Expanding the change laboratory and the interventionist researcher's role in teacher education-school collaboration

May Britt Postholm 🆔 *

Department of Teacher Education, Faculty of Social and Educational Sciences, Norwegian University of Science and Technology, Trondheim, Norway

This study is framed by cultural-historical activity theory (CHAT), and the Change Laboratory (CL) is used as a method to enhance development, with student teachers, teacher educators, and practice teachers as the participants. The aim of the project was to study and promote learning processes across the boundaries of school teaching and university-led teacher education; the purpose of the sub-study that this article is based on was to describe how the Change Laboratory and the role of the interventionist researcher (IR) expanded in a teacher education-school collaboration. The data material consists of the programs of each of the eight CL sessions that were conducted, and two dialogues are presented to provide a picture of the IR's role in dialogues during CL sessions. The findings show that the eight CL sessions are spread out over a period of 2 years, with 1 year in between, and that this temporal expansion establishes positive conditions for development in school and teacher education contexts, as well as in collaboration between these two institutions. Furthermore, the study highlights the importance of the IR listening to all perspectives to foster multivoicedness in CL sessions, thereby creating an arena characterized by trust and collective agency. The findings show that the IR is both a process leader and collaboration partner who provides direction and forceful input to the dialogues.

KEYWORDS

cultural-historical activity theory, change laboratory, teacher education school collaboration, interventionist researcher's role, developing teacher education

Introduction

In the late 1970 and early 1980s many students of human development began to articulate a need for a new unit of analyses that took into consideration the cultural context of human cognition. The Laboratory of Comparative Human Cognition (LCHC) came into being in the early 1970s at University of California, San Diego. As its name implies, members of LCHC pursue research which takes differences among human beings as a starting point for understanding human mental processes. The questions asked were how to develop a psychology that takes as its starting point peoples' actions in a cultural context, and what kind of methodology that could be used to study behavior in context (Cole et al., 1997).

Researchers from different disciplines combined insights from the cultural historical tradition of Vygotsky, Luria, and Leontèv, American pragmatists such as Dewey and Mead and sociocultural anthropologists and sociologists. Thus, they combined approaches from American cultural approaches and Russian historical approaches (Cole et al., 1997). Wertsch (1991) chose mediated action as the proper unit of analyses using Vygotsky's

sociocultural theory enriched by Bakhtin's theory of social language, speech genre and voice. Another example of cultural-contextual theorizing is situated learning (Lave and Wenger, 1991) focusing on communities of practice as the unit of analyses. Rogoff (1992) states that development is participation in sociocultural activity. Rogoff advocates for a historical analysis of the collective activity system, building upon the activity theory introduced by Leontèv (1978, 1981). Engeström (1987) further develops his work based on activity theory, referred to as cultural-historical activity theory (CHAT) by Cole (1996), highlighting the multivoicedness of activity and emphasizing that contradictions serve as the driving force for development (Engeström, 1987). In the study presented in this article, the theoretical framework is based on Engeström and his colleagues' elaboration of CHAT and the Change Laboratory (CL) as a formative methodology.

In the mid-1990s, researchers at the Center for Research on Activity, Development and Learning (CRADLE) at the University of Helsinki developed an intervention tool kit that they named the CL. The CL is a method of intervention based on Vygotsky's (1978) method of double stimulation, and the principle of ascending from the abstract to the concrete (Davydov, 1990), and it was developed to handle some of the challenges met in implementing developmental work research (DWR) in educational and work practice (Sannino, 2008). The CL has been applied in various contexts, as for instance in a bank, a healthcare center, a hi-tech company (Engeström, 2007a), as well as in a library (Engeström et al., 2013). Additionally, it has been employed in a study involving personnel in a supported housing unit for young people with a history or risk of homelessness (Prokopis et al., 2022), and in a study focused on supporting sustainability transformations in organic agriculture (Mukute et al., 2018). Researchers at CRADLE have proposed having a similar number of sessions within a typical CL, ranging from 6 to 12 successive CL sessions to analyze and specify the challenges in developing an activity and, furthermore, creating a new model for it. The study in a library including eight CL sessions every other week over a period of 2 months (5 October to 26 November), is described as a full-scale change laboratory process (Engeström et al., 2013).

The CL has also made its entrance into schools and teacher education. A search in Web of Science using the search strings "Change laboratory" and "Teacher education" resulted in just four hits when excluding publications from the current study. Combining the search terms "Change laboratory" and "Schools" yielded eight relevant results, excluding studies that focused on digital contexts or were conducted outside of primary or secondary schools. I focused my search on two main areas: schools collaborating with researchers to enhance their teaching practices, and teacher education that incorporate the CL. This approach allowed me to gain insights into how the CL has been employed to develop both pre-service and in-service teachers. In both cases, it was about teacher education. The studies are introduced in the section titled "Related research" later in the article. Drawing upon readings and analyses of these studies and an appreciation of the extended form and content of the CL, as well as the role of the IR in the current study, this article focuses on the researcher's role and the content and timeframe of a CL conducted in a teacher education setting in Norway.

The project (2019–2023) in which the CL method was put into practice involved school and university teacher education, with student teachers, teacher educators, and practice teachers taking part. The aims of this project were (1) to work with participants to identify and carefully describe the obstacles and barriers to change in teacher education and subject teaching in schools, (2) to conceptualize these obstacles and barriers, (3) and to show how these might be overcome so that new teacher education and teaching practices might be developed. As such, the aim was both to study and promote learning processes across the boundaries of school teaching and university-led teacher education.

Research shows that Norwegian teacher education has for many years been characterized by a gap between theory and practice (Trippestad et al., 2017; Lillejord and Børte, 2017), this is also true internationally (Trippestad et al., 2017). Although, in recent years, there has been a stronger focus on integration between theory and practice, two recent studies about partnership between Norwegian schools and universities in relation to the student teachers' theses, demonstrate that both teachers in schools and university teachers seldom involve themselves outside their own immediate settings (Andreassen, 2015; Jakhelln and Pörn, 2018). The CL should be used on a fairly unexplored arena with a researcher leading the processes in this CL gathering participants from three perspectives coming together to find solutions to barriers and obstacles felt like an impediment for their studies, work, and development. The motivation and purpose of the article was to show how the CL can be an arena for collaboration in teacher education where obstacles and barriers can be identified and overcome, and what role the researcher can have in the processes that constitute tripartite collaboration, contributing to work that is relevant and useful for all. With this as the background, the problem formulation of the study conducted was formulated as follows:

> *How are the Change Laboratory and the interventionist researcher's role worked out in teacher education-school collaboration?*

The theoretical framework and related research section below present the CL method and the researcher's role. Next, the context of the study is presented inviting the reader into the studied setting before an outline of the data collection process and analyses. In the results section, an overview of the CL sessions and dialogues from these sessions are provided, followed by a subsequent discussion. Concluding comments end the article focusing on the expansion of the CL and the researcher's role.

Theoretical framework

The CL

The CL is presented as a formative intervention method for developing work activities by practitioners in collaboration with interventionist researchers (IRs)[1], and as a "tool kit for envisioning,

---

1 In the text I name the researcher who conducts research on the CL sessions as the interventionist researcher (IR) to distinguish the IR from other researchers that also participate in CL sessions. These researchers named co-researchers, conduct research on the processes outside the CL.
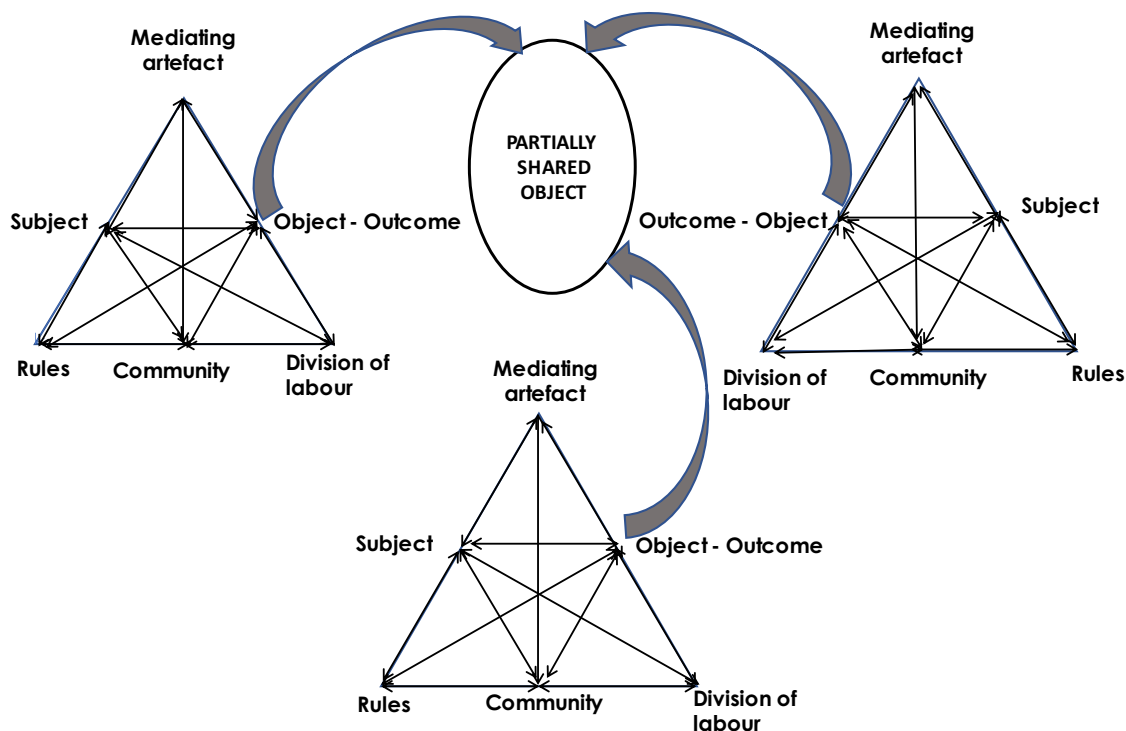
FIGURE 1
network of activity systems.

