Definitions of collaborative actions of development.

Collaborative action	Descriptions	Data examples ^{a,b}
Presenting an idea 呈现观点	Presenting ideas, developing initiatives.	Example of 'Presenting an idea' passage (Team B) Sheila: Well, could it be a project? Could we do a project about laundry affairs? [Contemplating] And what would it look like if it was a project? Then it would be partially contextual. ^c Ann: But look, here is learning by doing [Looks and points to a table of learning theories] Yeah so. Sheila: What are you looking at?
Accepting the idea 接受观点	Complying with the presented initiatives (agreeing, often by echoing or listing thoughts, participants).	Example of 'Accepting an idea' passage (Team B) Sheila: PAKCage Ann: Package Sheila: A Laundry [teaching] package Ann: (smiling) A Laundry package Excerpt from 'Accepting the idea' passage (Team C) Sadie: There comes the experimental ... there comes the same as the previous presenter [said]. Phoebe: Yes, experiments. Through ... there we could put the time ... product or something like this.
Developing the idea further (Revision of idea) 进一步发展观点	Developing the (accepted) ideas further, initiating developing inside the presented ideas.	Excerpt from 'Developing the idea further' passage (Team B) Ann: For this. I was thinking if we could start somehow in a problem-based way? Bring some really felted and languished sweater. How it has been washed wrongly. Sheila: Well I have some examples of those. Ann: Then, is the basis of [learning of] washing tags what's in it [in/happened to a sweater] Sheila: So what has happened to it? The problem is at first, the sweater looks like this.
Questioning 质疑	Challenging the ideas or the development of ideas or the group work in general through learning theory knowledge or through one's teaching experience, or by inquiring into one's own everyday teaching practices, or theories as such.	Example of 'Questioning' –passage (from theory) (Team A) <i>Notice following Ignoring – passage of the same team discussion below</i> Johanna: Yes, I am thinking that ... it's also, where the contextual was ... it reads in somewhere, that learning by doing is highlighted in it. Jane: Yes, it does come from that too. Planning through materials is stressed in it. Johanna: Aren't both of these [constructivism & contextuality] kind of this ... ?
Ignoring 忽略	Making discreet inquiries or disagreements; topic change initiatives. Ignoring may be temporary and does not typically end the developing of an idea.	Example of Ignoring –passage (Team A) <i>Notice above preceding Questioning passage of Team A</i> Tina: Are you now on the berry trip [that we] talked about before? You were still talking about a packed lunch [for the berry trip]. Yes. I put in for it. Johanna: Well yeah, so what? How then?
Suppressing the development 压制观点的发展	Ending the development of an idea, at least for a while. The subsequent development of previously stalled ideas may reoccur in later passages.	Example of 'Suppressing the development' –passage (Team C) Sadie: Well, it is of course household appliance maintenance ... if we think that, it's like that ... hmmm. Nina: A little detached from this. Phoebe: Yes, it just looked that they don't fit with this.
Reifying 具体化	Concretizing the ideas or a developed teaching method, looking them through by defining, revising and (writing).	Nina: It doesn't help if you put them here. Pre-tasks ... basic purchases ... Excerpt from 'Reifying' –passage (Team B) Ann: What did you say in this part? (points on the paper) Sheila: Problem, what are the causes. So yes. How should I put [say] it nicely? How should I have acted? How to act correctly [in order to solve the laundry problem]? Ann: How do I act correctly? Sheila: Yeah. How could it be even better? How do I do the right thing? Then come these demonstrations.

^a Data examples are translated from Finnish into English. The names of the teachers in displayed citations are changed.

^b Analysis and categorization of collaborative actions of development was conducted in relation to the content of the previous turn taking chain. Data examples in the Table 1 are separate and therefore do not give a complete description of collaborative action categories.

^c In Finnish, among teachers' group discussion, the concepts: of contextual or contextuality, refer to a sociocultural approach and have been adopted from a lecture during which these concepts were used by the professor in her lectures on the socio-cultural approach on learning.

