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Advancing student teachers' learning in the teaching practicum through Content-Focused Coaching: A field experiment

Eva S. Becker ^{a,*}, Monika Waldis ^b, Fritz C. Staub ^a

^a University of Zurich, Switzerland

^b FHNW University of Applied Sciences and Arts Northwestern Switzerland, Switzerland

HIGHLIGHTS

- Instructional coaching is an essential facet for supporting student teachers in the teaching practicum.
- CFC-elements can be introduced in brief training sessions and influence cooperating teachers' practice.
- Pre-lesson conferences were conducted more often and with longer durations.
- Collaborative assistance and constructive feedback and reflection in lesson conferences were enhanced.
- Student teachers' instructional quality (as reported by pupils) developed more positively.

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ABSTRACT

A pivotal role of cooperating teachers is to assist student teachers' planning, enacting and reflecting of lessons during the teaching practicum. This study evaluated training sessions in elements of Content-Focused Coaching: 59 cooperating teachers were randomly allocated to a training session in: a) pre-lesson conferences for joint lesson planning, b) core issues for lesson designs, c) both elements or d) another educational topic (control group). Effects on the quality of collaborative exchange in lesson conferences, student teachers' competency gains, and instructional quality (as reported by pupils) were examined during a three-week teaching practicum. Implications for professional development programs are discussed.

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1. Introduction

Field experiences and the teaching practicum constitute important parts in teacher education programs. The teaching practicum serves various functions and is considered to be “a unique time in teachers' professional development” (Fives, Hamman, & Olivarez, 2007, p. 917). It offers the opportunity to develop and reflect on teaching skills, gain vicarious experiences by observing and learning from knowledgeable others and to relate theoretical knowledge acquired at universities with experience-based learning in schools (e.g., Flores, 2015; Korthagen, 2010;

Schön, 1983).

Student teachers (STs) typically attribute the teaching practicum as highly effective in developing their competencies (Hascher, Cocard, & Moser, 2004; Hoppe-Graff, Schroeter, & Flagmeyer, 2008; Smith & Lev-Ari, 2005). Furthermore, the teaching practicum is considered one of the most important components of the teacher preparation program (e.g., Clarke, Triggs, & Nielsen, 2014). However, it is not practice per se that makes a teaching practicum “effective” (Grudnoff, 2011). For instance, Hodges (1982) found that STs could not handle the classroom pressures (e.g., pupil management) in an unsupervised teaching practicum and were overwhelmed by handling their experiences alone. Similarly, Ronfeldt & Reiniger (2012) showed that it was not the length of the teaching practicum that was associated with STs' perceptions of instructional preparedness or their self-efficacy but the quality of perceived support. Thus, “appropriate support mechanisms”

* Corresponding author. Department of Education, University of Zurich, Switzerland.

E-mail address: eva.becker@ife.uzh.ch (E.S. Becker).

(Gurvitch & Metzler, 2009) during practical phases are essential for STs' skill acquisition.

STs are usually supported, supervised and mentored by experienced school-based teachers (i.e., cooperating teachers¹) and/or university supervisors (i.e., teacher educators) during their teaching practicum (Lawson, Çakmak, Gündüz, & Busher, 2015). In Switzerland cooperating teachers (CTs) have the most frequent interaction with STs during their teaching practicum. CTs assist STs in their daily activities, whereas teacher educators usually only supervise single teaching units. The contribution of CTs to the professionalization of STs is generally highly valued (Borko & Mayfield, 1995) and considered to be “a cornerstone of teacher preparation programs” (Mena, Hennissen, & Loughran, 2017, p. 48). However, the intensity and methods of supporting STs are very heterogeneous between and also within teacher education programs (e.g., Martins, Costa, & Onofre, 2015). There are a variety of different approaches to support field experiences (e.g., Futter, 2017; Hennissen, Crasborn, Brouwer, Korthagen, & Bergen, 2008; Wang & Odell, 2002) and CTs are differently prepared for their important tasks (in some countries or states mostly with alternative certifications not offered by the institutions of teacher education, see Hoffman et al., 2015). Despite a growing body of research focusing on the teaching practicum, most of it is based on qualitative research designs (Lawson et al., 2015) and the impact of specific mentoring and supporting tools on STs' development and teaching skills has not yet been sufficiently researched with experimental designs (Hobson, Ashby, Malderez, & Tomlinson, 2009; Spooner-Lane, 2017).

The present study seeks to address this research gap through a field experiment evaluating the effects of a short professional development training for CTs. The training focuses on two specific tools that are based on Content-Focused Coaching (CFC; see West & Staub, 2003), namely collaborative exchange in pre-lesson conferences and a list of core issues that help to plan and reflect the lesson design. Coaching processes have been studied pre-dominantly in regard to providing support for in-service teachers (e.g., instructional coaching, see Denton & Hasbrouck, 2009), but it is increasingly recognized as an important facet for supervising the teaching practicum (Hoffman et al., 2015). Within our study, CTs were randomly assigned either to a control group or to one of three intervention groups that received brief training sessions in 1) pre-lesson conferences for joint lesson planning, 2) core issues for lesson designs and 3) both elements, before supervising a teaching practicum. We investigated effects on CTs' practice and learning in the teaching practicum, i.e., STs' professional development (self-reported) and their instructional quality (as perceived by pupils) in a longitudinal research design.

2. CTs' tasks in teacher preparation programs

In the majority of teacher preparation programs throughout the world, universities collaborate with schools and school-based CTs in order to support learning processes in the field, to improve the quality of teaching and also to ease the confrontation with the reality of the classroom (see also Dicke, Elling, Schmeck, & Leutner, 2015; Lee & Feng, 2007). CTs are experienced classroom teachers who take on different roles in the teaching practicum from being an “Observer”, a “Provider of Feedback”, an “Instructor”, an “Equal Partner” or “Mentor” (for an overview see Kwan & Lopez-Real,

2005). STs report that they primarily expect their CTs to offer instructional (also called task assistance) and emotional support (Davis & Fantozzi, 2016; Hennissen, Crasborn, Brouwer, Korthagen, & Bergen, 2011). Similar goals have been identified for mentoring beginning teachers in induction programs (Gold, 1996; Richter et al., 2013).

Emotional support includes careful listening, building confidence, encouraging self-esteem, and enhancing self-reliance (Gold, 1996). Supportive CTs enable STs to put difficult experiences into perspective, which helps them to increase their motivation and job satisfaction. A number of studies document the importance of the interpersonal relationship between CTs and STs (e.g., Beck & Kosnik, 2002; Hobson et al., 2009; Hudson, 2016). Providing emotional support can impact affective experiences such as an increased sense of safety and confidence or reduced feelings of isolation and stress (e.g., Bullough, 2005). CTs that demonstrate responsibility, sharing, and adaptability can initiate processes of reflective practices (Nguyen, 2009) and risk-taking for greater learning (Stanulis & Russell, 2000). The importance of the emotional support component might be even higher for assisting pre-service teachers as compared to in-service teachers. Grudnoff (2011) pointed out that the evaluative component might be more accentuated during a teaching practicum, potentially harming the relationship between the CT and the ST. It is thus important to prepare CTs for potentially conflicting roles, and to propose settings and tools for creating an atmosphere in which STs can openly discuss teaching-related questions (see also Gibbons & Cobb, 2017).

Instructional support or *task assistance* fosters the development of the professional knowledge and skills needed to succeed in the classroom (Gold, 1996). It includes, among others, assistance with lesson planning, instruction-related feedback and advice, and help with assessment and diagnostic issues. By offering instructional support, learning activities that support pupils' learning in the classroom are emphasized (Todorova, Sunder, Steffensky, & Möller, 2017). Hence, it is expected that instructional support not only impact (student) teachers' competence (knowledge and skills) but also the quality of instruction and pupils' learning (Richter et al., 2013). Instructional support is targeted in a variety of coaching programs for in-service teachers and its positive effects have been repeatedly shown (for a current meta-analysis see Kraft, Blazar, & Hogan, 2018). However, empirical results for the effectiveness of specific instructional support mechanisms for pre-service teachers are scarce. An exception is the study by Matsko et al. (2018) who have found that domain-specific instructional support is related to STs' self-perceived perceptions of preparedness to teach. To gain more evidence-based knowledge on what kind of assistance advances learning during the teaching practicum and how to prepare CTs for their tasks, careful investigations of the quality of specific mentoring and coaching strategies and their implementation in practice are required.

3. Strategies and tools to support a teaching practicum

Supporting STs in their teaching practicum and offering emotional and instructional support is a demanding task that requires sufficient time for interactions and also specific strategies for these interactions. A lack of time in dialogues seems to be problematic to build a relationship, establish effective communication and support the learning of STs (e.g., Hudson, 2016; Mukeredzi, 2017; Zanting, Verloop, & Vermunt, 2001). Empirical studies have also shown that strategies that optimally foster STs' learning are not innate - although CTs usually bring a wealth of teaching experience with them - but must be developed and practiced (Crasborn & Hennissen, 2010). Interactions with CTs who received no specific training often revolve around matters of technical rationality and

¹ Other studies have used various other terms to refer to these teachers, such as associate teachers (e.g., Ferrier-Kerr, 2009), (school-based) mentors (e.g., Bullough, 2005), supervising teachers (e.g., Stenberg, Rajala, & Hilppo, 2016) or mentor teachers (e.g., Hennissen et al., 2008).

practical issues, whereas subject-specific pedagogical issues and the principle-based examination of teaching and learning processes often receive insufficient attention (Borko & Mayfield, 1995; Hobson et al., 2009; Høynes, Klemp, & Nilssen, 2019). Hence, it seems important to provide CTs with tools that help them focus their conversations with student-teachers on relevant (subject-specific) aspects that foster pupils' learning.