designing, and experimenting with new forms of work and a social setting in which this can be done" (Virkkunen and Newnham, 2013, p. 15). The CL was originally conceived as an arena for both researching and facilitating learning, with learning understood as expansive learning. Expansive learning is not merely the acquisition of established knowledge but rather participation in a creative process aimed at transforming activity (Engeström, 2015) and generating something new—"that is not yet there" (Engeström and Sannino, 2010, p. 2). The essence of transformative agency was defined by Virkkunen (2006) as "breaking away from given frames of action and the taking of initiatives to transform them collaboratively" (p. 43). Morselli and Sannino (2021) have also introduced the concept of collective agency within the framework of CHAT. This means to have a relational capacity that involves relying on other as a recourse for learning and contributing to collective learning (Edwards, 2011; Pyhältö et al., 2014). The "CL processes normally consist of 6–12 well-prepared weekly sessions of 2–3 h and a varying number of follow-up sessions after a period of about 2-month experimentation with the new solution" (Virkkunen and Ahonen, 2011, p. 238). Virkkunen and Newnham (2013) suggest that the community in a CL should work intensively but not be isolated:

They should be in contact with other members of the organization and discuss their insights of the systemic causes of problems and their ideas for the new form of the activity and for new tools and organizational arrangements as well as experimentation with new tools during the respective phases of the process (p. 20).

In the current project the three perspectives, the student teachers, teacher educators, and practice teachers, were visualized by each their activity system, thus constituting a network of activity systems (Engeström, 1987, 2015). A network of activity system is shown in Figure 1 below.

The minimum elements of an activity system are subject, mediating artifacts (signs and tools), object, rules, community, division of labor, and outcome. In a network of activity systems, the participants act on a partially shared object they have collectively constructed (Engeström, 1987, 2001). Contradictions within and between activity system factors drive development and change (Engeström and Sannino, 2010).

The CL steps follow the phases of the expansive learning cycle (Engeström, 1987, 2001; Engeström and Sannino, 2010), as shown in Figure 2 below.

Step 1 is starting with the identification of key problems in the current practice, then moving on to a historical and empirical analysis of the systemic contradictions at the root of the problem, the modeling of a new solution, the initial testing and implementation of the model in small-scale pilot areas, and finally to the full-scale implementation, follow-up, and assessment of the impact of the new solution in practice. According to Engeström's (1996) model representing the phases in the CL process, participants in the CL should, in the last phase, teach others what they have learned.

The CL is based on separation and embeddedness at the same time, but it is located as close to concrete practice as possible; however, it is "protected by walls" from that practice (Engeström, 2007b, p. 372). The boundaries between the CL and the practice can be permeable (allowing movement across them), but it is the practitioners who are encouraged to go out of the CL to check reality, according to Engeström (2007b).
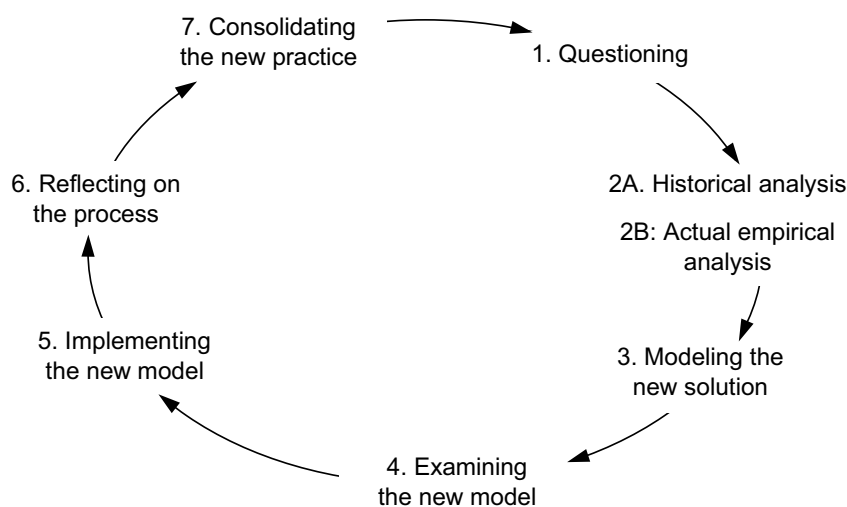
FIGURE 2
The expansive learning cycle.

The IR's role

The researcher's role in formative interventions is to analyze practice together with practitioners. As Engeström and Sannino (2010) put it, "In formative interventions, the researcher aims at provoking and sustaining an expansive transformation process led and owned by the practitioners" (p. 15). The IR should prepare the agendas for the sessions and plan the tasks. He or she is also the chair of the discussions in the CL sessions and the leader of the joint expansive learning processes, based on divergent needs, motives, and pressures expressed to form a partially shared object (Engeström, 1987, 2015). Engeström et al. (2014) state that the IR's plans in formative interventions are not smoothly implemented and that the participants take over the process at some point. The gaps between the IR and the participants need to be negotiated, according to the researchers.

The IR can use different tools and probes to support the dialogues and discussions in the CLs. The IR uses mirror data, which can be comprised of documents, transcribed dialogues, and video recordings. Moreover, the IR supports dialogues that join various ideas to create a common understanding among the participants that motivates them to act on a shared object. During the work in the CL sessions, the activity system and the expansive learning cycle function as tools to analyze the situation historically, the here-and-now situation, and how the content of the nodes in the activity system should be changed to enable them to act on the object more successfully in the future (Engeström, 2007b; Virkkunen and Newnham, 2013).

Related research

CLs enacted in teacher education

Studies have elucidated the dynamic processes and outcomes inherent in teacher education approaches. Martínez-Álvarez et al. (2021) conducted a study in the United States wherein 16 professors from two academic departments of teacher education synergized their expertise to devise tailored educational programs for prospective teachers specializing in bilingual education, English as a second language, or special education teaching. Through six orchestrated CL sessions, facilitated by two teacher educators assuming the roles of IRs, the endeavor aimed at fostering an integrative framework to cater to the multifaceted needs of pupils, encompassing both those with and without disabilities. While the precise duration of the CL remains unspecified, the study posits that the sequential arrangement of three initial sessions spanning 2 h each, followed by three subsequent 1-h meetings, likely unfolded over a 12-week period. The analysis of the study highlights the crucial role of collaborative efforts in fostering a mutual pedagogical comprehension. However, it also emphasizes the necessity of establishing a unified teaching program as a prerequisite for interdisciplinary collaboration.

Chang (2021) conducted a CL involving 10 Chinese and Korean bilingual student teachers undergoing practicum training in the United States, and furthermore, together with colleagues (Chang et al., 2021), CL sessions among Chinese student teachers enrolled in a semester-long course centered on bilingual education. Both these CLs were conducted over a 15-week semester. Fifteen weekly 100-min CL sessions were integrated into the student teachers' educational journey, culminating in advancements in implementing novel bilingual teaching methodologies within their pedagogical repertoire (Chang, 2021). In the second mentioned study (Chang et al., 2021) the student teachers underwent training at a primary school, where they collaborated with practicing teachers in bilingual classrooms. Among the 18 student teachers, three took part, and the findings indicate that the CL method, coupled with participatory analyses, can significantly enrich student teachers' learning experiences and facilitate improvements in bilingual teaching practices.

