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Reviews

Teachers and pre-service teachers as partners in collaborative teacher research: A systematic literature review

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HIGHLIGHTS

- Collaborative teacher research teams including multiple actors promotes teachers' professional learning.
- PTs appear to learn more when the collaboration with in-service teachers is an equal partnership.
- Participation in collaborative teacher research teams expands the concerns of PTs to pupil learning.
- Improved reflection and inquiry skills are not automatically transferred to daily teaching practice.
- Future research should focus on the role of teacher educators in facilitating collaborative teacher research as a Third Space.

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ABSTRACT

A systematic literature review (N = 14) was performed with a focus on the influence of collaborative teacher research on the professional development of pre-service teachers (PTs). A thematic overview of reported outcomes is presented. Collaborative teacher research has proven itself to be a promising practice for improving PTs' knowledge and attitudes regarding collaboration, reflection, inquiry, and student-centred teaching. Shared inquiry in less hierarchical partnerships between pre-service and in-service teachers, and other multiple actors, advances PT's learning more than one-to-one relationships between a mentor and a PT.

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The potential of collaborative teacher research, as a way of teacher learning and school development, is well documented and not new (Burbank & Kauchak, 2003; Cochran-Smith & Lytle, 1992). After decades of research and theory development, numerous terms have been used in the field to address the actions of teachers as researchers. The widely-cited work of Dewey (1929) on teachers as reflective practitioners dates back to the beginning of the 20th century. In the 1940s the action research movement emerged (Adelman, 1993; Lewin, 1946; Masters, 1999) and in the 1990s, teacher research became a prominent framework in professional development and school reform (Brydon-Miller, Greenwood, & Maguire, 2003; Reason & Bradbury, 2001). The teacher research movement seems to survive (Cochran-Smith & Lytle, 1993; Hollingsworth & Sockett, 1994; Lytle et al., 1994; Ray, 1993; Zeichner, 1994) and recently an increased attention on teacher research can be noted, with many studies reporting the positive effects of teacher research on teachers' practice and their students' learning (Blumenreich & Falk, 2006; Levine & Marcus, 2007; Love, 2009; Somekh & Zeichner, 2009).

Nevertheless, teacher research does not seem to gain a foothold in most schools. This might be due to the fact that teacher-education programs produce teachers who do not identify with the role of the teacher as a researcher and are not convinced of its effects. Teacher education's core responsibility is to train teachers who are able to deal with the complexity of teaching and, therefore, able to observe, analyze, and develop their practice in order to validate decisions and actions and, in the end, to provide excellent teaching to improve the learning of all pupils (Munthe & Rogne, 2015; Toom et al., 2010). Teachers are involved in decision-making about appropriate actions every day and, as explained by Cochran-Smith and Lytle (2009, p. 151), they "have to continuously form and reform the interpretative frameworks that guide their moment to moment actions as well as their deliberate and more considered long-term decisions in the interest of educating for a more just and democratic society". Predetermined technical skills, and academic and passed down experiential knowledge might be insufficient for the intelligent problem-solving that is required given the increasing complexity of teaching (e.g. diverse groups with low-income and underprivileged pupils). Therefore, it has been advocated to introduce systematic inquiry into pre-service teacher education curricula (Munthe & Rogne, 2015).

However, traditional images of teaching do not include teacher research and it is not really helpful for adopting 'inquiry as stance' if students of teaching notice that engagement in some kind of practitioner research is expected from them in teacher education, while teachers in the schools, who serve as models, do not frame themselves as researchers. The well-known gap between campus-based teacher education courses and field experiences, and the competing messages students get from these two contexts continues to be a problem (Feiman-Nemser, 2001; Flessner & Stuckey, 2014; Le Cornu & Ewing, 2008; Zeichner, 2010; Zeichner, Payne, & Brayko, 2015). Conventional approaches to professional learning for in-service teachers (ITs) suffer from a similar kind of tension between those who produce and disseminate knowledge for teachers and those who are supposed to take it home and apply it in their classrooms (Apple, 1986; Burbank & Kauchak, 2003; Christianakis, 2010). Their knowledge, which counts for educating teachers and providing for their continuous learning, has currently been under debate. Placing students of teaching in schools without much preparation and leaving it to schools and the free market to prepare them for their job, with the "danger that teacher education will be transformed into a pure market economy divorced from universities" (Zeichner et al., 2015, p. 131), is not a satisfying alternative. Zeichner et al. (2015) call for "forms of democratic professionalism in teachers and teacher education, where colleges and university, schools and communities come together in new ways to prepare professional teachers who provide everyone's children with the same high quality of education" (p. 131). As Feiman-Nemser (2001) puts it, "Although teachers need access to knowledgeable sources outside their immediate circle, professional development should also tap local expertise and the collective wisdom that thoughtful teachers can generate by working together." (p. 1042). Teachers' experiences, voices, and thoughts should be at the core of professional development activities (Burbank, Kauchak, & Bates, 2010; Cochran-Smith & Lytle, 1999). The 'new' vision toward professional learning covers an array of approaches whereby teachers work together and take responsibility for their own learning and build on their on-going work of teaching. Instead of being consumers and implementers, they may become researchers and designers, aiming at the improvement of their practices and the learning of their students (Avalos, 2011). Although during the last decennia there has been growing support for the vision that collaborative research by teachers about their own classrooms represents a powerful way to realize this new vision (Cochran-Smith & Lytle, 1992, 2009), the old assumptions about teachers' roles in professional development seem to prevail in practice and policy (Cochran-Smith, 2005; Zeichner, 2010).

After twenty years of increased attention on teacher research,

we suggest an in-depth exploration of empirical studies in which the effects of collaborative teacher research in pre-service teacher education have been investigated.

1. Theoretical framework

1.1. Teacher research

After decades of research and theory development, numerous terms have been used in the field to address the actions of teachers as researchers. This has led to some ambiguity regarding different frameworks for 'teacher research', 'action research', and 'practitioner research'. In the 1950s and 1960s, these activities were mainly referred to as action research. Action research emphasizes the use of a cyclical process, which includes a series of steps in which the teacher outlines the challenge, seeks existing knowledge, collects data, plans and implements the strategy for change, evaluates the results, and prepares a new cycle of improvement (Hagevik, Aydeniz, & Rowell, 2012). The results of this kind of action research cannot be generalized to other contexts than the context in which it was performed (Christianakis, 2010) but generalization is not the aim of action research (Levin & Rock, 2003). The most important aim is for teachers to improve their practice and their knowledge of their field.

Stenhouse (1985) was the first to describe the concept "teacher research", as inquiry carried out by teachers in a systematic and intentional manner to study their own practice, teaching, and student learning. The result of this inquiry should bring teachers to an improvement of their classroom practice (Levin & Rock, 2003). Cochran-Smith and Lytle (2009) use 'practitioner inquiry' as an umbrella term for a category of systematic research carried out by practitioners with a variety of positions in education and at different levels of education. Their professional practice is the site and focus of their research and, therefore, inquiry is embedded in practice and the boundaries between inquiry and practice are blurred. Practitioner inquiry, as defined by Cochran-Smith and Lytle (2009), encompasses five genres, two of which refer to research carried out by school-based teachers and other collaborating educators: action research and teacher research. Their description of 'teacher research' is the closest to what we envision to investigate in this study and we will, thus, systematically adopt the concept of 'teacher research': inquiries of school-based teachers and pre-service teachers (PTs) who collaborate in research communities, possibly together with university-based colleagues, in order to "examine their own assumptions, develop local knowledge by posing questions and gathering data, and – in many versions of teacher research – work for social justice by using inquiry to ensure educational opportunity, access, and equity for all students" (Cochran-Smith & Lytle, 2009, p. 40). Means and ends are equally important in these research communities. That is, on the one hand, teacher collaborative, reflective, and inquiry-based learning in itself is an important aim and, on the other hand, a focus on the improvement and enrichment of student learning is crucial. Many inquiry cycles, with a varying number of steps, have been used for teacher research. Whatever the number of steps, a key feature is the systematic approach: careful definition of the problem, challenge, or question the team wants to address; use of internal and external sources of knowledge; collection, analysis, and interpretation of data from multiple sources before and after the design and implementation of actions.