Furthermore, studies have shown that CTs spent a large proportion of their time in post-lesson conferences conversing with STs (Crasborn & Hennissen, 2010; Gröschner & Seidel, 2012). In these conferences feedback is often given in the form of practical advice, whereas CTs rarely encourage in-depth reflection on teaching and learning processes or pupils' learning (Hoffman et al., 2015; Schüpbach, 2007). There seems to be a tendency for asymmetric dialogue (see Marková & Foppa, 1991) regarding the amount of speaking time and thematic and interactional control, that is CTs tend to dominate the conversations with STs (Bullough et al., 2002; Haggarty, 1995; Futter & Staub, 2017). To support STs in taking an active role for their professional growth and to come up with their own questions and learning needs, CTs are advised to lead discussions in a less directive manner. For instance, by taking the ST's perspective as a starting point, showing attentive behavior and using open-ended questions (Crasborn & Hennissen, 2010; Hennissen et al., 2008).

The presented findings raise the questions of how CTs can be prepared for their demanding tasks? A wide range of approaches and programs have emerged (see also Sorensen, 2012) such as coaching based on the concept of the reflective practitioner (Schön, 1983), educative mentoring (Feiman-Nemser, 1998), the SMART program (Supervision Skills for Mentor teachers to Activate Reflection in Teachers; Crasborn & Hennissen, 2014) or programs that focus on joint mentoring processes between university-based teacher educators, CTs and STs such as 3-level mentoring (Niggli, 2003) or the SMILE program (Chizhik, Chizhik, Close, & Gallego, 2018). These programs were effective in changing CTs' practices and how they see their role in teacher preparation programs. However, their effects on STs' competency development or teaching quality has, to our knowledge, rarely been investigated. In addition, the approaches and programs are rather broad and include various supporting methods. Hence, it is difficult to distinguish which aspects of the program have the strongest effect on CTs' practice and STs' learning and which aspects are a worthwhile focus in shorter professional development programs. The present study builds on the approach of CFC (West & Staub, 2003), a form of instructional coaching, but specifically focuses on two elements or tools that can be proposed in brief training sessions to foster emotional and especially instructional support in the teaching practicum.

4. Content-Focused Coaching

At the turn of the century, CFC was developed in the context of providing professional development as part of systemic school development projects, offered by the Institute for Learning at the University of Pittsburgh. At that time, coaches trained in CFC began supporting experienced and novice teachers on-the-job to foster their habit of mind in creating productive learning environments (see West & Staub, 2003 and Staub, 2004 for more details on the origins of the CFC model). In the US, CFC is now used in many districts to provide on-the-job support for in-service teachers mostly by Mathematics Coaches and English Literacy Coaches for elementary school teachers (see Gibbons & Cobb, 2016). In Switzerland and Germany, CFC has been extended and adapted for use in STs' education programs in a variety of disciplines by providing trainings for CTs or university-based teacher educators (see e.g., Becker & Staub, 2018; Kreis & Staub, 2011).

4.1. Elements of Content-Focused Coaching

CFC is grounded in a coaching cycle of pre-lesson conferences and the enactment of lessons and post-lesson conferences. It does not prescribe specific instructional methods but supports the learner in their daily activities of planning, teaching and reflecting on lessons by proposing settings and tools for coaching interactions. The present study focuses on two main elements of CFC, namely the usage of a set of *core issues* for lesson designs and engaging in co-constructive dialogues, especially in the planning stage of a lesson (*pre-lesson conferences*). Other coaching activities in CFC such as modelling instruction or co-teaching were not focused on in the training sessions (for more details on these elements of CFC see e.g., Gibbons & Cobb, 2016, 2017; West & Cameron, 2013).

Core issues for lesson designs represent a list of guiding questions that were developed as a practical tool for coaching dialogues to support the design and development of effective teaching strategies that foster pupils' learning. They are founded on principles of learning drawn from research in cognitive psychology, such as articulating clear expectations or helping pupils recognize their accomplishments (Resnick & Williams, 2005). To infuse principle-based thinking into practice, a related set of questions has been developed (Staub, 2001; 2004) that covers four main areas: 1) subject matter and learning objectives of the lesson, 2) embedding the lesson in a broader planning horizon and the curriculum, 3) pre-knowledge and (anticipated) learning difficulties of the learners, and 4) lesson design to support the intended learning outcomes. The corresponding questions (see Table 1) can be flexibly used as a framework to address pivotal issues when planning a or reflecting on a lesson. Their purpose is to initiate a thorough understanding of teaching content, the clarification of learning objectives and competencies, a thoughtful lesson design and the anticipation and close monitoring of reaching learning goals.

Another key element of CFC in the teaching practicum is the use of *pre-lesson conferences* that aim for the joint development of lesson plans. *Pre-lesson conferences* are recommended to communicate lesson objectives and teaching strategies. Lesson planning is understood as a design problem that needs to be solved co-constructively between the CT and the ST (Staub, 2001). In the process of agreeing on a shared lesson plan, the CT invites the ST to express his or her own ideas, beliefs and convictions; to elaborate on lesson ideas; and to justify choices by using invitational conversation techniques. During this process the CT gives direct assistance and uses meta communication for strategic planning and coordination (in CFC called coaching moves; see Staub, 2015). The aim of CFC is to reduce asymmetries in dialogues by striking a balance between patience and active listening on the one hand, and the introduction of lesson-design proposals, suggestions and arguments on the other hand. This demanding task might be easier to accomplish in pre-lesson conferences, as they offer a setting in which the evaluative component is less accentuated: Here jointly planning a lesson is the focus and not something the ST did or did not do in a lesson. Proposals and recommendations can be articulated more openly, in a dialogue of mutual respect in which both partners can bring in their own questions and ideas.

4.2. Empirical evidence on the effectiveness of CFC

Various studies have explored the effectiveness of the CFC approach for increasing teaching quality and pupils' learning for in-service teachers (for an overview see Matsumura, Garnier, & Spybrook, 2013). Fewer studies have demonstrated the applicability of CFC in the teaching practicum because CFC was originally developed for the training of experienced and novice teachers. A quasi-experimental study during teaching practicums for primary

Table 1
Core issues for lesson designs with guiding questions.

1. Subject matter and learning objectives of the lesson
- What is/was the intended learning outcome? What are/were the learning goals of the lesson?
- What are/were the central concepts?
- Should certain strategies be/have been developed?
- What skills should be/have been promoted in this lesson?
2. Embedding the lesson in a broader planning horizon and the curriculum
- Do any of these concepts and/or skills get addressed at other points in the unit?
- Which goal is/was a priority with regard to the entire teaching unit?
- Is/was the lesson design targeted at the main goal of the lesson?
- What are the main curricular contents we are/were working towards?
3. Pre-knowledge and possible learning difficulties of the learners
- What relevant concepts have already been explored with this class?
- What strategies do/did the learners need to know?
- What relevant experiences of students can/could we draw on in relation to this concept?
- What difficulties, ambiguities or misconceptions are/were pupils confronted with?
4. Lesson design that supports the intended learning outcome
- What teaching methods are/were used and why for these particular contents?
- How should/was the beginning of the lesson (be) organized?
- What are/were the concrete tasks and instructions?
- What models, visuals and/or other instructional materials are/were used? How and why?
- In what ways are/were pupils encouraged to share their thinking and understanding?
- What are/were the indicators for pupils learning?
- How is/was ensured that pupils are/were engaging in discussions about important lesson contents, listening to one another in an atmosphere of mutual respect?
- How are/were pupils' new ideas highlighted and clarified?
- How is/was newly constructed knowledge consolidated through practical phases?
- How are/were pupils who have/had particular difficulties supported?
- What additional or enriched tasks are/were provided for high-achieving pupils?
- How is/was the progress acknowledged?
- Is/was the time allocated to each part of the lesson appropriate?

school teachers showed that both STs and CTs evaluated the newly introduced pre-lesson conference as useful for learning and developing professional competencies (Futter & Staub, 2008). Empirical findings from an extensive intervention study (50-h CFC-training for CTs plus about as many hours self-study time) showed that STs' learning gains and STs' quality of teaching were significantly higher in the intervention group compared to the control group (Kreis & Staub, 2011). However, the training effort for CTs was very high, which may be an obstacle to the wider application of the CFC approach.

The question remains, whether brief interventions that are tailored to practical time-restraints are still beneficial. Furthermore, existing studies on CFC mostly evaluated the applicability and learning effectiveness of pre-lesson conferences, while the use of core issues in the teaching practicum has yet to be evaluated systematically.