Chang's subsequent study in 2024 centered on CL sessions conducted across three cohorts of student teachers, each spanning

15 weeks during the fall semester. A total of 39 student teachers participated in these CL sessions, comprising 37 individuals, including 24 Chinese-speaking and 15 Spanish-speaking student teachers who became participants in the research. The findings, reporting on CL sessions gathering teacher educators and student teachers, suggest that the pedagogical support provided through mediational tools introduced and co-constructed in CL sessions can facilitate the transformative agency of student teachers.

CLs enacted in school

In an upper secondary school setting in Sweden, Augustsson (2021) conducted a small-scale intervention study involving 2–3 teachers' intervention the researcher. The CL sessions initially focused on general modeling, adhering to the expansive learning cycle. However, the participants' expressed need for practical solutions prompted a dual process, integrating both general modeling, and specific lesson design within the sessions. The study's findings challenge the conventional linear progression from the abstract to the concrete, advocating instead for a reciprocal movement between the two as a catalyst for development.

In total, six CL sessions, with session lengths ranging from 57 to 96 min, were conducted over an 18-month period, deviating from the conventional CL timeframe. The main argumentation for this was the aim to have the whole process of the change effort inside the process to let implementation and consolidation is part of the intervention. Albeit adhering to traditional CL methodologies outlined by Engeström (2007b). Botha (2017) intervention in a secondary school in Cape Town emphasized the bottom-up perspective in fostering collaborative practices among teachers.

In China, university researchers (Diao et al., 2022) supported teachers in developing their own research activities within their own teaching practices. The CL was introduced as a method for fostering collaboration among teachers as well as between teachers and IRs. Seven recorded dialogues from the CL sessions, each lasting ∼2 h, were analyzed. The CL sessions spanned duration of 3 months, revealing that this timeframe was insufficient for actionable outcomes. Additionally, the study indicated challenges in constructing a shared object during the sessions.

Following the CL sessions held in Sydney, which comprised eight extended sessions involving an IR, teacher education colleagues, and local education professionals focusing on Himalayan education, collaborative efforts were directed toward enhancing teaching practices in Nepal. Subsequent to the Sydney visit, teacher educators lead spearheaded small-scale projects in schools alongside teachers to refine their teaching. The study's findings reveal that the collaborative initiatives undertaken by the participating schools and teachers resulted in transformative changes, rendering classrooms more equitable and inclusive (Hopwood et al., 2023).

A CL conducted in an Italian secondary vocational school spanned over 11 sessions. The initial eight sessions took place from February to April, followed by a subsequent session in May, and two additional follow-up sessions in the subsequent school year aimed at monitoring progress. Facilitated as an in-service training for teachers by an IR, the first author, the study focused on addressing an acute situation within the school involving a decline in student enrollment (Morselli and Sannino, 2021).

A study by Salloum and BouJaoude (2023) reports findings from initial CL sessions in two schools in Lebanon, demonstrating how teachers transitioned from abstract discussions of teaching (CL 1 and 2) to practical implementation in teaching (CL 3). While the timespan for CL sessions 1 and 2 is not specified in the article, each session lasted ∼2 h. The study illustrates that teachers adapted their teaching methods to prioritize student-centered activities.

Sannino et al. (2016) present findings from a study conducted in a primary school in Finland. The research group implemented an 11-week CL intervention consisting of weekly 2-h sessions. All 27 teachers and the school principal participated in constructing a vision for the school's future. Prior to the CL sessions, the research group collected data to assess the school's current situation. Although the overall atmosphere at the school improved, the study noted that teachers' negative discourse about students persisted, though positive discussions were seen as enrichment.

Spante et al. (2022) collaborated with teachers from a lower secondary school in Sweden, involving the principal, a recreation educator, a school nurse, and a union representative. Each CL session typically included 25 participants. In total, nine CL sessions were conducted, with each session lasting 2 h. The primary objective was to enhance the collective professional agency within the school community, emphasizing strategies for engaging students, and fostering collaboration with parents. A subsequent follow-up study indicated that the CL sessions had contributed to significant changes within the school.

Lastly, in a CL comprising seven 2-h sessions, 12 teachers from an upper secondary school in a southern African country participated (Virkkunen et al., 2012). The introduction of a new tool during these sessions challenged the categorization of students and facilitated a more multifaceted perspective of them, which had not been the case before the CL sessions.

Collectively, these studies underscore the transformative potential of the CL method in fostering pedagogical innovation, interdisciplinary collaboration, and transformative agency within educational settings. In teacher education, the CL sessions within an educational program brought together teacher educators and student teachers. All the studies presented adhere to the standard CL process, except for one study. Augustsson's (2021) small-scale study in a school, spanning 18 months, incorporated six CL sessions and challenged the linear model from the abstract to the concrete (Davydov, 1990).

The researcher's role as enacted

The studies presented demonstrate that the researchers adhered to the theoretically described role of the IR, using models, tool and mirror data, and, furthermore, facilitated dialogues and discussions in which participants engaged with new ideas, thereby experiencing a form of double stimulation (Vygotsky, 1978). In Augustsson's (2021) study, the expansive learning cycle functioned as a framework for the development process. Through analyzing dialogues, the research sought to investigate the practical applicability of the CL method. Notably, in these analyses, the role

TABLE 1 The participant's experiences.

Name	Education	Experience as a teacher in school	Experience as a teacher educator (TE)	Experience as a teacher educator supervising master's students	Experience as a practice teacher (PT)
IR	PhD	14 years	18 years	48	
TE education, TEE	PhD	7 years	34 years	5	
TE physical education, TEPh	Master's degree	1 year, 6 months	7 years	0	
TE physical education TEPh	Master's degree	1 year, 7 months	5 years	0	
TE mathematics 1, TEM1	PhD	0 years	8 years	7	
TE mathematics 2, TEM2	PhD	0 years	8 years	7	
PT physical education, PTPh	Bachelor level	8 years			4 years
PT mathematics, PTM	Bachelor level	9 years			5 years

of IR was not the primary focus, which is one of the emphases in the current study.

Context of the study

The CL sessions conducted at the teacher education institution in this research were connected to the work of the third-year R&D assignment and the fifth-year master's thesis of the student teachers' educational program. Each of two cohorts of student teachers included four student teachers in mathematics and four student teachers in physical education for a total of 16 students. Cohort 1 started in autumn 2019, and cohort 2 started in autumn 2020. The IR, the author of this article, led the CL sessions. The student teachers took part in the CL alongside their formal education. Additionally, teacher educators and practice teachers in the subjects of mathematics and physical education took part in the project (two teacher educators and one practice teacher in each subject, one teacher educator in education, and the headmaster of the school). The IR and three of the five teacher educators have experience as teachers in school and all the five teacher educators and the IR have several years of experience as teacher educators. They were therefore familiar with practice both in school and teacher education, and also how collaboration between these two arenas had functioned. The participants' education and experiences are shown in Table 1 below.

The student teachers had their field practice from the third to fifth year at the same school. The intention was that they should become known to the school, the teachers, and the pupils in the classes where they were practicing. During the fourth year, between work on the R&D assignment and the master's thesis, they met the same teachers and pupils in the school, and they were followed up by the same teacher educators during the practice period. This organization of the student teachers' field practice and their continuous collaboration with the same practice teachers and teacher educators made up a coherent educational pathway for the

students. To provide a description of the CL sessions conducted and the researcher's role, cohort 1 is used for exemplification.

The five teacher educators in the project, researchers in addition to the IR, were named co-researchers, and it was these teacher educators that followed up and supervised the student teachers in school together with the practice teachers. It was also the co-researchers that conducted research on the processes outside the CL. The co-researchers were therefore known to the processes and the perceived tensions and contradictions outside the CL. The IR organized the CL sessions based on dialogues with co-researchers about their experiences and her preliminary analyses of accomplished CL sessions.

Materials and Methods

Approach

The study aims to describe how the CL was used in teacher education-school collaboration and what role the researcher can have, using data material from cohort 1. The collaboration period stretches over a period of 3 years, with four CL sessions in the first year, none in the fourth year, and four CL sessions in the fifth year. The study is confined to a specific time and location, and, in line with Creswell (2013), the employed methodology is thus that of a case study, being a study thoroughly describing an activity bounded in time and place, as Creswell define it.

Data material and analyses

The programs for all eight CL sessions are presented in their entirety in Table 2 below to provide an overview of the frames for and the structure of the sessions. The content of the programs is commented on in the running text, with reference to Table 2, and is analyzed and discussed in relation to the IR's role in the discussion

TABLE 2 Overview of the CLs.