1.2. Teacher collaboration

In most current versions of teacher research, collaboration is a key feature (Darling-Hammond, 2010; Moran, 2007; Rigelman & Ruben, 2012; Zeichner, 2010). The ultimate aim of this collaborative research is to develop an evidence-based answer to a mutual concern in practice, which, at the end, improves pupil learning (Ball & Cohen, 1999; Kirschner, Dickinson, & Blosser, 1996). Collaborative teacher research promotes reflection skills and a more open attitude among colleagues to share problems they face in their daily teaching (Cochran-Smith & Lytle, 2009; Hagevik et al., 2012). Research shows the importance of collaboration for retaining good teachers, for professional learning as an essential aspect of instructional improvement (Gardiner & Robinson, 2011; Little, 2003), and for promoting a more positive attitude towards educational change (Jaipal & Figg, 2011). Rigelman and Ruben (2012) state that all learning occurs through social interaction, regardless of the age of the learner. The professional dialogue that is created while colleagues build on each other's ideas is often underestimated (Cochran-Smith & Lytle, 1992). It is, therefore, argued that teacher collaboration is a key feature of salient teacher research.

Strangely enough, teacher research in pre-service teacher education used to be implemented one classroom at a time, and with little input from a school team or connected stakeholders. One would expect that working in a team is as salient for PTs as it is for ITs. In order to provide an authentic environment for teacher collaboration in pre-service teacher education, partnerships between schools and universities are indispensable.

Collaborative teacher research, including both PTs and ITs, requires partnerships between universities and schools that are based on the mutual concern to improve the learning of all parties involved. Sometimes, these partnerships take the shape of professional development schools (Holmes Group, 1990). The profound partnership between these schools and universities is based on a mutual concern to improve student learning through the improvement of instruction, based on the collaborative inquiry of practitioners and researchers. Darling-Hammond (2010) describes professional development schools as teaching hospitals in which public schools provide hybrid spaces were teachers and researchers meet on a non-hierarchical level and prospective teachers are guided with their first steps in practice. Zeichner (2010) states, however, that efforts are required for academic and practitioner knowledge to fuse in new, less hierarchical ways. Mutual expectations about the roles of university-based teacher educators, school-based teachers, and PTs need to change.

1.3. Teacher resistance to collaborative teacher research

As valuable as collaborative teacher research may be, the shift in roles and the expansion of roles might cause tensions among teacher researchers. One of the reasons is that many teachers consider the work of practice as their core business, and consider the research work as ballast, something that unnecessarily steals time from teaching (Cochran-Smith & Donnell, 2006). Although Hargreaves (2000) calls the period from the late 1980s to the turn of the century the "age of the collegial professional" (p. 162), he recognises that many stick to their classroom autonomy and isolation, especially when collaboration is enforced upon them.

The context for learning that is provided in conventional teacher education programs is not particularly helpful for adopting the new roles. Probably unconsciously, the image of the teaching profession as a profession performed in isolation, guided by intuition and experience and especially concerned with the day-to-day practicalities of teaching is maintained by teacher education (Burnaford, 1999; Lortie, 1975; Santagata & Guarino, 2012). The intuition and exclusively experienced-based image of the profession is reinforced by mentors dismissing evidence-based practices discussed in teacher education as 'impractical' (Feiman-Nemser, 2001), and by

teachers modelling a trial-error approach to solving problems in daily practice (Consuegra, Engels, & Struyven, 2014; Schussler, 2006), or emphasizing the tricks and trades, which are quite contradictory to the research disposition that is recommended by teacher education researchers. Moreover, the role of the teacher who investigates his or her own practice in collaboration with colleagues is not modelled in practice. Again, this creates a divide between what is eventually being promoted in teacher education and what is observed in the field. The consequence is that some students tend to defend the theories of inquiry that they learned in teacher training and are disappointed by the practice of the teaching profession, whereas others are disappointed in and dismiss theory and research (Moore, 2003; Yayli, 2008). Moore (2003) found that PTs tend to follow the modelled teaching style of their mentor teacher, even if this is in contrast with what theory and teacher education tells them.

1.4. Modelling collaborative teacher research during teacher education

Cochran-Smith (1991) recommends that internships should be arranged in such a way that PTs can collaborate with ITs who question their own practice. The example function of ITs is crucial. If the PTs observe that ITs in the team are prepared to try out new approaches and accept the fact that a temporary decline of efficiency could be part of that, they will feel more safe and prepared to take the risk of experimenting with their own approaches to teaching (Oosterheert & Vermunt, 2001).

Establishing collaborative inquiry in teacher education enables PTs to learn what they are not ready to do on their own. This approach aligns with the Vygotskian theory stance of a zone of proximal development (Rigelman & Ruben, 2012). Collaboration with ITs, who model reflective practice, provides powerful opportunities to develop in-depth understandings of practice and promotes future professional development (Darling-Hammond & Bransford, 2007). Involving PTs in teacher research helps them to establish a research disposition and to make evidence-based decisions about their teaching (Nicholas, Baker-Sennett, McClanahan, & Harwood, 2011). This strategy is, however, only effective when strong support is provided for building PTs' competencies and attitudes towards the relationship between theory and practice, and for the issues that arise from becoming a member of a new group. Acculturation can only happen when the PT has the ability to question the school culture and to address questions in the research team (Kotsopoulos, Mueller, & Buzza, 2012). Kotsopoulos et al. (2012) mention that the existing frameworks of teacher research mostly focus on PT research in an isolated context. Which aspects of PT's research disposition will be carried forward in their later careers, and why, is uncertain. No longitudinal studies were found that could make us understand how the inclination and ability to research their own practice evolve after PT's leave pre-service teacher education.

1.5. Effective collaborative teacher research

There is a significant body of literature on 'teacher research' but investigation into the effectiveness of teacher research partnerships is limited (Burbank & Kauchak, 2003). Wayne, Yoon, Zhu, Cronen, and Garet (2008) state that there is limited evidence on the effectiveness of teacher professional development programs in general. While professional development of teachers is considered as one of the keys to improve the quality of education, little empirically valid research has been done to study how professional development effectively improves teacher knowledge and attitudes, teacher practice, and pupil outcomes (e.g. wellbeing, engagement, academic self-efficacy, learning). The use of a common framework for investigating the effectiveness of professional development would be helpful (Desimone, 2009). Recently, Van Veen, Zwart and Meirink (2011) and Wayne et al. (2008) presented a framework to evaluate the effectiveness of professional development programs based on the 'theory of improvement'. This theory describes the relationship between: 1) the characteristics of a professional development program, 2) knowledge and attitudes of teachers, 3) teaching practice of teachers, and 4) pupil outcomes (see Fig. 1).

They identify two relationships, which they refer to as the 'theory of change' and the 'theory of instruction'. The theory of change involves the relationship between the characteristics of the intervention and teachers' learning and their teaching practice. The theory of instruction involves the relationship between the content of the intervention and pupil learning.