5. The present study and hypotheses

The present intervention study took place in the context of single-phase teacher education programs preparing STs for secondary I level (grade 7 through 9) in the German speaking part of Switzerland. Within these programs, STs must complete at least two practical phases (several weeks each) in cooperating schools where they are assisted by a CT. During this time STs have the obligation for teaching various classes for their CT in one or more subject domains. They have almost the same responsibilities as a professional teacher, that is preparing lessons, leading the class and

grading pupils work. As these are complex and difficult tasks for STs, CTs are asked to support STs through offering emotional and instructional support.

In order to prepare CTs for this support, different brief training sessions (two-and-a-half-hours) were carried out in this study. After an introductory talk, CTs were randomly allocated to a training session that focused either on the CFC element of pre-lesson conferences (group *P*), the CFC element of core issues for lesson designs (group *CI*), both elements (group *PCI*) or another educational topic, namely homework or school culture (group *Contr*). The two topics in the control group were highly relevant for teachers and schools but clearly distinct from CFC. STs were not informed about the specifics of the training activities of their CTs. The contents and procedures of the CFC interventions are described in detail in Table 2.

5.1. Hypotheses for effects on CTs' practice (manipulation check)

To examine if the proposed elements of the training sessions were indeed transferred into CTs' practice (manipulation check), the following hypotheses were investigated:

H1a. Learning about pre-lesson conferences (groups *P*, *PCI*) should lead to a higher percentage of enacted pre-lesson conferences as well as a longer duration of these conferences compared to the control group (group *Contr*).

H1b. The percentage of enacted post-lesson conferences is not expected to be affected by any of the interventions because post-lesson conferences are the traditional way of assisting STs. However, the duration of post-lesson conferences should be longer in the group only learning about core issues (*CI*) since these CTs will be specifically encouraged to use in-depth reflection on teaching and learning processes.

It is unclear if the duration of post-lesson conferences for groups *P* and *PCI* will differ from one another or the control group. On the one hand, it could be argued that the time available for lesson conferences was already used for pre-lesson conferences or that the pre-lesson conference might lead to very focused and short post-lesson reflection. On the other hand, it could be that aspects discussed in pre-lesson conferences will be taken up again after the lesson. This might extend the duration of post-lesson conferences.

H1c. CTs in groups learning about core issues (*CI* and *PCI*) are expected to discuss core issues in greater depth and intensity in lesson conferences with their ST.

5.2. Hypotheses for Effects on Learning in the Teaching Practicum (Intervention Effects)

Learning in the teaching practicum was expected to be evident in: a) the quality of collaborative exchange in lesson conferences as reported by the STs in lesson diaries, b) STs' self-reported competence gains in a retrospective online questionnaire and c) STs' quality of teaching as reported by their pupils.

H2a. Learning about pre-lesson conferences (groups *P*, *PCI*) enhances the quality of *collaborative assistance* given by the CTs during pre-lesson conferences since CTs are encouraged to assist STs with their lesson planning more thoroughly.

H2b. A higher quality of *constructive feedback and reflection* during post-lesson conferences is expected for all intervention groups (groups *P*, *CI*, *PCI*) as compared to the control group for two reasons: First, the *core issues* help structure reflection activities in post-lesson conferences. Second, the *pre-lesson conferences* may help

Table 2
Description of training sessions on elements of CFC.

Introductory talk with video examples for all groups, including control group (approximately 20 min)		
<ul style="list-style-type: none"> - Monologues and dialogues in lesson conferences (What do typical lesson conferences look like? Video example that shows how an idea is introduced in a post-lesson conference in a monologue; Video example that shows how an idea is introduced using a dialogic conversation style (starting with an open question, both bring in their views, idea is introduced as a suggestion) - Goal in lesson conferences: Supporting student teachers in combining different elements of teacher knowledge for a specific lesson design: What to teach? (content), How to teach? (teaching methods), Who to teach? (knowledge of a given group of learners) 		
Pre-Lesson Conferences (group <i>P</i>)	Core Issues (group <i>CI</i>)	Pre-Lesson Conferences and Core Issues (group <i>PCI</i>)
<p>Talk (approximately 15 min)</p> <ul style="list-style-type: none"> - Why are pre-lesson conferences important? - Procedure of pre-lesson conference: (1) student teacher presents first draft of lesson design; (2) the design is elaborated on and transformed in a dialogue; (3) student teacher and cooperating teacher recapitulate the most important changes to the lesson plan - Coaching moves to support dialogues: Invitational Moves, Direct Assistance, Meta-Communication <p>Working with video examples (approximately 30 min) Five short sequences from a lesson conference are shown that illustrate</p> <ol style="list-style-type: none"> 1) how the student teacher presents first draft of lesson design; 2) how the cooperating teacher uses invitational moves to elaborate on the lesson design in a dialogue; 3) how the cooperating teacher proposes ideas and gives direct assistance; 4) how the cooperating teacher and student teacher create new ideas in a joint lesson plan; 5) how the cooperating teacher recapitulates the most important changes to the lesson plan with the student teacher. <p>Group discussion on how to implement pre-lesson conferences into existing practice (approximately 10 min)</p> <p>Role-play (approximately 50 min) Cooperating teachers engaged in a role-play of a pre-lesson conference, which was analyzed and reflected on regarding the use of conversational techniques that support dialogues (e.g., waiting, attentive behavior, asking the coachee to bring in own ideas, asking open-ended questions).</p> <p>Exchange, Conclusion (approximately 15 min) Short recap on the experiences and learning gains from the role play</p>	<p>Group-activation (approximately 20 min)</p> <ul style="list-style-type: none"> - What aspects do you place particular emphasis on in your post-lesson conferences? - In your opinion, are there any aspects that should be discussed in every post-lesson conference? <p>Talk (approximately 20 min)</p> <ul style="list-style-type: none"> - What are the four core issues? How were they developed? How can core issues be used in lesson conferences? - Coaching Moves to support dialogues: Invitational Moves, Direct Assistance, Meta-Communication - Procedure of post-lesson conference: (1) exchange about perception of lesson; (2) joint reflection; (3) outlook on the next lesson and further conferences <p>Working in pairs: Participants received list of core issues and guiding questions and were asked to read it carefully and compare it with own practices (approximately 15 min)</p> <p>Working with video examples (approximately 50 min) Participants received background information on a mathematic lesson carried out by a student teacher. After watching a sequence of this lesson, they worked in pairs to analyze the lesson sequence: 1) What core issues would you address in a post-lesson conference? 2) How would you address them? 3) What are potential obstacles?</p> <p>Exchange, Conclusion (approximately 15 min) Short recap on how core issues can help to focus more strongly on relevant issues when reflecting on the lesson design</p>	<p>Talk (same as in group <i>P</i>)</p> <p>Working with video examples (same as in group <i>P</i>)</p> <p>Group discussion (same as in group <i>P</i>)</p> <p>Group-activation (same as in group <i>CI</i>)</p> <p>Talk (same as in group <i>CI</i>)</p> <p>Working in pairs (same as in group <i>CI</i>)</p> <p>Exchange, Conclusion (approximately 10 min) Short recap on how pre-lesson conferences and core issues can improve cooperating teachers' practice</p>

Note: The control group (group *Contr*) participated in a training session on school culture or homework after the introductory talk.

structure reflection activities, since CTs can refer to previously discussed topics.

H3. Higher *competency gains in cognitive activation and classroom management* are expected for all intervention groups (groups *P*, *CI*, *PCI*) as compared to the control group because of the intensified cooperation between STs and CTs. Furthermore, STs whose CT learned about *pre-lesson* conferences (groups *P*, *PCI*) may also claim higher *competency gains* in lesson planning. CTs in these groups were encouraged to invest time in pre-lesson conferences, offering STs the opportunity to gain vicarious experiences and assisted practice in lesson planning.

H4. Since CFC interventions explicitly focus on lesson design and pupils learning, all three intervention types (groups *P*, *CI*, *PCI*) are expected to have a positive impact on STs' development of instructional quality (*clarity of instruction, cognitive activation and pupils' disruptive behavior*) as perceived by their pupils.

6. Method

6.1. Recruitment

CTs were recruited from five institutions of teacher education in the context of a routine preparatory meeting for the teaching

practicum or they were individually contacted. In parallel, STs were recruited in the context of an institutional event providing information about the upcoming practicum. CTs and STs participated in this study on a voluntary basis. For reasons of comparability, the present study focuses on the subject domain of mathematics.

Approximately 130 CTs were randomly assigned to the four different training sessions with varying group sizes (maximum group size of 25 CTs). However, some CTs participating in the training sessions were unable to participate in the study for the following reasons: i) the CT and ST did not both consent to participating in the study; ii) the CT had previous experience with CFC; iii) the CT did not teach mathematics for grades 7 to 9. Thus, a large number of CTs participating in the training sessions were not able to participate in the study and the sample sizes between the different intervention groups differed slightly. The final sample included 59 CTs and their STs with 18 dyads in the control group (*Contr*), 12 dyads in the pre-lesson conferences group (*P*), 18 dyads in the core issues group (*CI*) and 11 dyads in combined pre-lesson conferences and core issues group (*PCI*).