The student teachers' 3rd year
CL 1 26. September 2019 ● **Preparation.** Reflect on questions. ● Presentation of the participants. The roles and the project and CHAT and CL (led by IR). ● The project: In heterogeneous groups: How do we understand the project? In plenary: summary discussion. What are the possibilities and challenges? ● **In homogenous groups:** Reflections based on experiences so far in the school and teacher education (questions to be reflected on before the CL). ● Every group presents its reflections. ● **In plenary**: What do we conceive as possibilities and challenges, tensions and contradictions? A network of three activity systems is used to represent the utterances (led by IR). ● Going through an assignment to be carried out next CL (led by IR).
CL 2 20. November 2019 ● **Plenary:** Reflections on the assignment conducted (led by IR). ● **Heterogeneous groups**: What assessment criteria are connected to the R&D assignment and the master's thesis? Task: Describe professional assessment criteria. ● **Heterogeneous groups**: Plan the work with the R&D assignment. What can be the theme of the assignment? What have you read about the theme? What should/could be read? How could the supervision be organized? Task: Frame different models for supervision. ● **Plenary**: Summary of the work in groups (led by IR).
CL 3 23. January 2020 ● Short presentation of CHAT, the activity system, contradictions, and the CL (led by IR). ● Assignment used as mirror data. ● **In heterogeneous groups**. Task: How can we work toward the object (in-depth focus on the subject, contributing to research-competent school development)? Discussion and preparation for presentation in each group. In this presentation, student teachers, teacher educators, and practice teachers describe the R&D assignment that is planned/being planned and focus on challenges and possibilities in the work. The network of activity systems should be used as the unit of analysis. ● **Plenary:** Summary and the next step in the work (led by IR).
CL 4 8. June 2020 ● **Preparation** before the CL. Reading of the assessment criteria for the R&D assignment. ● Short introduction of CHAT, the activity system, and contradictions (led by IR). ● **In groups:** (teacher educators, practice teachers, and headmaster in one group; student teachers in mathematics and physical education each in their own groups). (The groups select one person to lead the conversation and one to write down what is said.) ● The task for the groups: Discuss what possibilities and potential challenges the assessment criteria have for the R&D assignment. Discuss how these assessment criteria eventually contradict the processes/actions during the work connected to the R&D thesis. ● **Plenary**: Presentation from each group and summary by the IR.
The student teachers' 4th year (no CLs)
The student teachers' 5th year
CL 5 24. August 2021 ● **Heterogenous groups:** What are the theme and problem formulation for the master's thesis, and how can the answer to this problem formulation be found? ● We use the network of activity systems to detect tensions, contradictions, and possibilities. ● **Plenary**: Discussion and summing up (led by IR).
CL 6 22. November 2021 ● **Preparation** before the CL. Reading of two texts about the use of CHAT and analyses. Read the texts and write down six questions for both of them. Reflect on what you as a participant in the project have experienced regarding the following areas: collaboration in the project, supervision, assessment, development, and research. Write down your reflections and bring your notes to the CL session. ● Mirror data handed out in the CL session. ● Plenary: with the mirror data as the starting point, discuss what tensions and contradictions have been solved and new tensions and contradictions experienced. The network of activity systems is used as the unit of analysis (led by IR).

(Continued)

TABLE 2 (Continued)

The student teachers' 3rd year
CL 7 7. March 2022 ● **Preparation** for discussion of assessment criteria for next CL session (see activity system) Read about criteria as they exist. Do the criteria function as rules or as aids on the way to the goal of the master's thesis? Do you experience any tensions/contradictions between the factors in the activity system related to assessment criteria? How do you feel about the criteria capturing the process of the master's thesis as you have experienced it in the project? How do you experience the criteria capturing the learning that you have experienced in the work on the master's thesis in the project? Do you have suggestions for other criteria? ● **Heterogenous groups**: with the process and purpose connected to the master's thesis, what criteria are relevant in the assessment of the master's thesis? ● **Plenary**: discussion and summing up (led by IR). ● **Seminar for the entire teacher education program**. IR presents the project. Eight student teachers present their work. ● 1800. **Dinner** for all at a restaurant.
CL 8 25. May 2022 ● **Preparation before the CL:** Everyone reads the document describing how they have experienced the situation before participating in the project. Write what changes you have experienced both when it comes to the R&D assignment and the master's thesis. Reflect on the following questions: What tensions/contradictions have been resolved? Are there any new ones that have arisen? Are there any new guidance models that have been developed and that should be continued? Are there any assessment criteria that are professionally oriented? What have you learned through the work on the R&D and master's thesis, and what significance do you think your own learning will have? ● **Homogenous groups**: sum up the situation here and now based on the preparation exercise. ● Each group presents their reflections. ● Experiences based on the work with the master's thesis: How were the theme and the problem formulation decided and developed? Experiences with supervision. Challenges? What worked well? What was learned and developed during participation in the project? What will it mean? ● **Plenary**: Discussion and summing up (led by IR).

section. The programs provide insight into how the IR has planned the sessions and delineate her tasks within them.

All the dialogues in the eight CL sessions were audio-recorded and transcribed, and these transcriptions thus constitute therefore a huge number of pages. One reason for this huge material is that the participants were working in both heterogenous and homogenous groups[2], and thus one CL session could therefore contain several transcriptions of dialogues. I will illustrate this with CL session five, a typical session, as an example. It includes transcriptions of a plenary dialogue, a dialogue with a homogenous group in mathematics, and a homogenous group in physical education, totaling 75 pages.

When analyzing this material, the constant comparative method of analyses was used (Strauss and Corbin, 1990; Corbin and

---

2   Heterogenous groups. Student teachers, teacher educators, and practice teachers collaborate in their subject group, one in physical education and the other in mathematics. The teacher educator in education and the headmaster take part in each their group.

Homogenous groups. Student teachers, teacher educators, and practice teachers in the two subjects collaborate in their respective groups. The teacher educator in education and the headmaster take part in each their group.

Strauss, 2013) to code and categorize the utterances. The focus was on the IR's role in the analyses. According to Strauss and Corbin (1990), a predefined category can be enriched with new content when it is opened up and given new meaning (p. 50). In this case, the category under consideration was the IR's role, and the analysis of the material involved seeking the IR's entry into the ongoing dialogues. The main predefined category was then "The IR's role in dialogues in the CL sessions." I aimed to deepen the analysis and further explore this category by developing sub-categories, guided by the questions presented by Strauss and Corbin (1990), such as when and how this role of the IR became visible. While coding the transcriptions of dialogues, the category was assigned labels or codes such as "asking questions," "providing suggestions," "summarizing utterances," "introducing models within CHAT," and "introducing concepts within CHAT," thereby enriching the category with specific content about "how." When asking questions about the material that started with "when," as suggested by Strauss and Corbin (1990), I identified two dialogues that represented sub-categories within the main category, providing a picture of the IR's role. I selected these dialogues because they encompassed all the labels or codes deemed appropriate in the analysis of the material. These two dialogues had distinct focuses, thereby also illustrating the IR's role in dialogues with different content. The first sub-category and dialogue were given the heading "When reflecting on the lack of communication between teacher education and school," while the second dialogue was titled "When planning a development project in school using CHAT." These two dialogues fluently represent the IR's way of communicating during the collaboration processes in groups in the CL and are presented in the findings section. Within these dialogues the representatives from both subjects are integrated.

Furthermore, the IR's comments and reflective notes following each CL session were included in the material to act as a prompt for the immediate comprehension of the processes during the sessions. These diverse data sources collectively contribute to addressing the problem formulation.

Quality and ethical considerations

Quality of the research was ensured by using member checking (Lincoln and Guba, 1985), which means that all participants taking part in the CL sessions have read the presentations of the findings and found them accurate when it comes to the processes and the IR's role. Permission to conduct this study was sought from and granted by the Norwegian Ethical Research Committee, as well as by all the participants. The participants signed an informed consent form. They were told that their names and the name of the school and the teacher education institution would be anonymized and that they would be given full confidentiality (NESH, 2021).

Results

Descriptions of the CL sessions

Below is presented an overview of the CL sessions conducted in cohort 1 (see Table 2). The first four sessions were whole-day seminars; the next four seminars lasted for 2–3 h.

During CL sessions, the IR held short presentations on CHAT, the activity system, the expansive learning cycle, and the CL to help the participants understand theoretical concepts and the models used in CL sessions (CL sessions 3 and 4). The participants were also expected to read two texts focusing on CHAT (before CL session 6) and texts focusing on assessment criteria (CL sessions 4 and 7). Before some of the CL sessions, the participants were expected to reflect on certain questions (for CL sessions 1 and 8) or an assignment (for CL session 2) as preparation. The questions to the student teachers, the practice teachers, and the teacher educators were almost the same; they were just adapted to the different perspectives. When they had reflected individually in the same way, they also had every opportunity to reflect together on the same issues. For example, the questions posed to the student teachers before the first CL session were as follows:

- What do you think about the assignments you have carried out in school so far?
- How do you feel assignments that have focused on the connection between theory and practice have contributed to an understanding of the school, the students' learning, and the teacher's practice?
- How do you feel about the guidance you received?
- What was your experience of the assessment like?
- What were the criteria for the assessment?
- How would you like assignments intended to link theory and practice to be designed ?
- What are your preferences when it comes to the guidance and assessment related to such assignments?
- How do you think such assignments have contributed relevant knowledge to the school?
- How do you think such tasks have contributed relevant knowledge to teacher education?