Regarding *collaborative action* categories data, it is remarkable that the most successful theory based team, team B, had only just a few actions of *presenting an idea* or *accepting the idea* (6, 1) compared to other groups (A 14, 13, C 18, 10). The total numbers of *developing the idea further* categories, revealed that the lowest value of this collaborative action occurred within the 'no-new-practices team', team C. Teams A and B had considerably more activity for *developing an idea further* (A: 11 and B: 12). For the *questioning* action teams A and B had a few more activity actions than team C (A: 5, B: 5, and C: 3). Team A, stood out with respect to exploring

ignoring actions; it had seven actions of *ignoring*, whereas teams B and C had only two and three actions, respectively.

Similarly, regarding the *suppressing the development* actions, both team A and team C had a large number of actions (A: 12; and C: 11) of this collaborative action category, whereas team B stood out by not utilising the *suppressing* action at all. Both teams A and B had three actions of *reifying*, whereas Team C had none.

This gives quite a surprising picture of the work of successful team B. It did not have very many ideas, but the ideas the team presented were neither accepted nor rejected quickly. Instead by

Table 2Frequencies of sequential pairs of collaborative actions – what leads to what (Team A: $n = 64 + 1$, team B: $n = 29 + 1$, team C: $n = 47 + 1$).

	Presenting an idea			Accepting the idea			Developing the idea further			Questioning			Ignoring			Suppressing the development			Reifying			
	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	
Presenting an idea	1	1		7	1	10	1	3	1	1	1		2		1	3		5				
Accepting the idea	2		3				6	1	2			1				5		4				
Developing the idea further	3	2	1	6					3	1	4	1		2	1	1					2	
Questioning	1	2							2					4	1	1		2				
Ignoring			3				2	1								2			2	1		
Suppressing the development	6		9				2			2	1										1	
Reifying	1	1						2		1			1									
Total	13	6	17	13	1	10	11	12	3	5	5	3	7	2	3	12	0	11	3	3	0	

questioning and developing an idea further the collaborative actions led to the reification of a few ideas that were presented.

The less successful, team C presented many ideas but they were accepted or ignored and were not developed further to end up as new teaching practices. Team A is somewhere in between these two teams by having more *further developing* and *questioning* than team C, but also more *accepting*, *ignoring* and *suppressing* actions than Team B. How is it possible that accepted ideas did not lead to the concretization of ideas? In order to answer this, we must look at the sequences and trajectories of the collaborative actions.

4.1.2. Frequencies of sequential pairs of 'collaborative actions'

I proceeded with the analysis of developing collaboration by looking at the sequential pairs of collaborative actions. In the following, I present the most significant results of the analysis. A 'sequential pair' refers to two adjacent collaborative action categories that shows which particular collaborative action leads to the subsequent and consequent collaborative action. The results for the analysis of frequencies of sequential pairs of collaborative action categories are shown in Table 2.

The tabulation of sequential pairs shows how many times a certain collaborative action category leads to another category. In Table 2, the frequencies of team A's data are shown in the left hand column ($n = 64 + 1$), team B data are in the middle column ($n = 29 + 1$), and team C data are in the right hand column ($n = 47 + 1$). The starting passages are not countable in the sense of frequencies of sequential pairs, because they do not have any preceding passage that leads to them. The table should be read from left to right, and row by a row. For example, presenting an idea leads to accepting the idea seven times for team A, once for team B and 10 times for team C.

First, I shall focus on team A: the collaborative action passages of *presenting an idea* usually led to *accepting the idea* (7). *Accepting the idea* actions led (6) to *developing the idea further*, but surprisingly *developing the idea further* usually led to *accepting* actions (6). *Questioning* most often (4) led to *ignoring*. When looking at which categories led to *suppressing the development*, Table 2 shows that apart from the *suppressing the development* category itself and *ignoring* category, all other categories led to *suppressing* actions. Consequently, *presenting an idea*, *accepting*, *developing ideas further* or also *questioning*, can lead to a *suppressing* action. It seems that there is a kind of dominant suppressing force in this group regardless of what is presented before. Team A seemed to 'sparkle as a firework' but in the end 'nothing really lit' as no new ideas came to fruition.