6.2. Sample

CTs were 27–63 years old ($M_{\text{age}} = 43.93$ years, $SD = 9.85$) and mostly male (76.3% male). They possessed between 4 and 39 years of teaching experience ($M = 19.45$ years, $SD = 10.01$), on average

8.24 years ($SD = 7.52$) of experience as a CT and the vast majority (89.5%) had previously supported at least one teaching practicum. The 59 STs included in our study were 20–33 years old ($M_{\text{age}} = 23.3$ years, $SD = 2.66$) and 55.9% were female. On average, STs were enrolled in their sixth semester ($M = 6.24$, $SD = 1.09$) and their study goal was to obtain a master's degree with a teaching qualification at the secondary I level. They all studied mathematics in addition to up to three other school subjects. Data collection focused only on math teaching. Thereby, each ST participated with one mathematic class ($n = 59$ classes) in either grade 7 (27.1%), grade 8 (45.8%) or grade 9 (27.1%) resulting in a total of 1000 pupils ($M = 16.95$ students per class) participating in the study ($M_{\text{age}} = 14.48$ years, $SD = 1.00$; 51.7% male).²

6.3. Sampling and measures

The present study focused on the effects of CFC training sessions on the quality of collaborative exchange, STs' competency gains and the development of instructional quality. Thereby, data was collected from STs and pupils as they are the recipients of CTs' practices. During the first three weeks of the teaching practicum following the training sessions, STs were asked to report on the lessons carried out in the selected mathematic class and the associated lesson conferences in an online-diary with scaled items. They were asked to fill out the online-diary by the end of the day on which the mathematic lesson(s) took place. A total of 479 online-entries ($M = 8.12$, $SD = 2.25$, $\text{Min} = 4$, $\text{Max} = 14$) were generated. Furthermore, a short questionnaire evaluating several instructional quality features was administered to the pupils of the classes being taught by the ST in the last mathematic lesson of the first, second and third week of the practicum. At the end of the third week of the practicum, STs were additionally asked to fill out a retrospective online-questionnaire evaluating their own learning experiences and competency gains. All employed scales and items can be found in Appendix B.

Occurrence and duration of pre-/post-lesson conferences.

The occurrence and duration of pre-lesson conferences accompanying the mathematic lessons were assessed in STs' online questionnaires with single items such as "Did you have a pre-lesson conference prior to the current mathematic lesson?" (Answer format: yes/no) and (if yes) "How long was the duration of the pre-lesson conference?" (Answer format in minutes). For post-lesson conferences STs were asked "Did you have a post-lesson conference after the current mathematic lesson" (Answer format: yes/no/not yet, but scheduled for later) and again (if yes) "How long was the duration of the post-lesson conference".

Use of core issues in pre-/post-lesson conferences. On days with completed lesson conferences, STs indicated (separately for pre- and post-lesson conferences) how intensively six teaching relevant questions related to the four main areas of the core issues were discussed using a 5-point Likert-scale from 0 = not at all to 4 = very intensively (e.g., "How intensively did you discuss the objectives of the lesson with your CT in the last pre/post-lesson conference?"). Reliability of these daily measures was assessed by using a three-level model with items (Level 1) nested in days (Level 2) nested in STs (Level 3) following the recommendations of Nezlek (2012) to correct for within- and between person variability. These analyses were conducted with HLM 7.01 (Raudenbush, Bryk, & Congdon, 2013) and showed sufficient reliability estimates for the

scale (0.82 for core issues discussed in pre-lesson conferences and 0.78 for core issues discussed in post-lesson conferences).

Quality of Collaborative Exchange. STs were asked to assess the quality of collaborative exchange in lesson conferences regarding collaborative assistance in pre-lesson conferences (e.g., "In the pre-lesson conference we changed and developed the lesson plan together") and constructive feedback and reflection in post-lesson conferences (e.g., "In the post-lesson conference the CT offered suggestions on how to improve the lesson design"). Some items were taken from Schüpbach (2007); however, others were specifically developed for our study. The items were answered on a four-point-Likert scale from 1 = completely disagree to 4 = completely agree. The scales, built from four items each, yielded acceptable reliability in a three-level model (0.84 for collaborative assistance and 0.69 for constructive feedback and reflection).

Competency gains. At the end of the third week of the practicum STs were asked to report on their own competency gains in terms of lesson planning, cognitive activation and classroom management. The three scales, each including four items, were adapted from former research projects (Gröschner, Schmitt, & Seidel, 2013; Hascher et al., 2004) emphasizing knowledge and skills acquisition of STs. Answers were given on a 6-point Likert scale from 0 = nothing to 5 = very much. Sample items are "How much did you learn through the (pre- or post-) lesson conferences with respect to aligning the lesson design with the major learning goal of the lesson?" (competency gains in lesson planning; $\alpha = 0.78$); "How much did you learn through the (pre- or post-) lesson conferences with respect to adapting the expectations of the lesson to pupils' knowledge and skills level" (competency gains in cognitive activation; $\alpha = 0.78$) and "How much did you learn through the conducted (pre- or post-) lesson conferences with respect to ensuring smooth transitions between individual teaching elements" (competency gains in classroom management; $\alpha = 0.81$).

Pupils' perception of STs' instructional quality. Three basic aspects of instructional quality, namely cognitive activation, disruptive classroom behavior and clarity of instruction were assessed at the end of the first, second and third week of the practicum with scales from the TIMSS and COACTIV research projects (see e.g., Lipowsky et al., 2009). Pupils were instructed to rate the items with respect to the mathematic lessons during the current week on a 4-point Likert scale ranging from 1 = completely disagree to 4 = completely agree. Two reliability estimates were calculated: First, reliability of the mean scale response for each pupil was estimated with three-level models (items nested within measurement occasions nested within pupils). Second, the reliability of class aggregated scale means for each measurement occasion were estimated by using intraclass correlations³ to confirm that there is sufficient agreement among pupils to assess teachers' classroom behavior (Lüdtke, Robitzsch, Trautwein, & Kunter, 2009). Cognitive activation was assessed with six items (e.g., "This week in our mathematic lessons, the ST encouraged us to ask questions"; reliability estimate = 0.77; ICC2 = 0.83/0.80/0.82). Disruptive classroom behavior was assessed with four items (e.g., "This week in our mathematic lessons, it took a long time until we were ready to work"; reliability estimate = 0.66; ICC2 = 0.81/0.82/0.83) and clarity of instruction was also assessed with four items (e.g., "This week in our mathematic lessons, the STs' explanations were comprehensible"; reliability estimate = 0.78; ICC2 = 0.86/0.84/0.83).

² The random distribution among the four training groups regarding personal characteristics of cooperating and STs as well as the group size of the training session and characteristics of the research class were checked with Chi-Square Statistics (see Appendix A).

³ In the present study, intraclass correlations (ICC2) for instructional quality were calculated with a 2-level model (1000 pupils nested in 59 classes, average cluster size $k = 16.95$) for each scale mean and measurement occasion: $ICC2 = (k \times ICC1) / [1 + (k-1) \times ICC1]$.

6.4. Data analysis

The present study used various sources (STs' data and pupils' data) for evaluating the CFC interventions and partially relied on repeated assessments (STs' diary reports and weekly reports from pupils). Hence, different statistical methods were employed for analyzing our hypotheses.

For assessing the impact of the intervention on CTs' implementation of lesson conferences (Hypothesis 1) and on the quality of collaborative exchange (Hypothesis 2), hierarchical linear regression models were computed with HLM 7.01 (Raudenbush et al., 2013) with STs online-entries ($N = 479$) on Level 1 nested in STs ($N = 59$) on Level 2. In these analyses, the intervention groups on Level 2 were dummy-coded with the control group as the reference group. This procedure allows to detect significant mean level differences between the control group and the three different intervention groups. In a two-level hierarchical regression model, the three dummy-variables were entered simultaneously as predictors for the different outcome variables. Separate models were estimated for each outcome variable. Due to the coding of the dummy-variables, the intercept in the regression model represents the mean value for the control group (when all predictors are zero) and the regression coefficients of the three dummy-variables indicate deviation of the respective intervention group's mean score from the control group's mean score.

For evaluating Hypothesis 3, STs' competency gains were assessed in a retrospective questionnaire with three subscales, namely competency gains in lesson planning, cognitive activation, and classroom management. Differences between the intervention groups were evaluated with univariate analysis of variance (ANOVA) in SPSS.

Finally, intervention effects on STs' quality of teaching (Hypothesis 4) were assessed using pupils' ratings from three measurement occasions. Thus, measurement occasions were nested in pupils and pupils were nested in STs (and CTs, respectively). Pupils' ratings were aggregated for each measurement occasion, simplifying the data structure to three measurement occasions nested in STs. Group differences in the development of instructional quality were then detected with a mixed analysis of variance (within subject factor: time; between subject factor: intervention group) in SPSS.