As a preparation for the eighth and last CL session, the participants were asked to read a summary of their reflections written by the IR on each of their perspectives based on the questions asked in the first CL session.

As a task in preparation for the second CL session, the participants were asked to reflect on a preliminary working hypothesis related to contradictions connected to the R&D assignment they were going to work on. Mirror data (Engeström, 2007b) were also introduced to the participants in CL sessions to analyze their situation (CL sessions 3 and 6). The activity system or networks of systems (Engeström, 1987, 2015) were used to analyze tensions and contradictions experienced in dialogues during the CLs (CL sessions 1, 3, 5, 6, and 7). During CL sessions, they also reflected on assessment criteria (CL sessions 2, 4, 7, and 8), supervision models (CL sessions 2 and 8), and possible themes for the R&D assignment (CL session 3) and master's thesis (CL session 5). Furthermore, the participants planned their work for the R&D assignment and the thesis and discussed how they could collaborate. In the last CL session, the participants reflected on what they had learned when participating in the project and what it would mean for their future practice. During the CL sessions, the participants worked in homogenous and heterogenous groups, allowing them to reflect within and across each other's perspectives (see Table 2).

Yrjö Engeström and Annalisa Sannino from Finland were invited to lead a two-full-day capacity-building seminar on CHAT for all the participants early in the project. During this seminar, the following partially shared object (Leontèv, 1978; Engeström, 1987) was constructed: an in-depth focus on the subject to contribute to research-competent school development. During this capacity-building seminar, the object for each activity system was formed. For the student teachers, it became "A successful and meaningful thesis," for the practice teacher "The R&D assignment," and for the teacher educators "Development of competencies for all parties." In CL session 6, about 2 years later, a dialogue ended in objects showing that the participants had developed their understanding of the object they acted on. The object for student teachers became "Become a better teacher and do research work that is useful for everyone." The object for the teacher educators became "Apply knowledge in the field of practice more actively in teacher education and connect two worlds, the school and teacher education; contribute to student teachers developing critical understanding and their professional development in collaboration with practice; and lastly, dare to go where the research leads." The object for the practice teachers became "Explore your own practice, develop to become a better teacher and a better supervisor, and develop the practice training for the student teachers" (IR's notes).

The dialogue in CL session 6 shows that the student teachers had clearly developed their understanding of the object to act on, and it had shifted from being an aim for their master's thesis to becoming an aim for their practice in school. They also stated that the tensions and contradictions they had experienced between school and teacher education had been resolved throughout the project. However, they introduced a hypothetical tension or contradiction, wondering how the organization of the project could be expanded to the entire teacher education system (Postholm, 2024a). Teacher educators in university and school had also co-constructed knowledge of a new activity related to collaboration between university and school, and that the development work became important for both parties (Postholm, 2024b). During the eight and last CL session the student teachers stated that they had become reflective practitioners and professionally oriented. Furthermore, they said that they had developed in-depth subject knowledge to help them argue for their choices in teaching, they had learned to collaborate, and they had learned about school development and had become well prepared for the profession (Postholm, 2024a).

It was not before the third session that all the parties agreed on a joint theme to work on connected to the R&D thesis (Postholm et al., 2023). Before the theme of the assignment was decided, the teacher educators and the student teachers had visited the school several times to meet the class and become acquainted with the school, the practice teachers, and the pupils. In February 2020, the student teachers underwent their practice training for 6 weeks, and they were supervised by the teacher educators and practice teachers both during and after the 6 weeks while working on their R&D assignment. It was easier for them to agree on a theme for the master's thesis because they built on their work on the R&D assignment, and the student

teachers, teacher educators, and practice teachers were known to each other and used to collaborating. The participants, except the IR, met several times in supervising sessions outside the CL, both in school and at teacher education institution, but it was in the CL sessions they gained a meta-perspective on the processes, and it was during CL sessions that the participants analyzed tensions and contradictions and looked for possibilities and challenges when planning their work outside the CL sessions (IR's notes).

After the second last CL session, the project group arranged a seminar inviting all teacher educators at the university. The IR briefly presented the project and the work of student teachers in the project (see Table 2, IR's notes).

The IR's role in dialogues in the CL sessions

Table 2 shows that there were eight CL sessions arranged for cohort 1. Below, two dialogues between the participants and the IR are presented. Dialogue 1 is from the first CL session when all the participants met for the first time after having reflected on some questions posed beforehand by the IR. Dialogue 2 is an extract from the first CL session in the fifth year and the fifth CL session overall, when the master's thesis was in focus.

During this first CL session, the participants reflected on the questions they were asked to think about as a preparation, together in homogenous groups before a plenary reflection. The IR led the plenary reflection process and also wrote down the participants' utterances in a network of three activity systems (one for each of the groups: the student teachers, the teacher educators, and the practice teachers) drawn on a sheet of paper covering a wall of the room where they were seated to assist in visualizing perceived tensions and contradictions, but also possibilities (IR's notes). Below, an extract of the dialogue that took place in the heterogenous group working on mathematics is presented. In addition, the teacher educator in education took part. The heading for the dialogue in the Cl session was "Reflections based on experiences so far in the school and teacher education" (see Table 2, CL session 1), showing lack of communication between teacher education and school.

When reflecting on the lack of communication between teacher education and school

TEM1:[3] The practice teachers are neither involved in the problem formulation nor in the supervision, it feels unpleasant.

TEE: We have to create better coherence for the student teachers. The student teachers also need to be known to the school,

---

3 Dialogue 1: IR, Interventionist researcher; TEE, Teacher educator in education; TEM1, Teacher educator in mathematics 1; PTM, practice teacher mathematics; ST1, student teacher 1; ST2, student teacher 2; ST3, Student teacher 3. Dialogue 2—TEPh2, Teacher educator in physical education2 (see also Table 1).

the teacher, and the class before they start working on the R&D assignment.

PTM: We can plan together for the student teachers to do something that we also want to develop, to make it realistic.

ST1: Some student teachers have experienced that the practice teachers were absent when they were in school practice. The collaboration between the teacher education and school could have been better.

ST2: We would have liked to be introduced to the school and meet the practice teacher before the work on the R&D assignment started.

IR: How did you reflect on the question: How do you think such assignments have contributed relevant knowledge to the school?

ST1: Well, the practice teacher has to know about our R&D assignments, and if the problem formulations were developed in collaboration with the schools, then wouldn't they also be more relevant to the teachers? We also reflected on the other question on how such tasks have contributed relevant knowledge to teacher education and agreed that such R&D assignments can contribute to teacher educators gaining insight into how their subject actually functions in the school. We think that many teacher educators have not been teachers in schools and that it can be useful for them that we are engaging in practice together with the pupils. This can help their university teaching to become better and more relevant for us in the next phase.

ST3: We can be the connection link between the school and teacher education, and our work on the R&D assignment can be useful for the school.

IR: What do you [practice teacher] think about this?

PTM: If these R&D assignments contribute to an understanding of the school, the pupils' learning, and the teachers' daily practice, the student teachers and the practice teachers need to talk about what they want to research, talk together about what to do.

TEE: But how realistic is this, that everyone should meet? Although we can try to approach this ideal situation by trying to do something.

IR: So, what is it really that we want to focus on in these R&D assignments? I think that next time we need to plan how to carry out the assignment. But if we now turn to the network of activity systems, what is the most pronounced tension?

ST1: We're talking about communication between teacher education and school, then.

PTM: Yes, this information flows between the school and teacher education. And there is a tension between the student teachers' R&D assignments and interests in practice and the teacher's plans.

IR: What ideas do we have to clear up these tensions?

The teacher educators, the practice teacher, and the student teachers seem to agree that the collaboration between the parties has been insufficient. The utterances reveal that they think the student teachers should be familiar with the school and class before planning the R&D assignment and that the practice teacher should be involved. The IR directs the dialogue to the questions they have reflected on and asks about the R&D assignment's relevance to the school. The student teachers obviously want the R&D assignment to be relevant for the school as the teacher educator in education,

and the student teachers also recognize that teacher educators can improve their teaching at the university by actively engaging in practical experiences alongside them. The IR then directs a question to the practice teacher to hear her opinion. The IR asks what they really want to focus on and reminds them that they need to plan how to carry out the R&D assignment in the next CL session. Then the IR brings up using the network of activity systems to analyze and find the most pressuring tension. After the participants have brought up the tensions they experienced, the IR asks for ideas to clear up these tensions.