For team B it was notable that several categories led to *developing the idea further* (12). One can also see that *developing the idea*

further and *questioning* seemed to feed upon each other as *developing the idea further* actions led to *questioning* on four occasions and to *questioning*, whereas *questioning* reciprocally led to *further developing* on two occasions. Team B did not implement *suppressing the development* actions at all. It appears that an innovative process was based on the use of an idea presented by questioning and subsequently revising, not ignoring or suppressing it.

For team C, it is intriguing that there was a large number of *accepting the idea* category actions (10) following *presenting an idea*. It is also interesting to note that there was a large number of *presenting an idea* actions that led to *suppressing the development* actions (5). Almost every category of collaborative action can lead to *presenting a completely new idea*, especially after *suppressing the development* (9). Thus, there is large number of actions that belong to the *presenting an idea* category as a whole. Team C did not have any actions in the *reifying* category whatsoever. It seems that, in this group many ideas were actually presented by individual participants but these ideas were not supported by the other members of the team. Even when an idea was accepted it was not developed further: instead another new idea was presented. This is like a brainstorming situation whereby all participants throw in their ideas but then these ideas are not developed further for some reason.

Next, follows an interpretation of the results of collaborative action analysis. Looking at the collaboration of team B, which was already known to be successful; after *presenting an idea* actions came varying kinds of collaborative actions, mostly *further developing of an idea* actions. By contrast, sequential pairs of collaborative actions of the less successful teams A and C were constructed of repetitious *presenting an idea* and *accepting it* actions, and then *suppressing the development* action that again led to *presenting an idea*. Team A seemed to have the development-supporting elements of team B. Team A also had *developing the idea further* and *questioning* actions, and *reifying* actions, which team C lacked. However, the hindering and preventing elements and also a large number of *ignoring* and *suppressing the development* actions for team A differentiate that team's collaborative actions from those of team B. Analysis of team C's collaborative actions shows a 'bouncing effect' of the collaborative developing process in that almost any collaborative action can lead to presenting new ideas.

Taking the Vygotskian view that learning and change have social origins, the collaborative actions of team B that support development seem to be based on the mutual constructing upon participants' development discussions as being the most noteworthy in the analysis. This can be made apparent when the *developing ideas further* and *questioning* actions led to each other (Dev.f. to Q 4 times, Dev.f. to Dev.f. 3 times, and Q to Dev.f. 2 times).

4.2. Trajectories of collaborative actions within collaboration

Apart from studying the frequencies of sequential pairs, I focused on tracing longer trajectories of collaborative development. The trajectories illustrate how collaborative actions proceed in a teacher team's collaborative development process. The trajectories are presented in Fig. 1.

In Fig. 1, three points are relevant. (1) The number of rows shows the number of actions. (2) One can follow the different groups by following the different shapes and colours (in the web version). In the trajectory, collaborative actions in team A are denoted by circles, those in team B are indicated by squares, and in team C by stars. (3) One can follow the lines that show the movement between the actions within each team.