6.5. Missing data

STs documented a total of 632 lessons in 479 online-diary-entries (double lessons taught on the same day were documented with only one online-entry). A comparison with the total number of mathematic lessons taught during the practicum (as reported in the online questionnaire following the teaching practicum) revealed that $M = 74.34\%$ of all lessons were documented (range 25%–100%, $SD = 8.34\%$), which is a high response rate considering the three-week diary assessment. Another set of missing data derived for the documented lessons if no lesson conference had taken place. This was the case for $n = 241$ online entries for pre-lesson conferences (50.3%) and for $n = 175$ online entries (36.5%) in which no post-lesson conferences had (yet) taken place. In these cases, there naturally can be no information on the duration, thematic issues covered and the quality of collaborative exchange in the lesson conference. As CTs were not forced to enact lesson conferences, these missing data represent a planned condition but must be considered when interpreting the results. We decided for a conservative approach in handling these missing data using listwise deletion in HLM (Raudenbush, Bryk, Cheong, Congdon, & du Toit, 2016). The main reason was, that missings were only on Level-1 and as hierarchical regression models were used, participants were still included in the analyses if they had at least one pre- or post-lesson conference in their teaching practicum (which was the case for all participants concerning post-lesson conferences and

86% concerning pre-lesson conferences). In addition, as empirical data are scarce, we were interested in describing CTs' practices also on a descriptive level for each training group and believe that imputed data would make interpretability more difficult.

Pupils' weekly perceptions of instructional quality should have led to 177 documented mathematic lessons (59 classes with 3 measurement occasions). However, in three classes only two questionnaires were filled out, resulting in 174 documented mathematic lessons. The missing data on these lessons were considered ignorable as they should not lead to biased estimates (e.g., Bennett, 2001).

7. Results

7.1. Preliminary analysis

Table 3 shows descriptive statistics and intraclass correlations for the diary data. Between-person correlations are presented in Table 4. Based on a total of 479 online-entries by the STs, descriptive analyses revealed that among all groups, pre-lesson conferences were carried out for every second documented (double) lesson (50.2%) and post-lesson conferences were conducted (or scheduled for later) in 74.3% of the documented (double) lessons. For 42.5% of the documented (double) lessons a pre- and post-lesson conference was conducted. The exclusive performance of pre-lesson conferences was rather rare (7.7%) and 18.0% of the documented (double) lessons were not discussed and reflected upon in any kind of lesson conference. Intraclass correlations show that a large proportion of variance (46%) for the variable "occurrence of pre-lesson conferences" was located at the person level (i.e., ST and CT-dyad), whereas only 19% of variance was attributable to the person level for the "occurrence of post-lesson conferences". Hence, 81% of variance is located on the situational level (i.e., between measurement occasions) and situational factors play a larger role than personal factors in determining if a post-lesson conference is enacted.

In pre-lesson conferences, lesson content and the lesson plan were discussed most intensively by student and CTs. In post-lesson conferences the lesson plan and teaching strategies to support pupils learning were the most intensively discussed topics. Intraclass correlations ranged between $ICC1 = 0.28$ to $ICC1 = 0.53$ for the different core issues, indicating that a substantial amount of variance is located on the person level (between STs or CTs, respectively) and on the situational level (i.e., days in the teaching practicum). The highest amount of variance located on the person-level was found for the discussion of "lesson objectives" ($ICC1 = 0.50/0.53$), indicating that there are substantial between-person differences if this issue is discussed in detail in pre- and post-lesson conferences. The discussion of pupils' prior knowledge on the other hand, had a larger proportion of variance on the situational level ($ICC1 = 0.39/0.28$), indicating that day to day factors influence the intensity of these thematic discussions.

7.2. Effects on CTs' practice (manipulation check)

Results are presented in Table 5. Supporting Hypothesis H1a, significantly more and longer pre-lesson conferences were enacted in group *P*. As indicated by the intercept, only 38% of the documented lessons were prepared with a joint pre-lesson conference between student and CTs from the control group. In the intervention group *P* this ratio was 36% higher (i.e., 74% of the documented lessons, $t = 3.14$, $p < .01$). As expected, STs in intervention group *PCI* also prepared more lessons with lesson conferences (16% more than members from the control group) – however, this effect was statistically not significant. Pre-lesson conferences in the control

Table 3
Student teachers' diary data on lesson conferences – descriptive statistics.

	Pre-Lesson Conferences				Post-Lesson Conferences			
	M	SD	N	ICC (1)	M	SD	N	ICC (1)
Occurrence of lesson conference (Dummy 0/1)	.50	.50	479	.46	.74	.43	478	.19
Duration of lesson conference (in minutes)	16.33	10.33	238	.43	18.88	10.67	304	.39
Intensity of core issues discussed (Range 0–4)	2.32	.76	236	.67	2.14	0.78	304	.63
Lesson content	2.68	1.01	236	.31	2.14	1.16	304	.44
Learning objectives	2.02	1.15	236	.50	1.84	1.29	303	.53
Embeddedness in teaching unit	2.13	1.07	236	.46	1.84	1.16	304	.41
Pupils' prior knowledge	2.30	1.14	235	.39	2.15	1.19	303	.28
Lesson plan	2.46	1.15	234	.43	2.29	1.16	303	.41
Teaching strategies to support pupils' learning	2.33	1.20	233	.53	2.57	1.10	303	.30
Quality of collaborative exchange (Range 1–4)	2.97	0.70	235	.58	2.93	.65	304	.49

Note: Quality of collaborative exchange pertains to collaborative lesson planning for pre-lesson conferences and to constructive feedback and reflection for post-lesson conferences. ICC (1) was calculated with Intercept-Only Models: $ICC1 = \tau^2 / (\tau^2 + \sigma^2)$; it gives the percentage of variance that is attributable to differences between persons (τ^2 = variance between persons; σ^2 = variance between measurement occasions).

Table 4
Between-person correlations of the study variables.

	1)	2)	3)	4)	5)	6)	7)	8)	9)	10)	11)	12)	13)
1) Occurrence PRE													
2) Occurrence POST	.40**												
3) Duration PRE	.31*	.12											
4) Duration POST	-.03	.05	.16										
5) Core Issues PRE	.42**	.17	.54***	.04									
6) Core Issues POST	.36***	.26*	.21	.28*	.70***								
7) Collaborative Exchange PRE	.45***	.18	.63***	.06	.75**	.42**							
8) Collaborative Exchange POST	.29*	.32	.17	.42***	.46***	.55***	.51***						
9) CG: Lesson Planning	.27*	.13	.15	.16	.45***	.47***	.38**	.46***					
10) CG: Classroom Management	-.36**	.07	-.12	.07	.14	.10	.09	.09	.22				
11) CG: Cognitive Activation	.08	.12	.18	.13	.45***	.34**	.35*	.28*	.45***	.44***			
12) IQ: Disruptive Behavior	-.05	.03	-.03	.25	-.12	-.09	-.11	-.25	-.08	.10	-.16		
13) IQ: Cognitive Activation	.19	.05	.05	-.29*	.37***	.29*	.29*	.21	.26*	.08	.36**	-.48***	
14) IQ: Clarity of Instruction	.03	-.10	.02	-.37*	.35*	.19	.23	.15	.15	.11	.23	-.55***	.85***

Note: CG = Competency Gains, IQ = Instructional Quality (as perceived by pupils); Repeated measures were aggregated to the student level to report between-person correlations.

*p < .05, **p < .01, ***p < .001.

group lasted for 13 min on average, whereas members from group P had pre-lesson conferences that were on average seven minutes longer ($t = 2.67, p < .01$) and members from group PCI had pre-lesson conferences that were on average 4.5 min longer ($p > .05$).

As expected (H1b), the percentage of enacted post-lesson conferences did not vary significantly between the different intervention groups. The duration of post-lesson conferences was expected to be longer for members of the group CI as compared to the control group. Post-lesson conferences in group CI were 21 min on average as compared to 17 min in the control group (3.65 min longer, $p > .05$). The longest post-lesson conferences (24 min) were conducted by members of group P, who significantly differed from the control group ($t = 2.35, p < .01$). Thus, hypothesis 1b was only partially confirmed.

Concerning the thematic issues discussed in lesson conferences, it was expected that learning about the core issues (groups CI and PCI) would lead to more intense discussions of these core issues (H1c). The positive coefficients showed small effects in the expected direction, but they did not reach significance. Unexpectedly, members of the intervention group P reported the most intense discussions of core issues in pre-lesson conferences ($b = .64, t = 2.67, p < .01$) and in post-lesson conferences ($b = 0.54, t = 2.22, p < .01$).

7.3. Intervention effects on the quality of collaborative exchange in lesson conferences

The intervention effects on the quality of collaborative exchange were analyzed with the same statistical procedure (hierarchical linear regression models). Results are displayed in Table 6. Partially

supporting Hypothesis 2a, the quality of collaborative assistance during pre-lesson conferences was rated higher by STs whose CTs were introduced into the element of pre-lesson conferences (group P) as compared to the control group ($b = 0.54, t = 2.87, p < .01$). The same was expected for members from intervention group PCI, yet the positive effect was statistically not significant ($p > .05$). For post-lesson conferences and in line with hypothesis H2b, a higher quality of feedback and reflection was found for both groups whose CTs were introduced into the element of pre-lesson conferences (groups P and PCI) as compared to the control group ($b = 0.54, t = 3.12, p < .01$ for group P; $b = 0.38, t = 2.23, p < .05$ for group PCI). No significant effects were found for group CI.