The heading for the second dialogue was "What is the theme and problem formulation for the master's thesis, and how can an answer to this problem formulation be found?" (See Table 2, CL session 5). The network of activity systems was used to detect tensions, contradictions, and possibilities. The IR distributed leadership to one person in each heterogenous group but intervened both to frame and introduce ideas and tools into the dialogue. The dialogue below is from the heterogenous group working on physical education. In addition, the teacher educator in education participated in this dialogue, where they began planning a development project in school.

When planning a development project in school using CHAT

IR: Have you started to discuss possible contradictions and possibilities using the activity system, and have you started to make a plan for testing out teaching at school and how to collect data?

ST1: We talked a little bit about it, that we had to make such a plan.

TEE: I thought about the theoretical framework; you can use CHAT.

IR: You can perhaps present the expansive learning cycle and write about the here-and-now situation and then go deeper into it and test things out.

TEE: The object is to use the outdoor facilities.

IR: But what outcome will it lead to? I envision the activity system when we talk about this.

TEE: I began to think about this during this summer; we can anyhow use the activity system as a tool to understand the project. The project began to fall in place for me then. The object is to use the outdoor facilities, but the outcome will hopefully be learning. It has to be valuable for the pupils' learning.

IR: So, using the outdoor facilities for the pupils' learning.

TEE: It has to be better learning outside.

ST1: Yes! Activities more appropriate outside than inside the classroom.

TEPh2: Someone tried to use outdoor facilities and found that it functioned and that the pupils learned. But still, they have fallen back to teaching inside. So, there have to be some perceived costs of doing it.

IR: It has to be meaningful?

TEE: Yes, it has to be meaningful.

PTPh: They have to learn to see possibilities vs. teaching what they are used to and feel safe doing.

TEE: So, the usefulness and the value of this have to be greater than the costs.

The IR starts the dialogue by asking if they have used the activity system to analyze and if they have planned teaching to be tested and researched. The student teachers respond that they are on their way to doing this, and the teacher educator in education offers a suggestion: they can use CHAT, she says. The IR suggests that the student teachers can use the expansive learning cycle to write about the here-and-now situation, focusing on how the teachers at school used the outdoor facilities. Then, a discussion about the object and learning starts. The teacher educator in education thinks the object is to use the outdoor facilities; then, the IR asks what outcome it will lead to and says that she envisions the activity system as they talk about this. The IR brings the activity system into the dialogue to help them visualize their thoughts. The teacher educator in education says that the object is to use the outdoor facilities and that learning will hopefully take place. The IR summarizes the object as the utilization of outdoor facilities for the pupils' learning.

The participants agree that it must be an activity that is suitable to engage the pupils outside. The teacher educator in physical education comments that some teachers have tried it and found it useful for the pupils' learning but nevertheless did not continue to use these facilities. They discuss that the use value must be higher than the costs. The IR asks if it must be meaningful for the teachers, and the teacher educator in education agrees.

Analyses and discussion

In the following discussion, I will address the research question: "How are the Change Laboratory and the interventionist researcher's role worked out in teacher education-school collaboration?" First, I will focus on the CL and how it is expanded in relation to its typical descriptions, considering both time and content. Next, I will examine the IR's role in dialogues in the CL sessions.

How the IR planned and organized the CL sessions

Table 2 shows that the eight CL sessions are spread out over a period of 3 years, with a pause during the fourth year when the student teachers did not work on either the R&D assignment or the master's thesis. This time period for a CL is significantly longer than a full-scale CL process that extends over a 2-month period (Engeström et al., 2013), encompassing CL sessions with a typical duration of 2–3 h, followed with a variable number of follow-up sessions (Virkkunen and Ahonen, 2011). Research conducted in the context of teacher education, where teacher educators, acting as IRs, and student teachers were brought together in a formal educational program, report that the researchers have designed the CL, considering a typical time frame for both the entire CL process and each individual CL session. Additionally, they adhered to the method of double stimulation (Vygotsky, 1978) and followed the principle ascending from the abstract to the concrete

(Davydov, 1990). The findings from these studies indicate that the development work was successful in achieving the intended goals (Martínez-Álvarez et al., 2021; Chang, 2014, 2021; Chang et al., 2021).

The studies reporting on researchers collaborating with teachers in schools also, for the most part, adhered to the typical time frames when implementing CL sessions. However, one study (Augustsson, 2021) deviated from both the timescale and the linear progression ascending from the abstract to the concrete (Davydov, 1990). In this study, the six CL sessions had a duration ranging from 57 to 96 min, and they were conducted over a period of 18 months. The participants expressed a need for practical solutions in their teaching practice, and the main argumentation for this time frame was the aim to have the whole process of the change effort inside the process to let implementation and consolidation is part of the intervention. In another study, the argument was in the same vein, that CL sessions spanning over 3 months are insufficient for producing actionable outcomes (Diao et al., 2022).

The CL sessions in the current study were connected to the student teachers' work with the R&D assignment and the master's thesis, but alongside the formal educational program. According to Virkkunen and Newnham (2013) the CL is a toolkit for designing new forms of work which can be done. The tripartite collaboration over the course of 3 years demonstrated that it was not sufficient merely to plan for action; rather, the planned actions needed to be tested and analyzed anew through tripartite collaboration in the CL. Thus, the linear progression from the abstract to the concrete was also broken in this study, as also findings in Augustsson's (2021) study show. However, the method of double stimulation (Vygotsky, 1978) was employed in the current study.

In this study it was, first and foremost, collaboration between the student teachers, the teacher educators and the practice teachers that needed attention already in the first CL session (see Dialogue 1). The student teachers raised tensions and contradictions related to teacher education–school collaboration and emphasized the need for alignment between assignments and practical interests. The study shows that it is not the IR's plans that are presented at the outset that the practitioners, after some time take over (Engeström et al., 2014); instead, the participants are free from the beginning to negotiate and come to an agreement about the work connected to the R&D assignment and the master's thesis (see Dialogue 1). However, it was not before the third session that all the parties agreed on a joint theme to work on connected to the R&D thesis (Postholm et al., 2023).

Based on the review of previous studies (Martínez-Álvarez et al., 2021; Chang, 2021, 2014; Chang et al., 2021), it is appropriate to conclude that this study is the first of its kind in teacher education that brings together teacher educators, student teachers, practice teachers, and a headmaster in a CL setting. This study is also the first of its kind where teacher educators taking part in tripartite collaboration in the CL supervise the student teachers together with the practice teachers in school. The teacher educators, also entitled co-researchers, thus follow the student teachers and practice teachers in practice and develop an understanding of how the plans designed in CL sessions are enacted in practice. The tensions and contradictions highlighted during CL session 2, which centered on insufficient collaboration (see Dialogue 1), are thus

actively addressed by this tripartite collaboration both in practice and during CL sessions. Additionally, the specific content that fills these collaborative processes is determined within the context of these collaborative efforts (see Dialogue 2).

The co-researchers' knowledge about the processes in school practice was valuable for the IR when planning CL sessions. Thus, the dialogue between the IR and the co-researchers contributed to a progression in the CL sessions building on collaboration outside the CL. Experiences outside the CL sessions were shared in the CL sessions throughout the project to detect new tensions and contradictions that needed to be solved. The network of activity systems was used as a tool during several CL sessions to visualize the participants' situation, tensions, and contradictions both within and between the systems. Either these tensions were connected to the school, the teacher education or collaboration between these two arenas, the participants knew the settings beforehand. Teacher educators as co-researchers and practice teachers were moving between practice outside and inside the CL, and it was not "protected by walls" from practice (Engeström, 2007b, p. 372), but rather put at the "center for practice."

In this project it is not just practitioners that "go out of the CL to check reality" (Engeström, 2007b) between the CL sessions; teacher educators, student teachers, and practice teachers move between the school and teacher education. Thus, there are more than just follow-up seminars after the CL sessions have ended (Sannino, 2008; Sannino et al., 2016; Virkkunen and Ahonen, 2011). This crossing over the boundaries between school and teacher education over time seems to lay the foundation for development as reality is checked between the meetings in the CL sessions. The results of the dialogue in CL session 6 show that the participants had developed an understanding of their role and the object to act on (Engeström, 1987, 2001). They had successfully developed a new practice between teacher education and school, transforming the activity into something new—"that was not yet there" (Engeström and Sannino, 2010, p. 2). They had broken away from the established frames of action and taken the initiative to transform them collaboratively (Virkkunen, 2006, p. 43). The student teachers, for instance, changed their object from "A successful and meaningful thesis" to "Becoming a better teacher and do research work that is useful to everyone." This commuting between practice and the CL sessions challenges the linear progression from the abstract to the concrete (Davydov, 1990). The findings suggest that tripartite collaboration across the boundaries of teacher education and school is essential for enhancing teacher education and preparing future teachers.