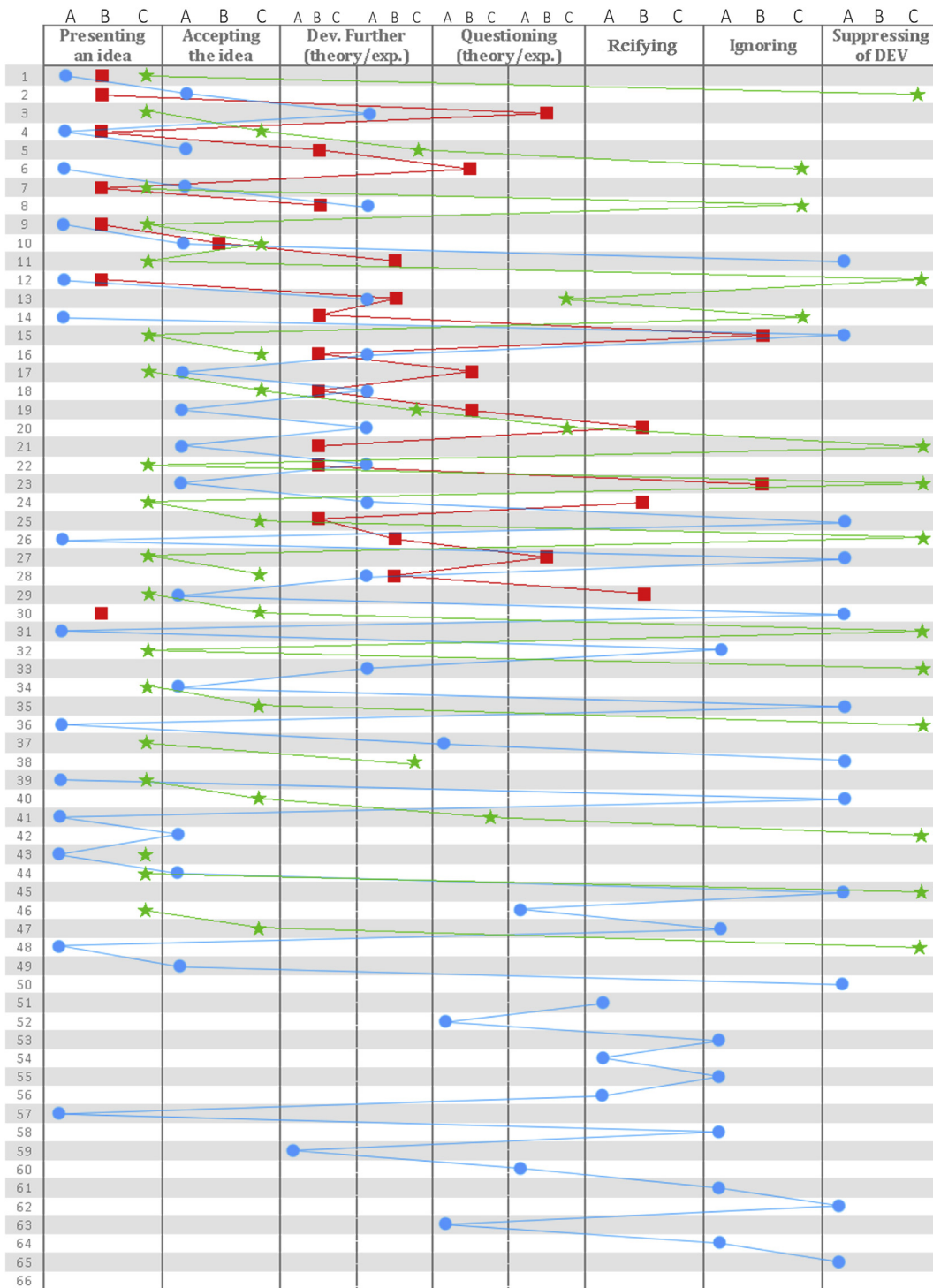


Fig. 1. Trajectories of three teacher teams' developing collaboration.

Each team's actions was respectively connected by a line in order to create trajectories. A collaborative actions mark without a line coming into it signifies the beginning of a collaborative action. For instance, in a team's discussion, there have been topic talk episodes other than those of developing talk or procedure talk between the collaborative actions (see Chapter 2.1). In the trajectories, inside the categories of *developing further* and *questioning*, there is separation between whether the developing or questioning arises from leaning theories or experiences enunciated in participants' developing talk.

The experience based **team A's** trajectory (blue (in the web version)) shows that, in the beginning of developing talk episodes, the interaction consisted of presenting ideas, accepting them and then developing them further. What follows is intriguing: there is a phase(s) (see numbered lines 12–24 in Fig. 1.) during which developing seems cumulative and focused on *developing* ideating further as *developing interaction* actions that alternate between *developing further* and *accepting the ideas*. However, it is noticeable that there were no *questioning* actions in these phases that were directly connected to *developing the ideas further* actions. Later the *presenting an idea* ended with *suppressing the development* on several occasions. The collaborative actions that occurred at the end of the discussion support *reifying*, and thereby a few *presenting an idea* actions and *developing further* actions appear. It is of interest that the *questioning* actions mostly led (4/5) directly to *ignoring* actions. It looks like the team did not have the ability to develop the ideas further through the *questioning* action.

When we look at the *developing* work within the successful theory-based team of **team B** (Fig. 1), we are interested in how team B succeeded in creating new teaching practices. The trajectory (red (in the web version)) shows how collaborative actions at the beginning of the discussion carried forward the creation of ideas. Then, the collaborative actions alternated between the actions of *developing the ideas further* and actions of *questioning*. *Further developed* and *questioned* developing led to *reifying* what was developed. Both developing and questioning developed constructions and the process of development itself through theoretical knowledge. This analysis strengthens the picture that was already seen in the sequential pair comparisons.