2. Research aims

In theoretical and opinion papers, many influential researchers of teacher education endorse collaborative teacher research performed in the setting of pre-service teacher education as a potential opportunity (e.g. Cochran-Smith & Lytle, 2009; Zeichner et al., 2015). The enthusiasm is related to high expectations for the professional learning of PT's and IT's, for educational innovation, and for children's learning and wellbeing. This was phrased eloquently by Zeichner (1992) when the professional development school movement that encouraged PT's and IT's to participate in thoughtful inquiry emerged in the 1990's:

> "It is an exciting time for those involved in the education of prospective teachers. The PDS partnership offers an opportunity to fully transform the practicum and to link teacher education and school reform. […] It is a fundamental alteration of teaching and teacher education that will enable teachers to assume their

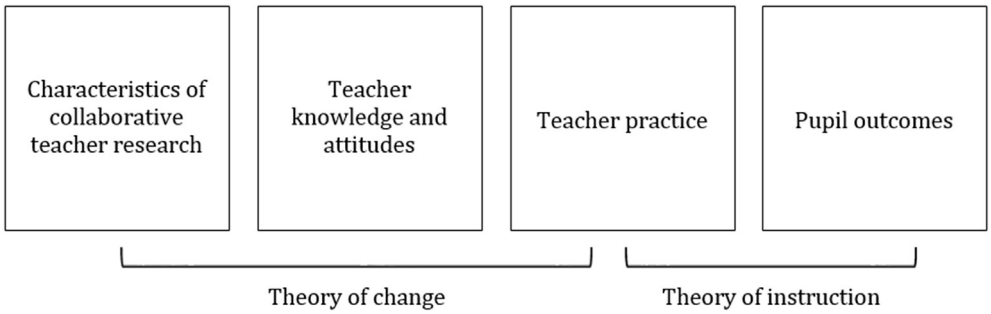

Fig. 1. Conceptual framework for studying the effects of collaborative teacher research (based on Desimone, 2009; Van Veen et al., 2011; Wayne et al., 2008).

rightful places as leaders of educational reform and teacher educators to assume their proper role in helping teachers do so, for the benefit of everybody's children." (p. 304).

This study aims at investigating the extent to which empirical research has provided evidence that collaborative teacher research in pre-service teacher education meets these expectations. Thus far, an overview of empirical studies does not exist. Therefore, we want to synthesize the scattered results of existing empirical studies. The research questions leading the systematic literature review that we performed are:

- Which outcomes (teacher knowledge and attitudes, teacher practice (theory of change), and pupil outcomes (theory of instruction)) of collaborative teacher research in pre-service teacher education have been investigated?
- How are outcomes for pre-service teachers related to types of collaboration?

3. Method

3.1. Search method

Literature was collected in the period of January–March 2013 and, in July 2015, a last check of evidence was performed. The ERIC and Web of Knowledge databases were searched using the following keywords: action research, collaboration, pre-service teacher education, pre-service teachers, participatory action research, teacher research, and practitioner research. Search controllers were set to ensure that the searches retrieved only peer-reviewed articles published in English. Based on our research aim and the prominence of teacher research in the 1990s, potential studies were screened for inclusion by using preconceived criteria during the selection process: (1) empirical studies; (2) the study includes collaboration between PTs and ITs; (3) studies reporting outcomes of PTs conducting teacher research; (4) publication between 1993 and 2013. The delineation of the period is inspired by the emergence in the early 1990's of the teacher research movement (Little, 1993), of professional development schools that gave a boost to collaborative research in partnerships of teacher education and schools (Holmes Group, 1990), and of the flood of literature that came with it. In the beginning of the 1990s, some influential publications gave cause for initiating research into the practice of collaborative teacher research in partnerships of teacher education and schools. The Holmes Group (1990) published their report, entitled *Tomorrow's Schools: Principles for the Design for Professional Development Schools*, and emphasized the importance of teacher education and schools working in close collaboration. Cochran-Smith and Lytle (1993) published their book, *Inside/Outside: Teacher Research and Knowledge*, on teachers as researchers. Murray (1993) pointed to the vagueness of the concept and implementation of professional development schools in those days. Twenty years later, it seemed time to review what has been found in the research about the impact of collaborative teacher research.

A PRISMA flow chart (Moher, Lierati, Tetzlaff, & Altman, 2009) demonstrates the different phases of the review process (see Fig. 2). Using these procedures, 89 studies were identified through a systematic search of the databases. In addition, 26 additional studies, found by a preliminary search, were included. This step was conducted before performing the full-scale systematic search to find out whether anyone else had done a review (Evans & Benefield, 2001). Moreover, it gave us the chance to do "scoping" searches or "pearl-growing" searches to better understand existing primary studies on the topic (Arksey & O'Malley, 2005). These steps offered the opportunity to develop a list of searching terms that could be used in the full-scale search. The preliminary search of different databases (ERIC, Web of Knowledge, JSTOR, Elsevier and SAGE Journals) identified 26 articles. Four titles were found through the manual search for a total of 26 titles retained (Levin & Rock, 2003; Mule, 2006; Rigelman & Ruben, 2012; Sim, 2010). Two of these articles were not retrieved via the systematic search (Mule, 2006; Rigelman & Ruben, 2012) but were relevant for the scope of this review. Arksey and O'Malley (2005) argue that this step is necessary to identify articles that possibly are overlooked in database searches. After removing 13 duplicates, the available abstracts of the 102 studies were screened using the inclusion criteria. After a strict application of the search parameters, 44 empirical research publications were studied in detail. This resulted in the exclusion of a further 30 articles and a final sample included 14 articles. Articles excluded in this phase involved: (i) articles not being transparent about the methodology, (ii) empirical articles not containing any outcomes of PTs, and (iii) opinion papers and descriptive reports. Each piece of empirical research was exposed to a thorough review. In attempting to map the identified research articles, an extraction form was created enclosing basic descriptive information extracted from each article (author, year, journal, and abstract).

An overview of the number of sources delivered by, and selected for, each search term and database can be found in Table 1. Since this database search was carried out in March 2013, an additional search was carried out in August 2015. This step followed the initial database search with a mirrored procedure. This separate search identified 29 studies. Nevertheless, after an in-depth screening, none of the articles could meet the prescribed criteria and the scope of this review. Within this last search, it is remarkable that teacher research is merely performed by PTs in collaboration with schools but without the involvement of ITs (e.g., Shanks, Miller, & Rosendale, 2012; Steele, Brew, Rees, & Ibrahim-Khan, 2013). Otherwise, some articles only emphasize the collaboration principle between PTs and ITs without incorporating the inquiry principle (e.g., Harding-DeKam et al., 2014).

3.2. Sample

This review discusses 14 studies in 7 journals and one conference paper published between 1996 and 2012 (see Table 1). Half of the included articles were published between 2009 and 2012, indicating a period of increased research attention for collaborative teacher research between PTs and ITs in these years. More than two-thirds of the studies were performed in the USA (10) and the remaining studies were conducted in Australia (1), Canada (2), and Turkey (1). On the one hand, this can be due to the longer research tradition in the US with partnerships between schools and universities (e.g. Holmes Group, 1990). On the other hand, the over-representation of Anglophile studies can be the result of the search being limited to articles published in English.

4. Results

4.1. Descriptive results

4.1.1. Terminology

In most articles, several terms referring to different theories and epistemological frameworks are used to refer to the process of collaboration and inquiry between PTs and ITs (see Table 2). Only one article (Kotsopoulos et al., 2012) was consistent in using one and the same terminology throughout to explain the collaboration. The article by Yayli (2008), performed in Turkish teacher education, does not explicitly refer to a specific theoretical framework.