The IR's role in dialogues in the CL sessions

The study shows that the CL sessions became a meeting place where all could come together to both plan and solve challenges together. The teacher educator in education noted in the first CL session (see Dialogue 1) that it was not realistic for all the participants in the project to meet; however, the CL sessions made that happen. The IR organized the work in the CL sessions both in heterogenous and homogenous groups. When working in homogenous groups, the student teachers, for instance,

could obtain a deeper understanding of their own perspective and develop trustful collaboration that also could help them when presenting their experiences and thoughts to the other participants, which also could help the participants to develop an understanding of each other's perspectives and their work in the project. In this way, the CL established the foundation for collective agency (Morselli and Sannino, 2021), enabling participants to rely on one another as a resource for collective learning and, in turn, develop their relational capacity (Edwards, 2011; Pyhältö et al., 2014).

When dividing the participants into groups in CL sessions, the IR walks around observing, listening, commenting, and introducing models. In the dialogues, the IR suggests what the student teachers can do, and she asks questions to clarify what is said and to give direction to the dialogues. Furthermore, the IR supplements and strengthens utterances by offering summarizing statements. The IR introduces mirror data and the activity system and the expansive cycle, and both introduce and ask for ideas, alternating between these instruments (Engeström, 2007b). The IR organizes the processes, prepares the agendas, and plans the tasks (Engeström, 1987, 2015). The IR is not a knowledge provider, and the dialogues show that the aim is for the participants to create joint knowledge when addressing the challenges and possibilities connected to the work. The IR asks question to hear all the participants' opinions, thus emphasizing multivoicedness (Engeström, 1987) and collective agency (Morselli and Sannino, 2021). The IR is, according to the findings, both a process leader and a leader of the knowledge-construction process, but not a decider. The program of the CL sessions (see Table 2) can give the impression that the IR is a knowledge provider when presenting CHAT, its models, and the CL. However, it is reasonable to assume that participants must understand the significance of the different nodes within the activity system and have a theoretical grasp of CHAT to effectively participate in dialogues with the IR. Thus, the participants can comprehend the tools and language used.

The current study shows that the participants were encouraged to read texts about CHAT on their own, which could lead to a more in-depth understanding of the theory. Without a theoretical foundation, the use of the activity system (Engeström, 1987, 2015) and the expansive learning cycle (Engeström, 1987, 2001; Engeström and Sannino, 2010) would be an oversimplified use of the tools, an instrumental use applying everyday concepts to the nodes in the system and the steps in the cycle. The study indicates that CHAT, with its concepts and models, is helpful for the IR in leading CL sessions, but they have to be used wisely to create a community of trust and equality and, thus, not used in a manipulating way.

Concluding comments, implications and future research

In this study, the CL and the IR's role are expanded in various ways. The duration of each session is extended during the first year, and the overall time frame for the entire CL is also expanded. The CL sessions serve not only as analyses of contradictions and tensions to develop a new form of activity that can be done, but also as an arena for fostering tripartite collaboration and reaching a consensus on the collaborative content, such as the focus in

the student teachers' R&D assignments and master's theses. In this study, the CL participants were expanded compared to earlier studies where teacher educators and student teachers interacted within educational programs. In this study, student teachers, teacher educators, practice teachers, and the school headmaster all participated in the CL sessions. Additionally, the CL sessions occurred outside the formal educational program, complementing the student teachers' formal education.

In this study, the IR plays a multifaceted role beyond merely introducing mirror data, ideas, and the activity system "to envisioning, designing, and experimenting with new forms of work and a social setting in which this can be done" (Virkkunen and Newnham, 2013, p. 15). In the current study, the IR, in addition to utilizing these tools, required participants to engage in self-reflection considering relevant questions, and read texts related to CHAT to prepare for CL sessions. Furthermore, the IR engaged in dialogues with the co-researchers to identify relevant content for inclusion in the upcoming CL sessions. This approach facilitated a flow between the CL sessions and the work conducted outside the sessions, which was directly related to the student teachers' R&D assignments and their master's theses. In these processes the IR also functioned as a leader and a supervisor during the planning and collaboration work in the CL session, adding to the IR's regular role.

Implications

The study shows that IR-led processes in CL sessions within educational settings must consider that the CL will expand beyond its typical description of a full CL. The content of the CL sessions is not solely focused on resolving tensions and contradictions but also on planning actions in practice. Furthermore, to ensure continuity in CL session processes, the IR benefits from collaborating with other researchers participating in the CL—referred to in this study as co-researchers—to gain insights into what happens outside the CL session. To enhance continuity, the IR can also introduce mirror data from previous CL sessions. This requires the IR to continuously analyze transcripts of recorded CL sessions to structure upcoming sessions. Furthermore, the study highlights the importance of the IR listening to all perspectives to foster multivoicedness in CL sessions, thereby creating an arena characterized by trust and collective agency.

The study is based on one CL conducted in an educational setting including student teachers, practice teachers and teacher educators. The purpose of the article was to show how the CL can be arena for collaboration in teacher education and what role the IR can have in these processes. The article does not lay the foundation for statistical generalization, but for naturalistic generalization (Stake and Trumbull, 1982), meaning that the findings can be adapted and transferred to similar settings.

Future research

Dialogue 2 shows how one of the teacher educators thinks with the help of the activity system as a tool and how the IR suggests that one of the student teachers could use the expansive learning cycle. It could be interesting for future research to conduct a study on how participants in CLs can appropriate the ideas and tools that are used and introduce them in their own projects with the aim of developing their practice.

In the current study, the IR had several years of experience as a teacher educator. The IR also had several years of experience as a teacher in schools, which made her familiar with both classroom practice and teacher education. In addition three of the co-researchers had similar experience as that of the IR. These are valid reasons to believe that the CL could serve as a central hub for fostering collaboration among the involved parties and facilitating their joint efforts in tripartite collaboration. It could be interesting for future research to focus on the IR's background and experience and explore how this impacts his og her role in the CL and how the CL is utilized as an arena for expansive learning and development.

According to Virkkunen and Newnham (2013), the community in a CL should work intensively but not in isolation, instead discussing their insights with the other members of the organization. Engeström (1996) also states that participants in a CL should tell others what they have learned. The student teachers reflected on how CL sessions could be incorporated into the broader teacher education institution. A seminar was organized for the entire teacher education program to expand the project. The intention was to share with the participants in this seminar what they had experienced and learned during the project. However, it remains an open question whether and how this arrangement can lead to collective knowledge construction within an organization. More development work and research must be done in connection with such projects to develop new thoughts and ideas about transfer and sustainability.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by SIKT - kunskapssektorens tjenesteleverandør. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

MP: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

Funding

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Generative AI statement

The author(s) declare that no Gen AI was used in the creation of this manuscript.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References

Andreassen, S. E. (2015). Studenter og praksislærer sammen om aksjonsforskning [Students and Practicum Teachers Together in Action Research]," in *Veier til fremragende lærerutdanning [Roads to Excellent Teacher Education]*, eds. U. Rindal, A. Lund, and R. Jakhelln (Oslo: Universitetsforlaget), 87–98.

Augustsson, D. (2021). Expansive learning un a change laboratory intervention for teacher. *J. Educ. Change* 22, 475–499. doi: 10.1007/s10833-020-09404-0

Botha, L. R. (2017). Changing education traditions with the change laboratory. *Educ. Change* 21, 73–93. doi: 10.17159/1947-9417/2017/861

Chang, S. (2014). Developing preservice bilingual teachers' transformative agency. *Teach. Teach. Educ.* 137:104405. doi: 10.1016/j.tate.2023.104405

Chang, S. (2021). Supporting expansive learning in preservice bilingual teachers' zone of proximal development of the activity system: an analyses of a four-field model trajectory. *Prof. Dev. Educ.* 47, 225–242. doi: 10.1080/19415257.2021.1879232

Chang, S., Martinéz-Roldàn, C. M., and Torres-Guzmán, M. (2021). The manifestation of Chinese perservice bilingual teachers' relational agency in a change laboratory. *Mind Cult. Act.* 28, 44–60. doi: 10.1080/10749039.2021.1881125

Cole, M., Engeström, Y., and Vazques, O. (1997). "Introduction," in *Mind, Culture, and Activity. Seminal Papers from the Laboratory of Comparative Human Cognition*, eds. M. Cole, Y. Engeström, and O. Vazques (Cambridge, MD: Cambridge University Press), 1–20.

Cole, M. (1996). *Cultural Psychology: A Once and Future Discipline*. Cambridge, MD: The Belknap Press of Harvard University Press.