The trajectory (green (in the web version)) of **team C** (Fig. 1) looks even more different from the others. In general, it looks like collaborative actions shuttle back and forth from *presenting an idea* via *accepting an idea* to *suppressing the development*. The collaboration was characterised by the continuous throwing around of ideas followed by the *acceptance of ideas* as they already were. Alternatively, collaboration was achieved by *ignoring* those ideas by presenting new ideas or suppressing the development, usually by starting to talk about something else such as their own experiences. There were only a few actions of *developing the ideas further* or *questioning* anything for team C's discussion.

4.3. Aspects in collaboration supporting or hindering successful collaborative development

Comparison of teams' trajectories reveals aspects in collaboration that support or hinder the development of new knowledge and practices. In general, the trajectories of both the experience-based team, team A and the theory-based team, team B look quite similar. Both of these teams' developing interaction started with the creation of ideas followed by the further development of those ideas. Despite their similarities, there were still considerable differences to be found between those two teams' development interactions. Team C's trajectory deviates from those of the other two teams.

When trajectories (Fig. 1) of the successful team B's (squares, red lines (in the web version)) were compared, the collaborative

actions led to *further developing* ideas. Ideas and theories are *questioned* but the developing did not stall because of that. Instead, *questioning* seems to feed the developing process. If the team ended up at an *ignoring* action, this still did not affect the further development of ideas. This collaboration consisted of focused and structured collaborative action passages towards developing teaching practices.

In team A's collaboration (circles, blue lines (in the web version)), the *collaborative actions* led to *presenting ideas* and *developing them further*. Then, the further development of ideas was *accepted* but not *questioned* during the *developing*. This pattern of accepting further development along with a pattern of *accepting* ideas that was followed by *suppressing* the *developing* actions, distinguishes team A's developing interactions from those of team B. Accepting an idea during a further development phase did not seem to serve connecting theory knowledge in the *developing* action. I hypothesize that this phenomenon was because questioning did not occur. The problem of team A's *developing collaboration* action is that it was mediated by interaction in which *further developing of an idea* led to *accepting*, instead of continuing to *further developing* or *questioning* of what was being developed or the process of development itself. Furthermore, all of the *developing the idea further* actions in team A, arose from collaborators' experiences. All these characteristics did not appear to be a very successful pattern for developing collaboration, although it seems to be reasonably good for the interactions of development. This appears to be the reason why this group did not create anything new. By this kind of development collaboration, a coherent teaching theme unit could be constructed, but such a unit would not consist of newly created novel teaching methods and practices. In summary, I hypothesize that the outcome of this kind of development pattern only leads to the type of teaching that repeats earlier experiences.

Collaboration in team C is depicted by stars, green lines (in the web version) (in Fig. 1), it shows that ideas were created and the trajectory displays a pattern of accepting ideas as they are or of suppressing the developing interaction, that lead to *presenting a new idea*. Collaborative actions by team C did not lead to the *further development* of ideas. Hence the team did not have anything *further developed*, and therefore there is nothing to be *reified*. This kind of collaborative development pattern does not support development, and it also seems to be the reason that renders it impossible to connect theory knowledge (learning theories) with development itself. Therefore, it is impossible to create new teaching methods under such a pattern. It seems that instead of the aim of developing new teaching methods and practices, team C had collaboratively created a cover aim for their development process. An example, of the cover aim could be the aim of creating content ideas. Furthermore, it seems that team C did not organize the development of ideas further from the idea stage.