7.4. Intervention effects on STs self-reported competency gains

It was hypothesized that STs' self-reported competency gains in cognitive activation, lesson planning and classroom management at the end of the teaching practicum are higher for the three intervention groups as compared to the control group (Hypothesis 3). As competency gains were assessed with a single assessment, ANOVA analyses were conducted with SPSS. Results are shown in Table 7. However, no significant main effects for competency gains were found (all $ps > .05$).

7.5. Intervention effects on the development of STs' quality of teaching as rated by pupils

In a last step, pupils' perceptions of three dimensions of

Table 5
Mentor teachers' practices – group comparisons with hierarchical linear models.

	Occurrence Pre (L1: n = 479; L2: n = 59)			Duration Pre (L1: n = 238; L2: n = 52)			Occurrence Post (L1: n = 479; L2: n = 59)			Duration Post (L1: n = 304; L2: n = 59)			Core Issues Pre (L1: n = 236; L2: n = 51)			Core Issues Post (L1: n = 304; L2: n = 59)		
	Est.	SE	t	Est.	SE	t	Est.	SE	t	Est.	SE	t	Est.	SE	t	Est.	SE	t
<i>Level 1</i>																		
Intercept	0.38	0.08		13.11	1.42		0.77	0.05		17.31	1.09		1.91	0.19		1.87	0.19	
<i>Level 2</i>																		
Dummy_P	0.36	0.11	3.14**	7.00	2.62	2.67**	-0.03	0.10	-0.31	6.82	2.90	2.35***	0.64	0.24	2.67**	0.54	0.24	2.22***
Dummy_CI	0.11	0.11	0.99	-1.30	2.02	-0.65	-0.05	0.07	-0.80	3.65	2.59	1.41	0.07	0.25	0.29	0.20	0.23	0.87
Dummy_PCI	0.16	0.14	1.15	4.54	3.49	1.30	0.01	0.08	0.15	-3.20	2.05	-1.56	0.38	0.29	1.23	0.46	0.26	1.75

Note: Dummy-variables on Level 2 were entered simultaneously and uncentered to the Model (reference group is the control group); Intercepts indicate the mean value for the control group; Coefficients are unstandardized. Varying sample sizes are due to missing data and the fact, that some students did not partake in any pre-lesson conferences in their teaching practicum.

Level 1: Outcome_{ij} = β_{0j} + e_{ij}.

Level 2: β_{0j} = γ₀₀ + γ₀₁ Dummy_P_j + γ₀₂ Dummy_CI_j + γ₀₃ Dummy_PCI_j + r_{ij}.

*p < .05, **p < .01, ***p < .001.

instructional quality, representing more distal outcome criteria to evaluate the effects of the interventions, were taken into account (Hypothesis 4). Pupils reported on facets of instructional quality three times during the teaching practicum. In a mixed ANOVA, the development of STs' instructional quality as perceived by their pupils in the intervention group were compared to the development of instructional quality in the control group since small positive effects were expected for all intervention groups. The within-subject factor was time (week 1, week 2, week 3) and the between-subject-factor was group (control group, intervention group). Results are depicted in Fig. 1. Analyses indicate that pupils' perception of disruptive classroom behavior and clarity of instruction in the intervention groups did not develop in the same manner as it did in the control group. In fact, disruptive classroom behavior increased for STs in the control group throughout the course of the teaching practicum, whereas it stayed on the same (low) level for STs in the intervention groups (Group/Time-Interaction: $F(2,53) = 3.94$, $p < .05$, $\eta^2 = 0.13$). Furthermore, clarity of instruction decreased more strongly in the control group than in the intervention groups ($F(2,53) = 3.08$, $p < .05$, $\eta^2 = 0.10$) over the three weeks of the teaching practicum. No significant time, group or interaction effects were found for cognitive activation (all $ps > .05$).

8. Discussion

Current literature emphasizes the need to prepare CTs for their

Table 6
Mentor teachers' practices – group comparisons with hierarchical linear models.

	Collaborative Assistance in Pre-lesson Conferences (L1: n = 235; L2: n = 51)			Constructive Feedback and Reflection in Post-lesson Conferences (L1: n = 304; L2: n = 59)		
	Est.	SE	t	Est.	SE	t
<i>Level 1</i>						
Intercept	2.58	0.15		2.68	0.14	
<i>Level 2</i>						
Dummy_P	0.54	0.19	2.87**	0.54	0.17	3.12**
Dummy_CI	0.17	0.22	0.74	0.23	0.18	1.23
Dummy_PCI	0.39	0.26	1.53	0.38	0.17	2.23*

Note: Dummy-variables on Level 2 were entered simultaneously and uncentered to the Model (reference group is the control group); Intercepts indicate the mean value for the control group; Coefficients are unstandardized. Varying sample sizes are due to missing data and the fact, that some students did not partake in any pre-lesson conferences in their teaching practicum.

Level 1: Outcome_{ij} = β_{0j} + e_{ij}.

Level 2: β_{0j} = γ₀₀ + γ₀₁ Dummy_P_j + γ₀₂ Dummy_CI_j + γ₀₃ Dummy_PCI_j + r_{ij}.

*p < .05, **p < .01, ***p < .001.

specific tasks in a teaching practicum and to familiarize them with the demands and expectations they will face (Hoffman et al., 2015). However, there is often a lack of time for professional development programs, which need to be cost-effective and simultaneously reach a relatively large number of CTs (Kraft et al., 2018).

Previous studies in Switzerland have already reported beneficial effects of CFC for CTs (Kreis, 2012; Kreis & Staub, 2011), yet, the introduction into basic elements of CFC with only a brief training session had previously not been empirically evaluated. The present field experiment included 59 CTs from five institutions of teacher education in Switzerland, who were either trained in CFC elements (n = 41) or in a control condition (n = 18). The allocation of the 59 CTs to the groups was randomized so that possible factors influencing CTs' practices and the effects of the teaching practicum (e.g., content knowledge, pedagogical content knowledge, educational experience of the CTs, instructional skills of STs etc.) were randomly assigned across the four intervention conditions. The randomized distribution of various demographics and experiences as a CT was additionally statistically evaluated (see Appendix A).

The results of our study show, that especially learning about pre-lesson conferences (group P) in a brief intervention, had an effect on CTs' practices during the teaching practicum. CTs had more and longer pre-lesson conferences. Taking into account that time resources for direct interactions are an important pre-requisite for emotional and instructional support of STs during the teaching practicum (Gröschner & Seidel, 2012; Hobson et al., 2009), this is a positive result.

Furthermore, important thematic issues for lesson conferences such as lesson content, lesson goals and teaching strategies to support pupils' learning (so called core issues for lesson designs) were discussed more intensively in the dyads whose CT learned about pre-lesson conferences in comparison to the control group. Thus, this CFC intervention may not only have increased the enactment of pre-lesson conferences but also led to a shift in topics in that there was more of a focus on relevant lesson design and reflection aspects. This result is a bit surprising as stronger effects were expected for the groups whose CTs were specifically introduced to the core issues (groups CI and PCI). It might be explained by the fact that a video example was used in the training sessions that displayed (comparably) important thematic issues in the planning stage of a lesson. Even though the use of core issues was not specifically pointed out, a slight mixture of the different CFC elements was unavoidable. Concerning the non-significant results for members from group CI and PCI, it may be important that the corresponding training sessions did not include a role-play. Only CTs in group P engaged in a role-play of joint lesson-planning. The introduction into the core issues might not have sufficiently

Table 7
Student teachers' self-reported competency gains: Descriptive statistics and group comparisons.

Competency gains	Contr	P	CI	PCI	ANOVA Statistics			
	M (SD)	M (SD)	M (SD)	M (SD)	F	df	p	Eta ²
Lesson Planning	2.26 (1.03)	2.92 (1.19)	2.75 (0.89)	2.34 (0.64)	1.53	3	.22	.08
Cognitive Activation	3.17 (0.78)	3.35 (1.28)	3.28 (0.80)	2.68 (0.78)	1.30	3	.13	.07
Classroom Management	3.17 (0.98)	2.54 (0.77)	3.31 (0.84)	2.93 (0.93)	1.97	3	.28	.10

Note: Response format was 0 “nothing” to 5 “very much”; $N = 59$ student teachers.