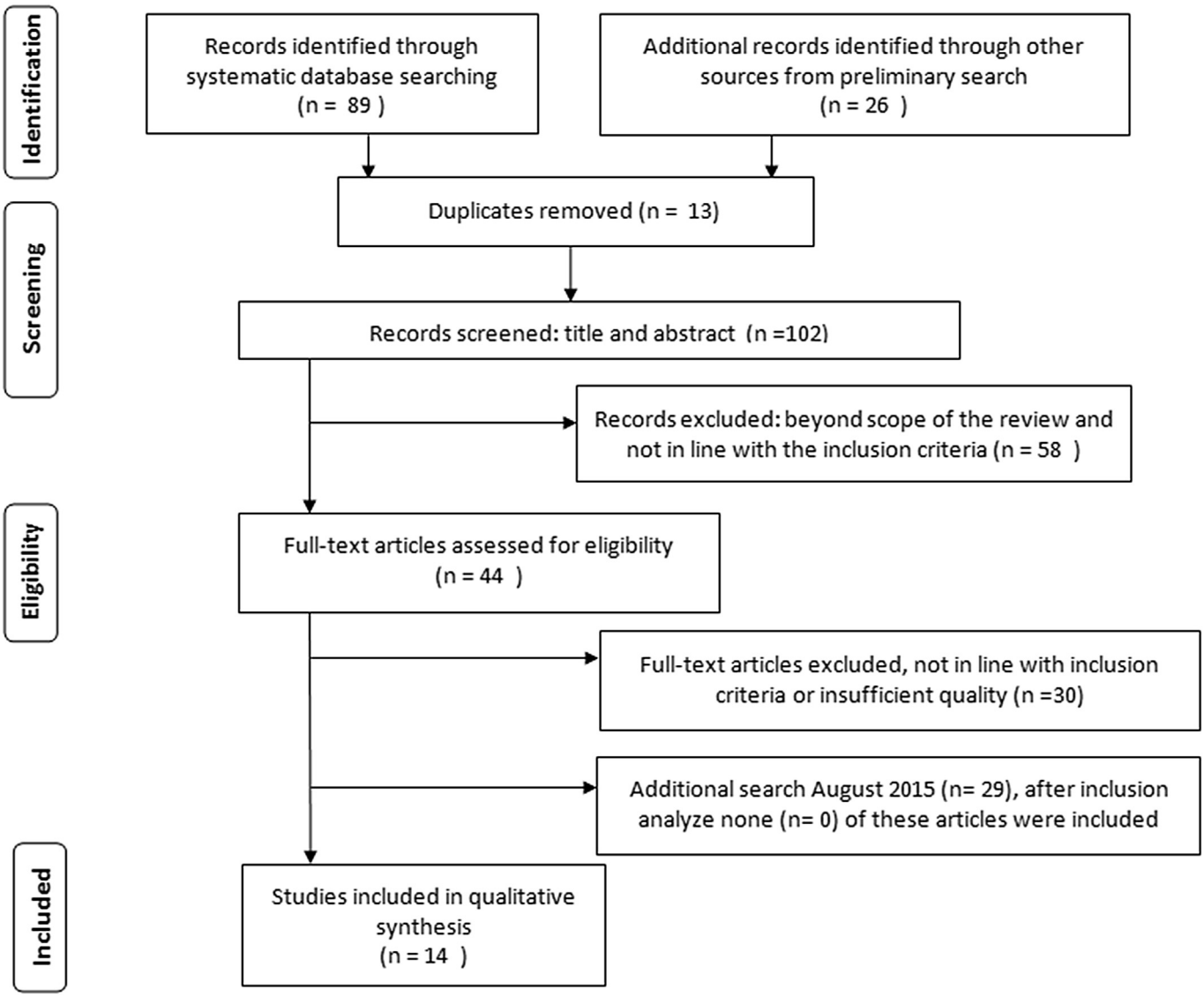

Fig. 2. PRISMA flowchart of article search.

4.1.2. Study designs

All studies are characterized by their relatively small sample-sizes (see Table 1). The number of PTs included in the studies ranges from 6 to 90, with 9 articles having 30 or fewer participants and only 3 articles having more than 60 participants (Chassels & Melville, 2009; Kotsopoulos et al., 2012; Yayli, 2008). In two articles, the number of PTs was not mentioned (Kirschner et al., 1996; Sim, 2010). The number of participating ITs is only mentioned in 6 articles. Moreover, the outcomes for ITs were reported in the results section of only four articles. The role of the teacher educator as a participant is rarely described and only in the study by Rigelman and Ruben (2012) is it incorporated in the theoretical framework and results section. However, all of the articles describe the collaboration process and the interaction between participants in general. The duration of the collaborative inquiry partnership varies between 4 months (e.g. Moran, 2007) and an entire school year (e.g. Mule, 2006). Three studies did not mention the time interval of the study (Kirschner et al., 1996; Kotsopoulos et al., 2012; Sim, 2010). There is a high degree of variation in time allocated for the preparation of research methodology courses, research collaboration, and teaching practice in general.

In all studies, qualitative methods were adopted to collect and analyse data and two articles report an additional survey (Table 1). All data represents perceptions. Most articles report perceptions of different stakeholders in order to increase reliability (triangulation of data and perspective). Also, a high variety in the type of qualitative data can be noticed, such as journals, reflective papers, field notes, and focus groups. On the one hand, these methodologies provide an in-depth understanding of the perceived outcomes for different participants of collaborative teacher research. On the other hand, a one-sided focus on perceptions limits the possibilities to discuss the 'effects' of collaborative teacher research on the learning of prospective teachers and their pupils.

4.1.3. Research foci

Table 3 provides an overview of the research foci (based on the goals, research questions, and main topics addressed in the results) of the reviewed studies. The classification of the research foci is based on the theory of improvement (Wayne et al., 2008). The majority of the reviewed studies solely focus on teachers' professional learning within the 'theory of change'. Pupil learning (theory of instruction) is not addressed. None of the studies measure

Table 1
Overview all included studies.

Author	Year	Country	Sample	Method
Balach & Szymanski	2003	USA	PT*: 6 IT*: 1 TE*: 1	Quantitative data: • Pre- post -test survey • Learning community instrument • Professional learning community instrument Qualitative data • Analysis of reflections
Burbank & Kauchak	2003	USA	PT: 10 IT: 10 TE: 0	Quantitative data • Descriptive statistics of questionnaire after CAR experience. Qualitative data • Formal and Informal observations • interviews • Journal • Focus groups • Meeting transcripts
Chassels & Melville	2009	Canada	PT: 60 IT: 20	Qualitative data • reflective papers • notes of a group discussion • first author reflective notes
Hagevik, Aydeniz, & Rowell	2012	USA	PT: 20 IT: unknown (consulting mentor) TE: unknown (consulting supervisor)	Qualitative data (multiple case study comparison) • written action research reports • PowerPoint presentations • interns' reflections in written research paper • open-ended qualitative survey • researcher's journal.
Kirschner, Dickinson, & Blosser	1996	USA	Case-study	Qualitative data • Case study triangulation of multiple perspectives • Description of process
Kotsopoulos, Mueller, & Buzza	2012	Canada	PT: 71 IT: unknown TE: 0	Quantitative data • 33-item end-of-program evaluation survey Qualitative data • written response to a weekly mandatory 'reflective' questions
Levin & Rock	2003	USA	PT: 25 IT: 25 TE: 0	Qualitative data (multiple case study comparison) • pre- and post- individual interviews with each PT and on-site mentor • audiotapes • written action research plans including reflections by PT • written final action research reports • reflections written by PT • portfolio reflections • field notes kept by the researcher
Moran	2007	USA	PT: 24 (10 interviewed) IT: unknown TE: 1 (supervisor)	Qualitative data • reflective journals • videotapes of teaching • transcriptions of audiotapes of team meetings and children's conversation • selected lecture classroom discussions and retrospective interviews
Mule	2006	USA	PT: 27 (6 cases analyzed)) IT: 30 mentor teachers (PDS site) TE: 6 university supervisors	• cross case study analyses • field notes
Nicholas, Baker-Sennett, McClanahan, & Harwood	2012	USA	PT: 22 IT: unknown TE: unknown (supervisor university) Human service professionals: unknown	Qualitative data • reflection data • focus groups
Rigelman & Ruben	2012	USA	PT: 23 IT: 16 TE: 8	Qualitative data: (case study) • PT written reflections • Semi-structured focus group interviews with PT and ET (every semester) • individual semi-structured interviews • observation interactions within the various PLCs
Santagata & Guarino	2012	USA		Qualitative data:

			PT: 25 IT: 0 TE: 0		• video segments • individual semi-structured interviews
Sim	2010	Australia	9 schools (included PT, supervising teachers, IT and TE; N: unknown)	Qualitative data • Project evaluation • Case study on design of the project within a theoretical framework • Focus groups with different schools enclosed in communities of practice project	
Yayli	2008	Turkey	PT: 90 IT: mentor (N: unknown) TE: supervisor (N: unknown)	Qualitative data • field notes • university classroom discussions • reflective journals • observation reports • open ended survey questions	

Note: PT: pre-service teacher, IT: in-service teacher, TE: teacher educator.

changes in pupil achievement after the implementation of the framework.

All of the reviewed studies focus on more than one goal. The primary goal of all interventions is to rethink the teacher education curricula. The development of PTs through participation in collaborative teacher research is mentioned as a purpose in all 14 studies (Teacher Education). Eleven interventions emphasize on the ongoing professional development of ITs. Five articles stress school change as a goal and have a broader focus on community development. Other recurrent goals include process-oriented goals, such as an improvement of collaboration skills, higher levels of reflection and self-awareness of the professional identity, and an open attitude towards research. Moreover, outcome-related goals are reported in eight studies: the improvement of teacher knowledge, a perceived improvement of teaching practice, and teachers' increased awareness of pupil learning needs. No studies investigated the effects of collaborative teacher research on pupil learning.

4.1.4. Thematic overview

In the following section, we will consider the different outcomes and obstacles of collaborative teacher research that have been identified in the reviewed studies. We organize this section along the lines of the four main perceived outcomes of collaborative teacher research that are reported by the reviewed studies (see Table 4).

4.1.5. Collaboration

Several studies have revealed that the PTs, included in research teams, learn to see collaboration as an opportunity for their own professional growth (Chassels & Melville, 2009; Nicholas et al., 2011). The types of collaboration between the PTs and the ITs (or other involved stakeholders) in the studies vary. In the phenomenological case study of Mule (2006), five PTs and their mentors were followed over one school year and three levels of collaboration are identified. First, *shared inquiry* is used to refer to the most in-depth collaboration between all partners; ITs and PTs work on a shared research topic and function as equal partners. Next, the level of *supported inquiry* can be distinguished as the mentor has a supervisory role over the inquiry process. The hierarchical relationship between student and mentor is salient and the final responsibility of the inquiry process is attributed to the PT. Ultimately, the level of *parallel inquiry,* which is the least developed level of collaboration, is where the collaboration between the school and the 'course task' of the student occur side-by-side. When we situate the reviewed studies in this framework, six studies adopt shared inquiry (see Table 5).

In studies where shared inquiry is performed, the relationship between mentor and PTs is less hierarchical and PTs report to learn more from the insights of the ITs. Chassels and Melville (2009) point out that the opportunity to talk about teaching and learning helps PTs to appreciate sharing insights with colleagues. It is important to mention that, in this study, the collaborative inquiry is occurring within a framework of lesson study. Students are encouraged to question their teaching, which leads to research questions that are close to the teaching classroom practice. The format of lesson study, in which ITs and PTs are sharing their practice and visiting each other, opens the doors for critical observation and reflection. Levin and Rock (2003) designed their study as a shared inquiry collaboration between five pairs of PTs collaborating in a framework of teacher research with their mentors. PTs, in the post-test interviews, define shared dialogue as an encouraging component to seek collegial advice in the future. ITs, in their post interviews, however, show that they experience great difficulties with living up to the non-hierarchical roles. ITs define their role as assisting PTs in becoming a teacher and not as being a

Table 2
Terminology and scope.

Results	Action Research	Collaborative action research	Collaborative inquiry	Community of practice	Critical Action Research	Lesson Study	Professional Development School	Professional learning community	Teacher Research
	6	5	2	2	2	2	2	7	3
1. Balach & Szymanski (2003)	X	X						X	
2. Burbank and Kauchak (2003)	X	X					X		X
3. Chassels and Melville (2009)						X		X	
4. Hagevik et al. (2012)		X			X				
5. Kirschner et al. (1996)	X						X	X	
6. Kotsopoulos et al. (2012)									X
7. Levin and Rock (2003)	X	X			X				
8. Moran (2007)	X	X							X
9. Mule (2006)							X	X	
10. Nicholas et al. (2011)	X		X						
11. Rigelman and Ruben (2012)			X					X	
12. Santagata and Guarino (2012)				X		X		X	
13. Sim (2010)				X				X	
14. Yayli (2008)									

co-researcher. The role of experienced mentor teachers is often limited to feedback and joint reflection. A lack of accountability appears when ITs are not deeply involved as equal partners in the partnership (Levin & Rock, 2003); the shared inquiry study of Kotsopoulos et al. (2012) reports similar findings. If ITs experience their role mainly as supervisor, the final responsibility to accomplish the research process is not shared but instead rests with the PT. In reflection papers, PTs stress that the support by ITs is absent and they experience a lack of commitment by the school for the achievement of the entire project. In the study of Burbank and Kauchak (2003), participating PTs report that the hierarchical relationship is a threat to open discussion. One PT explains that one does not dare to speak freely, but rather the teaming is characterized 'as an act of satisfying' the site teachers' goals (p 509).

Studies that extend the shared collaboration beyond the one-on-one mentor-mentee relationship appear to be more successful in fostering PTs' learning. The study of Rigelman and Ruben (2012) proposes a framework between one IT, one PT, and one TE, collectively learning to improve classroom practice. They found that in a research team with multiple actors, PTs are more likely to experiment with pedagogical practices that are in contrast to those of their mentors. In the study of Nicholas et al. (2011), students are involved in a team with diverse professional backgrounds to deepen their understanding of the broader community concerned with the learning of children. This high level of collaboration resulted in an advanced awareness of the importance of social services and of their role as a teacher within the broader community. PTs developed a constructive attitude towards a variation of perspectives, which enables them to look at teaching in ways they would never have otherwise considered.

4.1.6. *Reflection*

Collaborative teacher research is reported to deepen the level of reflective thinking on practice (Hagevik et al., 2012; Moran, 2007;

Table 3
Classification of articles by domains of research focus.