When exploring the trajectories between the collaborative actions between lines 12–26 of team A and team B (Fig. 1), there is a similar kind of density of focusing on developing ideas further. Both these teams had an accumulation of the *developing an idea further* actions. It is of interest that when investigating in greater detail whether the *developing an idea further* and *questioning*, which arose from learning theories or teachers experience that team B's actions appeared to arise both from learning theories and experience. For instance, *developing an idea further* occurred six times from theory and two times from experience, and *questioning* arose two times from theory (see Fig. 1). Furthermore, team B's collaboration as depicted between lines 12–26 developed further alternates mostly between *questioning* and *reifying* actions. In contrast to this, all the *developing an idea further* actions in team A's collaboration, (between lines 12–26 in the Fig. 1), arose from experience (6) only. It is

of interest that the *questioning* activity was lacking during this dense phase of further development, whereas the *developing an idea further* actions mainly alternated with *accepting* actions (4). This describes the willingness to show mutual agreement towards revised ideas rather than to continue developing or questioning the ideas for the development to proceed further.

In conclusion, the findings indicate that collaboration that serves the further development of defined ideas and the associated questioning together with reifying can make such collaboration fruitful and supports the successful development process. Surprisingly, the acceptance of ideas too readily inhibits or even completely prevents development. The continuous proposing of ideas, followed relatively quickly by acceptance of those ideas as they are, did not seem to serve development. Both accepting an idea too quickly and suppressing of a development led to the discontinuation and the bouncing to developing collaboration.

The interpretation of the collaboration as depicted by the three teacher teams' trajectories, the overlapping quality types of developmental collaboration appeared to be as follows:

- 1) *brainstorming action* produced ideas (such as team C), *team spirit type of action*, where all group participants were in agreement without questioning or challenging actions (prevalent in teams A and C) and
- 2) *creative action*, where ideas were revised and questioned and the resulting new knowledge and practices could be created (relevant to team B)

The brainstorming kind of group action whereby ideas are accepted but not accumulated is not a fruitful way of developing or creating new knowledge and practices, especially in relation to theoretical knowledge. Participants' excessive acquiescence towards consensus manifests in the all too ready acceptance, and hinders or even prevents development.

5. Conclusions and discussion

Various investigations, using different approaches and research frameworks have proved collaborative learning to be effective in many kinds of settings and contexts (Grossman et al., 2001; Sawyer, 2006, 2013). This study contributes to the knowledge of what types of collaborative actions support or hinder the process of collaborative knowledge creation for the development of new knowledge and practices in the context of teacher learning. Furthermore, this study suggests certain directions that may help teacher educators and teachers' in-service designers in addition to the teachers themselves to proceed with and foster productive collaborative process for developing teaching. The concept of ZPD in the Vygotskian approach particularly emphasizes *collaboration as a mediating tool*. It led the inspection to the group level, and offered a theoretical framework for an understanding of the collaborative development in the context of teacher learning.

The results of this study are consistent with those of Barron's (2003) study which also found that *the more successful teams actually discussed the proposals, whereas less successful teams tended to reject or ignore the proposals*. In that author study of 6th grade pupils took place in a classroom setting, where the more successful groups responded by accepting or discussing the correct proposals. Contrary to Barron's findings on an individual's proposals and the responses of others, the acceptance of collaborative action at a group level in this present study resulted in the hindrance or the prevention of progress. However, in Barron's (2003) study *the connection of proposals to prior discussions was an indicator of success*. This was also evident in the

successful developmental collaboration seen in team B of the present study.

Tillema and van der Westhuizen (2006) pointed out that a commitment to collaborate is required in order to achieve productivity in knowledge creation. According to the findings of this study collaboration that supports development consists of a trajectory of ideation and development. This trajectory further indicates support for some of the ideas and the questioning of those ideas presented, or simply the further development of ideas themselves. Listening to what others say and discussing and questioning about ideas and raised topics seem to lead to further development and to the creation of new knowledge.

In contrast, *excessive agreement during the process of collaborative development appeared to hinder, or even prevent collaborative action, and also suppress development of new teaching practices*. Tillema and van der Westhuizen (2006) have argued that *when constructing knowledge, it is important to question one's present conceptions*. Teachers must challenge their own earlier experience and conceptions on learning (theories). These conceptions occur when made explicit by sharing them in social situations. The findings of this study show that *merely accepting the presented ideas as collaborative group action, parallels the action of leaving one's conceptions non-explicated*.