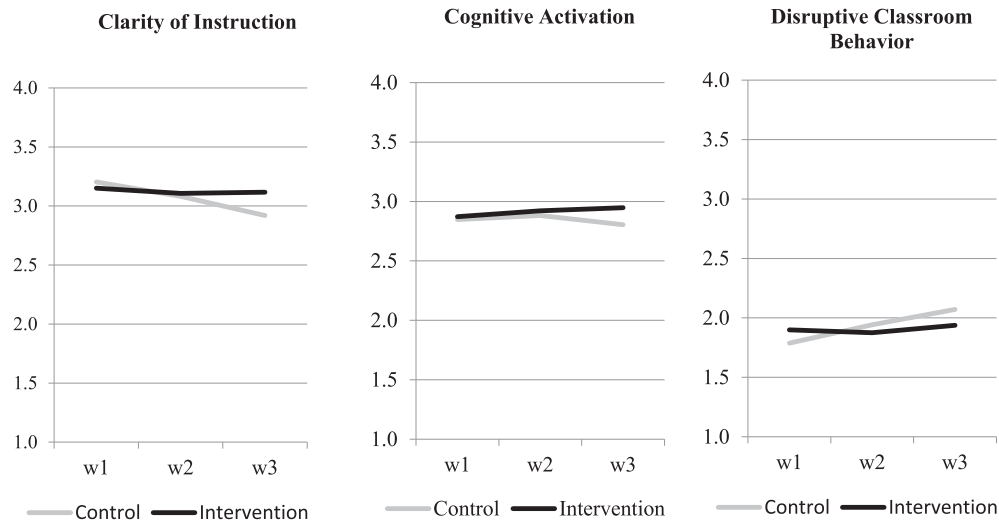


Fig. 1. Descriptive statistics for the development of student teachers' instructional quality as perceived by their pupils (measurement points after week 1, week 2 and week 3 of the teaching practicum); Response format was 1 = disagree to 4 = completely agree.

explained their practical usage in the planning and reflection stage of a lesson. For a productive use of core issues in lesson conferences, future interventions should include practicing components and enhanced information on the usage of core issues in lesson conferences (e.g., using a card set during lesson conferences, introducing the core issues to the ST, select specific core issues and guiding questions for the conference together).

The effects of the CFC-interventions were also evaluated with respect to *collaborative lesson planning* and *constructive feedback and reflection* in lesson conferences. Previous studies have reported that many mentoring and coaching conversations are rather directive in nature (e.g., CTs giving direct advice), focus less on promoting autonomy and reflection and therefore, STs are often constrained to a rather reactive role (Crasborn, Hennissen, Brouwer, Korthagen, & Bergen, 2011; Franke & Dahlgren, 1996). CFC aims to reduce asymmetries in dialogues. Cooperating teachers are usually more experienced and knowledgeable than student teachers, so there is a natural asymmetry that cannot be fully overcome. However, CFC is based on socio-constructivistic beliefs (see West & Staub, 2003). That is, a person learns by constructing meaning in interaction with (more knowledgeable) others. Therefore, in coaching dialogues both interaction partners need to have the opportunity to bring in topics and ideas. In CFC, coaching moves are suggested to make cooperating teachers aware that they should use invitational moves regularly and give direct assistance a bit more cautiously by framing own ideas as a suggestion to be argued for or against and by asking the coachee to come up with their own questions and ideas. In addition, pre-lesson conferences are proposed as a setting in which the joint lesson design (for which both

are accountable) is in focus and not (solely) the evaluation of student teachers' actions. As hypothesized, the CFC training sessions focusing on pre-lesson conferences (group P) led to higher ratings of the quality of collaborative exchange in lesson conferences in terms of *collaborative planning* and *constructive feedback and reflection*. Thus, pre-lesson conferences seem to be a powerful tool to enhance the quality of collaborative lesson planning but also to reflect on what happened during teaching after the enacted lesson. However, the closed-ended measurement format represents only a first approximation to the quality of constructive instructional coaching dialogues. Future research should investigate the extent CFC-interventions succeed in stimulating co-constructive coaching dialogues, for instance by analyzing video sequences. In general, the positive results concerning the quality of collaborative exchange and thematic issues covered in lesson conferences are in line with research from case studies on “Lesson Studies” (e.g., Cajkler, Wood, Norton, & Pedder, 2013). This approach also incorporates pre- and post-lesson conferences and points out the importance of a collaborative exchange between CTs and STs.

The present study further focused on outcomes of the short CFC-intervention regarding STs' professional learning. In addition to changes in CTs' practice, a positive impact on the development of STs' competencies was expected and assessed via retrospective self-reports. However, no significant intervention effects on self-reported competency gains at the end of the three-week internship were found. It is possible that intense conversations with a CT highlight the complexity of teaching and lead to a more realistic appraisal of abilities. Previous research has shown, that some STs tend to overestimate their own knowledge and competencies

(Rosas & West, 2009). Especially novice teachers might be a little “naïve” or “overly optimistic” concerning their competencies before a teaching practicum (Hascher et al., 2004). The results on self-reported competency gains from a practicum of three weeks should not be over-interpreted, especially since only one-shot retrospective evaluations were utilized. Future research needs to investigate the self-assessment of competency development in the teaching practicum in more detail.

The present study did, however, also include an external perspective on the development of STs' instructional quality by means of pupil's ratings. In secondary schools, this is a frequently used method (e.g., Praetorius et al., 2017; Wagner, Göllner, Helmke, Trautwein, & Lüdtke, 2013) and intraclass correlations showed that there was sufficient agreement among the pupils (Lüdtke et al., 2009). Pupils rated instructional quality three-times throughout the course of the practicum. A mixed ANOVA revealed that pupils' ratings on aspects of instructional quality degraded over the course of the teaching practicum for STs in the control group (more “disruptive behavior” and lower evaluations in “clarity of instruction”). STs in the intervention groups were able to maintain their (relatively high) level of instructional quality. It is possible that STs are evaluated more positively in the beginning of a teaching practicum as they are new and different to the regular classroom teacher. Yet, over the course of the practicum pupils might realize that their evaluation was too benevolent. The finding that the development of instructional quality can be influenced by a short training session for CTs is quite promising: It represents probably the most essential aspect of the teaching profession and by using pupils rating, a common method bias could be avoided (see e.g., Podsakoff, MacKenzie, Lee, & Podsakoff, 2003).

8.1. Strengths and limitations of the study

Learning in the teaching practicum takes place in a complex environment with a variety of factors that can potentially affect learning outcomes (Hobson et al., 2009; Lawson et al., 2015). For instance, STs and CTs were recruited from five different institutions to obtain a sufficient sample size. It is possible that context-specific peculiarities of the institution and the corresponding teacher education program are important for interpreting the findings (Brouwer & Korthagen, 2005), yet not enough data was gathered to systematically include and compare the different institutional profiles.

The present study tried to reduce and capture the complexity of the potential variety of situational and individual factors by focusing on only one subject domain (mathematics) and allocating STs randomly to the different intervention groups within each institution. Furthermore, data was collected from multiple perspectives (STs and pupils) and from retrospective reports but also situational reports on learning processes and learning gains. These multifaceted methods allowed for an up-close view into STs' learning experiences during the teaching practicum. However, our data relies solely on self-reports by the recipients of CTs' practices. As data was assessed and evaluated confidentially, STs and pupils should have been able to answer honestly. Yet, it cannot be completely ruled out that sympathy (or the absence thereof) might have influenced their reports. Future studies should also integrate other data sources such as the CTs' perspective, observations or video-recordings.

To the best of our knowledge, the sample of this study is bigger than in many other field experiments on coaching processes and learning experiences during the teaching practicum. However, the rather small numbers of dyads in each intervention group (12–18

STs) represent a major limitation of the study. It is possible that true effects were not detected or that significant effects do not reflect true effects due to low statistical power (e.g., Button et al., 2013), especially since no large effects can be expected from brief interventions only. In addition, only a relatively short period of three weeks from the teaching practicum was evaluated in the present study. It is quite possible that changes in STs' competencies need more time to unfold. Future studies should evaluate longer periods and include follow-up assessments with larger samples.

The present study included a relatively tight assessment plan, posing high demands on STs who had to document their practicum experiences on a situational basis as well as on pupils who provided weekly assessments of instructional quality. Fortunately, response rates in the diary study were comparably high (75%) and missing data occurred only to a limited degree. Some constructs, however, were only assessed with a few items and closed-item formats were mostly used. For instance, it would be informative to receive more detailed information on the topics and issues focused on in lesson conferences and the nature of learning experiences that the STs experienced. A few open-ended questions were also included in the online-questionnaires but did not lead to a richer understanding, as STs did not provide detailed information here. To address these questions, future studies need to more extensively make use of qualitative data by using interviews, video or voice recordings.

In general, future studies could also broaden the focus of evaluation, for example by including affective variables such as emotions in the teaching practicum or the interpersonal relationship between cooperating and ST. Emotional support is considered to be an important facet in relationships between STs and CTs (Hascher & Hagenauer, 2016; Hastings, 2004), yet this study focused more strongly on effects of instructional support.

9. Conclusion

The present study meets practical demands in teacher education for introducing CTs to methods of assisting STs in the teaching practicum. The study showed that brief CFC-training-sessions, which are feasible even in CTs' busy schedules, can significantly change CTs' practices: With the suggestion of pre-lesson conferences, a quite simple but obviously helpful tool could be implemented. In addition to positive effects on the occurrence, duration and quality of exchange between CTs and STs, we found small effects on STs' development of instructional quality. Hence, the implementation of pre-lesson conferences based on the approach of CFC can be recommended for practice. The implementation of core issues seems to be more demanding. We did not find consistent or significant positive intervention effects for the training sessions on core issues (groups *CI* and *PCI*), which might be explained by the lack of practicing components in the training sessions. Further studies are needed to research the conditions in which core issues effectively improve lesson planning and reflection.