Results	Theory of change							Theory of instruction
	School change	Teacher education[a]	Professional development[a]	Collaboration[a]	Reflection	Inquiry	Teaching	Pupil outcomes
	5	15	11	15	10	9	8	0
1. Balach & Szymanski (2003)		**X**	**X**	**X**	x	**X**		
2. Burbank and Kauchak (2003)	**X**	**X**	**X**	**X**	x		x	
3. Chassels and Melville (2009)		**X**	**X**	**X**	**X**	**X**	x	
4. Hagevik et al. (2012)		**X**	x	**X**	**X**	x	**X**	
5. Kirschner et al. (1996)	**X**	**X**	**X**	**X**		**X**		
6. Kotsopoulos et al. (2012)		**X**	x	x	x	x		
7. Levin and Rock (2003)		**X**	x	**X**	x	**X**	x	
8. Moran (2007)		**X**		**X**	x		x	
9. Mule (2006)		**X**		x	x	**X**	x	
10. Nicholas et al. (2011)	**X**	**X**	**X**	**X**	x			
11. Rigelman and Ruben (2012)	**X**	**X**	**X**	**X**	**X**	**X**	**X**	
12. Santagata and Guarino (2012)	**X**	**X**	**X**	**X**		x	x	
13. Sim (2010)		**X**	**X**	**X**				
14. Yayli (2008)		**X**		**X**		**X**		

Note: Capital X:focus retrieved from the research question or goals section in the article. Lower-case x: focus retrieved from the analyses in result section of the article.
[a] Keywords used in search for articles.

Table 4
Thematic overview of perceived outcomes of teacher research.

Domain	Theme	Author
Collaboration	• Modelling & new relationship with experienced teacher	Balach & Szymanski (2003) Burbank and Kauchak (2003) Chassels and Melville (2009) Kirschner et al. (1996) Levin and Rock (2003) Mule (2006) Rigelman and Ruben (2012) Santagata and Guarino (2012) Yayli (2008)
	• Development of a community of professionalism	Balach & Szymanski (2003) Burbank and Kauchak (2003) Chassels and Melville (2009) Hagevik et al. (2012) Kirschner et al. (1996) Kotsopoulos et al. (2012) Mule (2006) Rigelman and Ruben (2012)
	• Sustained conversation within multiple perspectives	Balach & Szymanski (2003) Burbank and Kauchak (2003) Chassels and Melville (2009) Hagevik et al. (2012) Kirschner et al. (1996) Moran (2007) Rigelman and Ruben (2012) Santagata and Guarino (2012) Sim (2010) Yayli (2008)
	• Development of specific collaboration skills	Chassels and Melville (2009) Mule (2006) Nicholas et al. (2011) Rigelman and Ruben (2012) Santagata and Guarino (2012)
Reflection	• Professional Identity	Burbank and Kauchak (2003) Hagevik et al. (2012) Levin and Rock (2003) Mule (2006)
	• Higher reflection level, higher order questioning	Chassels and Melville (2009) Hagevik et al. (2012) Kirschner et al. (1996) Levin and Rock (2003) Moran (2007)
	• Development of self-regulating behaviours	Moran (2007)
Inquiry	• Attitude change toward research (motivation, value, openness toward research,…)	Balach & Szymanski (2003) Burbank and Kauchak (2003) Chassels and Melville (2009) Kirschner et al. (1996) Moran (2007) Mule (2006) Rigelman and Ruben (2012) Santagata and Guarino (2012) Yayli (2008)
	• Inquiry skill development	Nicholas et al. (2011)
	• Improved dialogue and alignment between theory and practice	Balach & Szymanski (2003) Burbank and Kauchak (2003) Hagevik et al. (2012) Kotsopoulos et al. (2012) Kirschner et al. (1996) Nicholas et al. (2011)
	• Openness to participate in teacher research in the future	Burbank and Kauchak (2003)
	• Improved teaching knowledge	

(*continued on next page*)

Table 4 (*continued*)

Domain	Theme	Author
Student-centred teaching		Chassels and Melville (2009)
		Kotsopoulos et al. (2012)
		Kirschner et al. (1996)
		Mule (2006)
	• Opportunity to examine teaching	Balach & Szymanski (2003)
		Burbank and Kauchak (2003)
		Chassels and Melville (2009)
		Hagevik et al. (2012)
		Kotsopoulos et al. (2012)
		Kirschner et al. (1996)
		Mule (2006)
		Rigelman and Ruben (2012)
	• Instructional improvement	Santagata and Guarino (2012)
	• Increased attention to curriculum	Burbank and Kauchak (2003)
		Chassels and Melville (2009)
		Hagevik et al. (2012)
		Mule (2006)
	• Gaining insight in pupil learning	Burbank and Kauchak (2003)
		Chassels and Melville (2009)
		Hagevik et al. (2012)
		Kirschner et al. (1996)
		Levin and Rock (2003)
		Moran (2007)
		Mule (2006)
		Nicholas et al. (2011)
		Rigelman and Ruben (2012)
		Santagata and Guarino (2012)

Mule, 2006). Hagevik et al. (2012) allocated the decisions of PTs to reflection levels based on the four reflection levels of Ward and McCotter (2004): routine, technical, dialogic, and transformational reflection. In routine reflection, there is no focus on problems, there is a disengagement from change and a tendency to blame others is observed. The technical level includes an instrumental response to specific situations without changing one's own perspectives. In the dialogic level, there is a focus on the perspectives of others and the process to learn in the long term. In the transformational level, investigation into the problem leads to changed perspectives and to fundamental changes in practice. Hagevik et al. (2012) observe that PTs' reflections are often restricted to the first levels of reflection. The level of technical reflection that focuses more on survival than improvement is common, with PTs focusing more on themselves instead of evaluating or changing practice. However, the findings of Hagevik et al. (2012) also show a shift to higher reflection levels when PTs are involved in a teacher research process; these findings are corroborated by Santagata and Guarino (2012). PTs seemed to deliberate on the perspective of pupils in their teaching practice, which encouraged a better understanding of diversity in their classroom. PTs involved in teacher research begin to systematically investigate teaching problems throughout this process and there is an evolution in reflection levels from more technical to more transformational levels. The dialogic layer is demonstrated in PTs listening to their pupils and using their ideas in teaching. The highest level of transformational reflection, in which fundamental assumptions are questioned, is rare for PTs. Three PTs demonstrated attempts to address the more ethical concerns of their practice, but the nature of their reflection remained dialogic. It is important to mention that, in this teacher research project, the collaborative nature was restricted to a supported and not a shared nature (see Table 5). Unfortunately, studies that go beyond the one-on-one mentor-mentee relationship did not examine changes in reflection levels.

The analysis of Hagevik et al. (2012) of PTs' written reflection diaries suggests that PTs are more willing to use teacher research as a means for reflective practice in the future. Likewise, Balach and Szymanski (2003) state that strong teamwork between PTs, ITs, administrators, and TEs leads to an appreciation of reflection in a group as a norm. Even if this increased awareness for the merits of reflection is reported in several studies, the findings also show that the tendency of reflective practice is limited to planned collaborative moments and tends not to be transferred to other contexts. This is unfortunate because the perspective of the PT needs to shift from 'tell me the answer' to reflective practitioners who find it important to identify questions and solve them in an evidence based manner in collaboration with others (Moran, 2007; Nicholas et al., 2011). Moran (2007) describes this shift as a move away from a "prescriptive teaching" stance toward a "collaborative inquiry stance".

The reviewed studies reveal that PTs, engaged in collaborative teacher research, develop their professional teaching identity. Levin and Rock's (2003) study investigated PTs' understanding of their professional role as a teacher. Based on data from pre- and post-interviews and reflection papers, they conclude that, in general, PTs' self-confidence grows and they express a better understanding of their role as a curriculum developer. Balach and Szymanski (2003) and Nicholas et al. (2011) also report an increase in PTs' student-centeredness and a deeper understanding of their role within school reform. Finally, several studies report the development of PTs' roles as teacher researchers (Burbank & Kauchak, 2003; Moran, 2007; Mule, 2006).