Pursuit towards a quick acceptance of ideas or willingness to agreement might have cultural dependence. It would be interesting to know how typical is it to embody agreeing, disagreeing or questioning to interaction during teachers' team work in different cultural contexts. Teachers, however, share the same profession with challenges regarding learning, teaching and professional development. There is similarity in the process of becoming of a teacher and development of a teacher in different context although having different manifestations in various countries (Avalos, 2011).

When one considers the symmetry or asymmetry of collaboration in the light of these results, there are different possible accounts of benefits and disadvantages of both. According to the original ZPD theory, a more capable adult or a teacher supports and challenges a child to progress in the ZPD. In the context of adults, specifically professional learning contexts, peers should challenge each other in order to support collaboration to succeed in the learning for progressing in ZPD. The theory-based team (team B) showed that *among equally capable team participants (symmetrical collaboration setting) there is the ability to create collaborative development sessions that support learning and creation of new teaching methods and practices*. Participants involved in symmetrical collaboration should be able to understand the theory behind the development challenge, in line with Vygotsky's theory. This understanding will give them the basis to challenge and question the ideas during the further development. Of course, one can always question whether team participants have equal capabilities even though they would have same level expertise. Differences between the studied teams suggest that the quality of collaborative actions in the development process have an influence on how successful the development is (the product of collaboration).

According to the results of the successful team (team B) new knowledge should be explored by the participants themselves in order to apply new theoretical knowledge to the development of teaching. *This was executed through ideating, developing the ideas further and by questioning, while utilizing learning theory perspectives*. Thus, a successful collaborative development process was constructed. Symmetrical collaboration leaves participants to set their own course of action. This study indicates that *in a symmetrical peer-to-peer collaboration setting, equals are able to support and carry out meaningful and creative collaborative development by revising presented ideas and questioning the developed constructions*.

In contrast, the results of collaboration of the less successful teams showed that a team's methods of working in organized collaboration could be one reason why the development process was less successful. This leads one to consider what would have helped these particular teams to improve their respective collaborative development.

If symmetrical, focused collaboration had been facilitated, then that facilitator may have distracted the team's creative action, or led the team towards collaborative actions of a less desirable kind. However, we can also ask, would the less successful teams have benefited from specific guidance? A specific guidance, in my opinion and also from my experience, might actually improve the quality of collaboration within the less successful teams. The guidance I mean involves intervening only when the process seems to end-up merely in brainstorming, or when the team-spirit results in too much agreement, or when the interaction turns merely into presenting ideas. If participants are not able or willing to question and challenge the development or are not able to revise the ideas in order to develop them further, then a guiding facilitator could advise and support these kinds of action. However, it must be borne in mind that in real life, peer-to-peer collaboration situations that aim at development such as in teachers' workplaces, facilitators of this kind are not always available. Therefore, the eventual goal of teachers and other professionals should be to be able to collaborate successfully without a facilitator.

Another reason why teams A and C were less successful at the development of new teaching practices could lie in the actual objective given to the group discussion. The aim of developing new knowledge and teaching practices might have been too difficult or non-motivating for teams A and C, but I was not able to confirm or investigate such a speculation in the present study. Tillema and van der Westhuizen (2006) argued that by participating in knowledge construction, a learner gains the motivation to learn through self-regulation so that she or he takes responsibility of attaining the set goals. In this study the teachers had enough professional motivation to enter the course voluntarily but simultaneously we can ask whether all the teams had sufficient professional or perhaps inner personal motivation to partake in the creation of new and shared knowledge. It would be crucial for the optimum creation of knowledge and practices that teachers attend the in-service courses in order to manage their own learning by themselves, rather than being managed.

Teacher learning, whether in a pre- or in-service education setting, benefits from arranging the contexts for the collaborative knowledge creation processes. This study indicates that when organizing group discussions that involve challenges to development, it would be beneficial to impart to the participants the knowledge obtained from supporting collaborative actions and from developing patterns. It would also be beneficial to advise participants to build on each other's developing talk and then question the constructions subsequently developed. By paying attention to supportive collaborative actions, may move the brainstorming type of actions towards those of creative action.

Further, if the aim is the collaborative development of something new, the key point is to emphasize that developing an idea further and questioning should be done by utilizing theoretical knowledge. In a teacher learning context, this entails using learned theoretical knowledge as a means of raising questions and revising collaboratively developed ideas.

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