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Appendix A

Table 1
Distribution of personal characteristics and contextual aspects among the four intervention groups

Variables	Intervention setting
Group size of intervention (<10 participants vs. larger groups)	$\chi^2_{[3]} = 6.80, p = .08$
Student teachers' sex	$\chi^2_{[3]} = 5.63, p = .13$
Student teachers' age	$\chi^2_{[33]} = 39.43, p = .20$
Cooperating teachers' sex	$\chi^2_{[3]} = 4.43, p = .22$
Cooperating teachers' age	$\chi^2_{[75]} = 93.41, p = .07$
Cooperating teachers' teaching experience (in years)	$\chi^2_{[81]} = 78.29, p = .57$
Cooperating teachers' experience in assisting a teaching practicum	$\chi^2_{[60]} = 67.88, p = .23$
School track of the research class (basic vs. extended requirements)	$\chi^2_{[3]} = 2.34, p = .50$
Grade level of the research class (7–9)	$\chi^2_{[9]} = 8.05, p = .53$

Appendix B. Item wording

B1 Use of core issues in lesson conferences

Prompt: To what extent did the pre-lesson conferences (post-lesson conference) with your cooperating teacher cover the following aspects and contents? Please rate the extent on a scale of 0 (not at all) to 4 (very intensively)

Pre_CI1 Post_CI1 Lesson content <i>Fachinhalte der Lektion(en)</i>
Pre_CI2 Post_CI2 Learning objectives of the lesson(s) <i>Lernziele der Lektion(en)</i>
Pre_CI3 Post_CI3 Embeddedness of the lesson(s) into the teaching unit <i>Bezüge der Lektion(en) zur Unterrichtseinheit</i>
Pre_CI4 Post_CI4 Pupils prior knowledge and difficulties <i>Vorwissen und Schwierigkeiten der Schülerinnen und Schüler</i>
Pre_CI5 Post_CI5 Lesson plan (time schedule, lesson preparation) <i>Unterrichtsverlaufsplan (Ablaufplan, Lektionspräparation)</i>
Pre_CI6 Post_CI6 Teaching strategies aimed at promoting the intended learning outcome (e.g. structure of teacher-led phases of the lesson, selection of learning tasks) <i>Gestaltung des Unterrichts zur Unterstützung des beabsichtigten Lernens (z. B. Aufbau lehrer geleiteter Unterrichtsphasen, Auswahl von Lernaufgaben)</i>

B2 Collaborative exchange in lesson conferences

Prompt: How did you experience the pre-lesson conference (post-lesson conference) of today's math lesson? Please use the scale from 1 (completely disagree) to 4 (completely agree)

Collaborative assistance in pre-lesson conferences	
CE_CA1	I experienced the pre-lesson conference to be instructive <i>Die Unterrichtsvorbereitung habe ich als lehrreich erfahren</i>
CE_CA2	The cooperating teacher offered suggestions on the lesson design <i>Die Praktikumslehrperson brachte Vorschläge zur Gestaltung des Unterrichts ein</i>
CE_CA3	We discussed together various options for designing the lesson <i>Wir diskutierten gemeinsam verschiedene Möglichkeiten der Unterrichtsgestaltung</i>
CE_CA4	We adapted and developed the lesson plan together <i>Wir veränderten und entwickelten gemeinsam die Unterrichtsplanung</i>
Feedback and reflection in post-lesson conferences	
CE_FR1	I experienced the post-lesson conference to be instructive <i>Die Unterrichtsnachbesprechung habe ich als lehrreich erfahren</i>
CE_FR2	The cooperating teacher provided me with direct feedback on which parts of my lesson she/he liked and disliked <i>Die Praktikumslehrperson gab mir direkte Rückmeldung, welche Teile meines Unterrichts sie gut fand und welche nicht</i>
CE_FR3	The cooperating teacher offered suggestions on how to improve the lesson design <i>Die Praktikumslehrperson brachte Vorschläge ein, wie der Unterricht besser gestaltet werden könnte</i>
CE_FR4	We discussed together various options for designing the lesson <i>Wir diskutierten gemeinsam verschiedene Möglichkeiten der Unterrichtsgestaltung</i>

B3 Student teachers competency gains

Prompt: How much new knowledge did you gain from the pre-/post-lesson conferences in the following areas? Please rate the extent gained on the scale from 0 (nothing) to 5 (very much).

Lesson planning	
CG_LP1	To consolidate and better understand the subject matter of the lesson(s) <i>Die Fachinhalte der Lektion(en) festigen und besser verstehen</i>
CG_LP2	To formulate and clarify the learning objectives of the lesson <i>Lernziele formulieren und klären</i>
CG_LP3	To focus the lesson design on the main objectives of the lesson <i>Die Lektionsgestaltung auf die wichtigsten Lernziele der Lektion ausrichten/abstimmen</i>
CG_LP4	To integrate the lesson(s) with the teaching unit in a meaningful way <i>Die Lektion(en) in sinnvoller Weise auf die Unterrichtseinheit beziehen</i>
Classroom management	
CG_CLM1	To manage the classroom <i>Die Klasse führen</i>
CG_CLM2	To organize the lesson such that it runs smoothly and in a goal-oriented manner <i>Den Unterricht so organisieren, dass er ruhig und zielgerichtet abläuft</i>
CG_CLM3	To ensure smooth transitions between the individual lesson elements <i>Für ruhige Übergänge zwischen einzelnen Unterrichtselementen sorgen</i>
CG_CLM4	To ensure a quiet learning atmosphere <i>Für eine ruhige Lernatmosphäre sorgen</i>
Cognitive activation	
CG_CA1	To ensure that students are intensely talking about lesson contents <i>Dafür sorgen, dass Schülerinnen und Schüler intensiv über Inhalte ins Gespräch kommen</i>
CG_CA2	To provide explanations and examples that support the understanding of the content <i>Erklärungen und Beispiele geben, die das Verstehen des Stoffes erleichtern</i>
CG_CA3	To adjust the level of difficulty of the lesson to students' knowledge and skills <i>Das Anspruchsniveau des Unterrichts dem Wissen und Können der Schülerinnen und Schüler anpassen</i>
CG_CA4	To support students' individual learning needs (e.g. offer different forms of learning support) <i>Schülerinnen und Schüler beim Lernen individuell unterstützen (u.a. verschiedene Formen von Lernbegleitung arrangieren)</i>

B4 Pupils' perceptions of the quality of math lessons

Prompt: How did you experience the lessons? Indicate the box that fits your answer best (1 "disagree" to 4 "completely agree"). This week in our mathematic lessons ...

Disruptive classroom behavior	
IQ_DB1	...it took a while until everyone was ready to work <i>...dauerte es sehr lange, bis alle zur Arbeit bereit waren</i>
IQ_DB2	...a lot of time was lost during the lesson <i>...wurde im Unterricht viel Zeit vertrödel</i>
IQ_DB3	...it was so noisy that we could hardly work <i>...war es so laut, dass man kaum arbeiten konnte</i>
IQ_DB4	...the lesson was disturbed by students <i>...wurde der Unterricht durch von Schülerinnen oder Schülern gestört</i>
Cognitive activation	
IQ_CA1	...the student teacher emphasized the relation between the different contents covered <i>...betonte der Lehrerstudent/die Lehrerstudentin die Verbindung zwischen den durchgenommenen Inhalten</i>
IQ_CA2	...the student teacher wanted to know how we solved the tasks <i>...wollte der Lehrerstudent/die Lehrerstudentin von uns wissen, wie wir die Aufgaben lösen.</i>
IQ_CA3	...the student teacher allowed us to thoroughly explain our thought processes <i>...liess sich der Lehrerstudent/die Lehrerstudentin unsere Gedankengänge genau erklären</i>
IQ_CA4	...there were tasks which we could solve in different ways <i>...gab es Aufgaben, die wir auf unterschiedliche Weise lösen konnten</i>
IQ_CA5	...there were tasks which would reveal whether the lesson content was understood <i>...gab es Aufgaben, bei denen man sah, ob man den Stoff verstanden hatte</i>
IQ_CA6	...the student teacher encouraged us to ask questions <i>...munterte uns der Lehrerstudent/die Lehrerstudentin auf, Fragen zu stellen</i>
Clarity of instruction	
IQ_CI1	...the explanations of the student teacher were comprehensible <i>...waren die Erklärungen des Lehrerstudenten/der Lehrerstudentin verständlich</i>
IQ_CI2	...there were illustrative examples which facilitated my understanding of the content <i>...gab es anschauliche Beispiele, die mir das Verstehen des Stoffes erleichtert haben</i>
IQ_CI3	...the student teacher provided explanations in such a manner that we could solve even the more difficult tasks <i>...erklärte der Lehrerstudent/die Lehrerstudentin so, dass man auch bei schwierigen Aufgaben gut nachkam</i>
IQ_CI4	...the student teacher explained things one after the other <i>...erklärte der Lehrerstudent/die Lehrerstudentin die Dinge schön der Reihe nach</i>

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