4.1.7. Inquiry

The reviewed studies identified positive changes in PTs' perceptions towards inquiry (Hagevik et al., 2012; Kirschner et al., 1996; Moran, 2007; Nicholas et al., 2011). Mule (2006) allocated the disposition of PTs to Wallace and Louden's (2000) four levels of engagement with inquiry: technical, personal, problem solving, and a critical interest in inquiry. The technical approach consists of the interest of PTs to perform certain skills and to follow prearranged manuals. The second level involves clarifying questions about their own concerns and their own professional identity as a teacher. The most prevailing interest in the study of Mule (2006) is the one of problem solving, which is mostly observed in problems of children's learning and classroom practice. The last level is critical interest, in which teachers engage in questions that are more related to ethical and social conditions within teaching. None of the PTs in Mule's (2006) study consider the critical interest in their research and he concludes that it is not certain whether PTs or beginning teachers are ready to engage on this level.

Some studies find that not all students recognize the value of inquiry, despite participation in collaborative teacher research. The analyses of Kotsopoulos et al. (2012) reveal ambiguity in PTs' views towards inquiry. Some PTs report that inquiry leads them to more questions than answers, whereas other PTs report learning about how to teach. Mule's (2006) findings confirm that not all students progress in the levels of inquiry disposition. Some PTs reject inquiry because they perceive inquiry as disorganized and not contributing to their practice. In general, however, an evolution is observed. An attitude change seems to occur during participation in inquiry, in which PTs start to value inquiry and its positive influence on the learning of students. According to Levin and Rock (2003), the cycle of inquiry becomes more accepted when all team members can internalize the systematic process of inquiry. The steps of inquiry force team members to question their practice in an intentional way. At first, the approach is experienced as unnatural, but as the systematic approach is followed and successes are experienced, appreciation for the approach generally grows.

Yayli's (2008) study investigated PTs' appreciation of theory during the inquiry process. Their findings are divergent: half of the participants report theory to be an unnecessary source of knowledge in teaching and not applicable in practice, while others report increased loyalty towards testing theory in their practice. When failing to implement theory in practice, PTs discard the international theories as not being relevant for their Turkish context.

Burbank and Kauchak (2003) distinguish between the impact on ITs and PTs. A survey study showed that ITs were more convinced than PTs that the process of inquiry had an impact on their teaching practice. In interviews, ITs attribute this difference to the fact that PTs may not be prepared to think about research, lack research skills, and do not have enough experience within the classroom. The authors suggest that teacher research teams should search for more meaningful research questions that are close to the concerns of PTs at the beginning of their professional development. The significance that PTs give to inquiry is also influenced by the way ITs perceive inquiry. In the research of Kotsopoulos et al. (2012), a negative influence of ITs on PTs was observed. Some students had the feeling that the process was a waste of time. The views of ITs towards inquiry are an important condition for PTs' development of a research disposition.

4.1.8. Student-centred teaching

The value of teacher research on teaching is documented in the included studies as a way to improve the instruction of teachers (Balach & Szymanski, 2003; Santagata & Guarino, 2012). Collaborative teacher research is argued to increase PTs' awareness of student learning and needs, which, in turn, allows for improving teaching practice. Mule (2006) makes a distinction between three 'sources of pleasure' to be involved in inquiry. PTs see their involvement in teacher research as a way of: (1) improving a child's life; (2) learning about their own classroom practice; and (3) improving their knowledge about teaching. An increase of PTs' involvement in improving a child's life is illustrated by the study by Santagata and Guarino (2012). PTs were able to move their attention from self-concerns, which are common reflections for beginner teachers, towards concerns of pupil learning. It appears that collaborative teacher research promotes discussion on pupil learning, which encourages PTs to become aware of the unique learning needs of their students (Levin & Rock, 2003; Rigelman & Ruben, 2012). Collaborative teacher research may have the power to force PTs to see their practice through the eyes of their pupils (Nicholas et al., 2011). PTs no longer perceive teacher research as an obliged task in teacher education, but as a challenge to improve student learning through inquiry (Moran, 2007). Levin and Rock (2003) also found an increased attention on pupil learning in ITs. Three out of five pairs of ITs expressed a perceived impact on their insights and awareness of pupil needs. The second and third effects of teaching that Mule (2006) identified (learning about classroom and improving knowledge about teaching) are illustrated by Chassels and Melville (2009). They report an increase of questioning the existing pedagogical knowledge and an exploration of new knowledge.

5. Discussion and conclusions

Researchers have recently recognized the potential of collaborative teacher research as a means to improve pre-service and in-service teachers' knowledge, attitudes, practice and, in turn, pupil learning (Cochran-Smith & Lytle, 2009; Zeichner, 2010). This systematic literature review was aimed at synthesizing the scattered results of previous empirical studies on the characteristics and effects of collaborative teacher research with pre-service and in-

Table 5
Overview possible collaboration levels in teacher research.

	One-on-one collaboration	Multiple actors collaboration
Parallel inquiry	Mule (2006)	
Supported inquiry	Kirschner et al. (1996) Mule (2006) Yayli (2008)	Balach & Szymanski (2003) Chassels and Melville (2009) Hagevik et al. (2012) Moran (2007) Santagata and Guarino (2012) Sim (2010)
Shared inquiry	Burbank and Kauchak (2003) Kotsopoulus et al. (2012) Levin and Rock (2003) Mule (2006)	Nicholas et al. (2011) Rigelman and Ruben (2012)

service teachers. The review identified 14 publications that met the inclusion criteria. Each of these studies has considerable merit for being one of the few to investigate collaborative pre-service and in-service teacher research teams. All of these studies help us to gain a better understanding of the possibilities, impediments, and conditions of such partnerships. However, if we want to make a case for collaborative teacher research in pre-service education, we need more and methodically stronger studies. Some of the (predominantly qualitative) studies that we reviewed lack important information on research methodology: number of all actors, the nature of interview questions, the amount of data collected, and the duration of the intervention. Furthermore, it is not always clear who collected the data and when they did so. It is important to know the extent to which the researchers were also involved in the collaborative teacher research and the assessment of PTs. Transparency about position and possible bias of researchers might be helpful to interpret the findings. Also, most of the results in the reviewed studies rely on perceptions of PTs. Very few studies have actively investigated the roles of other actors, such as ITs and teacher educators. This is unfortunate, since the little evidence available shows that these roles can have an important impact on PTs' professional learning.

5.1. Differentiated definitions as a display of engagement

Our results show a great variety in the terminology used to refer to the process of collaboration and inquiry between PTs and ITs. The dissonance between terminologies is understandable. Recently, Elen (2016) argued that the use of different definitions for the concept of research has an important added value to the field of educational research that is highly engaged with practice. Elen (2016) identifies two approaches toward differentiated definitions. First, a disciplined approach in which researchers aim to reach consensus about one "best" definition in order for all researchers to adopt this perspective and build a shared knowledge base, allowing for comparison between studies. Second, in an engaged approach, researchers remain critical toward different definitions in order to continuously improve definitions in light of a certain research question and context. Zeichner, in 1993 (p. 200–201), when discussing different definitions for action research, states that debates about whichever model is best are "highly informative in an academic sense", but "essentially irrelevant to many of those who actually engage in action research". Both Elen (2016) and Zeichner (1993) emphasize that allowing various definitions to coincide is inherently part of research that is highly engaged with practice.