Corbin, J., and Strauss, A. (2013). *Basics of Qualitative Research*. Thousand Oaks, CA: Sage Publications, Inc.

Creswell (2013). *Qualitative Inquiry and Research Design: Choosing Among Five Approaches, 3rd Edn.* Thousand Oaks, CA: SAGE Publications Inc.

Davydov, V. V. (1990). *Types of Generalization in Instruction: Logical and Psychological Problems in the Structuring of School Curricula*. Reston, VA: National Council of Teachers of Mathematics.

Diao, C., Zhou, X., Mao, Q., and Hing, J. (2022). The development of transformative agency of teachers in teaching research activities in China. *Front. Psychol.* 12:724175. doi: 10.3389/fpsyg.2021.724175

Edwards, A. (2011). Building common knowledge at the boundaries between professional practices: relational agency and relational expertise in systems of distributed expertise. *Int. J. Educ. Res.* 50, 33–39. doi: 10.1016/j.ijer.2011.04.007

Engeström, Y. (1987). *Learning by Expanding*. Orienta-Konsultit Oy: Cambridge University Press.

Engeström, Y. (1996). Developing as breaking away and opening up: a challenge to Vygotsky and Piaget. *Swiss J. Psychol.* 55, 126–132.

Engeström, Y. (2001). *Expansive learning at work:* toward an activity-theoretical reconceptualization. *J. Educ. Work* 14, 133–156. doi: 10.1080/13639080123238

Engeström, Y. (2007a). Enriching the theory of expansive learning: lessons from journeys toward coconfiguration. *Mind Cult. Activity* 14, 23–39. doi: 10.1080/10749030701307689

Engeström, Y. (2007b). "Putting Vygotsky to work. The change laboratory as an application of double stimulation," in *The Cambridge Companion to Vygotsky*, eds. H. Daniels, M. Cole, and J. Wertsch (Cambridge University Press), 363–382.

Engeström, Y. (2015). *Learning by Expanding.*Cambridge: Cambridge University Press.

Engeström, Y., Rantavuori, J., and Kerosuo, H. (2013). Expansive learning in a library: actions, cycles and deviations from instructional intentions. *Vocat. Learn.* 6, 81–106. doi: 10.1007/s12186-012-9089-6

Engeström, Y., and Sannino, A. (2010). Studies of expansive learning: Foundations, findings and future challenges. *Educ. Res. Rev.* 5, 1–24. doi: 10.1016/j.edurev.2009.12.002

Engeström, Y., Sannino, A., and Virkkunen, J. (2014). On the methodological demands of formative interventions. *Mind Cult. Act.* 21, 118–128. doi: 10.1080/10749039.2014.891868

Hopwood, N., Dhungana, P., Pant, B. P., Shrestha, D., and Shahi, R. (2023). *Professional learning promoting agency in challenging practice contexts. Stud. Conti. Educ.* 46, 177–196. doi: 10.1080/0158037X.2023.2219051

Jakhelln, R., and Pörn, M. (2018). Challenges in supporting and assessing bachelor's theses based on action research in initial teacher education. *Educ. Action Res.* 27, 1–16. doi: 10.1080/09650792.2018.1491411

Lave, J., and Wenger, E. (1991). *Situated Learning. Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

Leontèv, A. (1978). *Activity, Consciousness, and Personality*. London: Prentice-Hall.

Leontèv, A. N. (1981). "The problem of activity in psychology," in *The Concept of Activity in Soviet Psychology*, ed. J.V. Wertsch (Armonk, NY: M.E. Sharpe, Inc.), 37–71.

Lillejord, S., and Børte, K. (2017). *Lærerutdanning som profesjonsutdanning – forutsetninger og prinsipper fra forskning. Et kunnskapsgrunnlag*. Oslo: Kunnskapssenter for utdanning.

Lincoln, Y. S., and Guba, E. G. (1985). *Naturalistic Inquiry*. Thousand Oaks, CA: Sage Publications, Inc.

Martínez-Álvarez, P., López-Velásquez, A., Kajamaa, A. (2021). Preparing educators for inclusive bilingual education: a boundary crossing laboratory between professional groups. *Cult. Hist. Psychol.* 17, 125–134. doi: 10.17759/chp.2021170316

Morselli, D., and Sannino, A. (2021). Testing the model of double stimulation in a change laboratory. *Teach. Teach. Educ.* 97:103224. doi: 10.1016/j.tate.2020.103224

Mukute, M., Mudokwani, K., McAllister, G., and Nyikahadzoi, K. (2018). Exploring the potential of developmental work research and change laboratory to support sustainability transformations: a case study of organic agriculture in Zimbabwe. *Mind Cult. Act.* 25, 229–246. doi: 10.1080/10749039.2018.1451542

NESH (2021). *The National Committee for Research Ethics in the Social Sciences and the Humanities*. Available online at: https://www.forskningsetikk.no/en/guidelines/social-sciences-humanities-law-and-theology/guidelines-for-research-ethics-in-the-social-sciences-humanities-law-and-theology/ (Accessed January 01, 2025).

Postholm, M. B. (2024a). A meeting place for meaningful collaboration – student teachers' experiences and learning. *Educ. Res.* 66, 1–17. doi: 10.1080/00131881.2024.2357106

Postholm, M. B. (2024b). Teacher educators in universities and schools' experiences and learning using the change laboratory as a meeting place. *Cogent Educ.* 11:2358292. doi: 10.1080/2331186X.2024.2358292

Postholm, M. B., Klemp, T., and Nordbotn, M, (2023). Tripartite collaboration in student research and development projects. *Scand. J. Educ. Res*. 68, 1424–1438. doi: 10.1080/00313831.2023.2250371

Prokopis, D., Sannino, A., and Mykkänen, A. (2022). Toward a new beginning: exploring the instructional dynamics of expansive learning with workers in a youth supported housing unit. *J. Workplace Learn*. 34, 628–642. doi: 10.1108/JWL-11-2021-0157

Pyhältö, K., Pietarinen, J., and Soini, T. (2014). Comprehensive school teachers' professional agency in large-scale educational change. *J. Educ. Change* 15, 303–325. doi: 10.1007/s10833-013-9215-8

Rogoff, B. (1992). Three ways to relate person and culture: thoughts sparked by Valsiner's review of apprenticeship of thinking. *Hum. Dev*. 35, 316–320. doi: 10.1159/000277225

Salloum, S., and BouJaoude, S. (2023). Formative interventions for science teachers' expansive learning and practices with multilingual learners: a case study from Lebanon. *Prof. Dev. Educ*. 1–23. doi: 10.1080/19415257.2022. 2162563

Sannino, A. (2008). From talk to action: Experiencing interlocution in developmental interventions. *Mind, Culture, and Activity,* 15, 234–257. doi: 10.1080/10749030802186769

Sannino, A., Engeström, Y., and Lemos, M. (2016). Formative interventions for expansive learning and transformative agency. *J. Learn. Sci*. 25, 599–633. doi: 10.1080/10508406.2016.1204547

Spante, M., Varga, A., and Carlsson, L. (2022). Triggering sustainable profesional agency: using change laboratory to tackle unequal access to educational success

collectively. *J. Workplace Learn*. 24, 162–175. doi: 10.1108/JWL-02-2021-0019

Stake, R. E., and Trumbull, D. (1982). Naturalistic generalization. *Rev. J. Philos. Soc. Sci*. 7, 1–12.

Strauss, A., and Corbin, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Thousand Oaks, CA: Sage Publications, Inc.

Trippestad, T. A., Swennen, A., and Werler, T. (2017). "The struggle for teacher education," in *The Struggle for Teacher Education: International Perspectives on Governance and Reforms,* eds. T. A Trippestad, A. Swennen, and T. Werler (London: Bloomsbury Academic), 17–37.

Virkkunen, J. (2006). Dilemmas in building shared transformative agency. *Activites* 3, 44–66. doi: 10.4000/activites.1850

Virkkunen, J., and Ahonen, H. (2011). Supporting expansive learning through theoretical-genetic reflection in the change laboratory. *J. Organ. Change Manag*. 24, 229–243. doi: 10.1108/09534811111119780

Virkkunen, J., Newnham, D. S., Nleya, P., and Engeström, R. (2012). Breaking the vicious circle of categorizing students in school. *Learn. Cult. Soc. Interact*. 1, 183–192. doi: 10.1016/j.lcsi.2012.08.003

Virkkunen, J., and Newnham, D. S. (2013). *The Change Laboratory. A Tool for Collaborative Development of Work and Education*. Rotterdam: Sense Publishers.

Vygotsky, L. S. (1978). *Mind in Society. The Development of Higher Psychological Processes*. London: Harvard University Press.

Wertsch, J. V. (1991). *Voices of the Mind. A Sociocultural Approach to Mediated Action*. London: Harvard University Press.