5.2. Effects of collaborative teacher research: the state of the art

Overall, findings from the literature provide preliminary evidence of the benefit of collaborative teacher research for pre-service teachers to improve their knowledge and attitudes towards: (1) collaboration, (2) reflection, (3) inquiry, and (4) student-centred teaching. Fig. 3 illustrates the intensity of research on these four themes and different stakeholders that are possibly involved in collaborative teacher research. First, evidence suggests that collaborative teacher research has an impact on PTs' collaboration skills and the impact is highly dependent on the degree and type of collaboration between PTs and ITs. Collaboration is mostly limited to one-to-one collaboration between a mentor and a PT. However, PTs appear to learn more in studies where the collaboration between ITs and PTs follows a design of shared inquiry (Mule, 2006), which is characterized by a less hierarchical collaboration. Schussler (2006) states that intense collaboration as equal partners provides more opportunities to develop joint ownership. Also, PTs appear to learn more when collaboration includes multiple actors (Nicholas et al., 2011). These findings confirm the theoretical work of Darling-Hammond (2010) and Zeichner (2010), who stress that hybrid spaces where multiple actors can meet in a non-hierarchical way is the most promising approach to merge practical and theoretical knowledge and to answer the daily needs of teaching practice. Zeichner et al. (2015) refer to such hybrid space as the Third Space. In such a partnership, particularly the role of the mentor needs to be re-conceptualized. The definition formulated by Taylor, Klein, and Abrams (2014, p. 5), in their recent review, could be useful. They state that mentors are 'educative co-learners who support pre-service teacher learning and reflection (Feiman-Nemser, 1998, 2001), as models of teaching practice (Franke & Dahlgren, 1996), as nurturing and supportive guides (Awaya et al., 2003), as school-based teacher educators (Bullough, 2005; Feiman-Nemser, 1998), and as collaborative colleagues and co-creators of knowledge for teaching (Beck & Kosnik, 2002). Collaborative teacher research by PTs and ITs, provides a perfect opportunity for this co-creation of knowledge for teaching.

Second, in the review, evidence is found for the impact of collaborative teacher research on PTs' reflection level. A progression is observed of reflection levels from routine to more transformational reflection. These reflection skills are, however, not automatically transferred to settings other than the setting of the collaborative research team (Balach & Szymanski, 2003). The

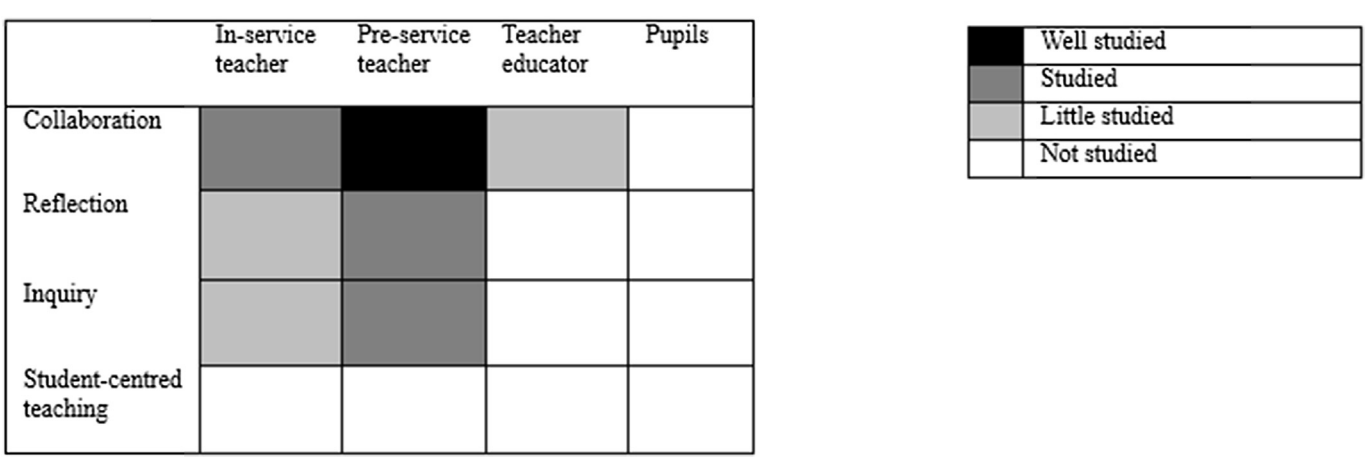

Fig. 3. Research intensity within the framework of collaborative teacher research.

development of reflection and inquiry as a stance is thus not self-evident, but situated. We hypothesize that, in order to realize a research stance in regular daily teaching practice, explicit transfer needs to be supported. We note that the studies that investigated changes in reflection did not involve shared inquiry, but the less advanced supported inquiry. In the latter (supported inquiry), PTs engage in reflection to comply with the requirements of the supervising mentor and the reflection is situated within the context of the teacher education program. The supervising mentor does not engage in an equal way in the reflection process and reflection is thus not modelled to be an inherent part of the daily teaching practice of the mentor teacher. This hypothesis is in line with Darling-Hammond and Bransford (2007) who stress that ITs need to model reflective practice. Our finding provides an important argument for including ITs in the collaborative teacher research team and investigating how ITs can be stimulated to adequately model the desired inquiry stance. Including ITs in collaborative teacher research teams is a complex issue: on the one hand, it is risky because it can threaten PTs' learning by means of negative modelling, but, on the other hand, if ITs are not actively engaged the collaborative teacher research remains an isolated project, and transfer of teacher research into daily practice is inhibited (Kotsopoulos et al., 2012).

Third, some studies show that, despite participation in collaborative teacher research, not all students develop a positive attitude towards inquiry (Kotsopoulos et al., 2012; Mule, 2006). In the empirical studies, several possible explanations are suggested: students experience inquiry as unnatural and raising more questions than answers, students feel that inquiry does not contribute to their practice. And students pick up the negative attitudes of ITs regarding teacher research.

Fourth and finally, the effects of collaborative teacher research on PTs teaching practice is understudied (Fig. 3). Participation in teacher research teams does seem to expand the concerns of PTs to include more attention for their pupils.

5.3. Effects on pupil learning: black box

The majority of the reviewed studies focus on the effects of collaborative teacher research on teachers' professional learning, which is referred to as the theory of change (Desimone, 2009; Wayne et al., 2008). The theory of instruction, which refers to the effects on pupil learning, is understudied. This is not surprising since it is not evident to investigate causal relationships between professional development, teaching practice, and pupil learning (Desimone, 2009; Wayne et al., 2008). Moreover, it illustrates the divide between two traditions: on the one hand, a focus on pupil learning in the measurement movement that holds teachers accountable for pupil learning and that regards teaching as a technical process that needs to be assessed by authorities outside of the classroom; and, on the other hand, a focus on the learning of all stakeholders in the distributed approach in which the researcher and practitioners collaborate to improve their learning and development (Cochran-Smith, 2016). The pitfall of a focus of pupil learning is an excessive emphasis on accountability and testing machines (Swennen, 2013). This may be in total contrast with what collaborative teacher research aims to achieve, especially in pre-service teacher-education. Nevertheless, a focus on pupil learning might be an important motive for teachers to engage in collaborative teacher research. This is in line with the equity agenda that is often associated with the teacher research movement, namely the intention to improve the learning of those who depart from an underprivileged position in the educational system. We suggest integration between both traditions where teachers themselves investigate pupil learning to assess whether their changed teaching practices have resulted in the desired pupil outcomes. We would argue to invest in competence development for teachers to assess evolutions in pupil learning in their own context.

5.4. Recommendations for practice and suggestions for further research

In the 14 reviewed studies, collaboration is often designed as one-to-one interactions of mentors supervising PTs. Our review shows, however, that the involvement of multiple actors (e.g., teacher educators, social workers) in a non-hierarchical level (shared inquiry) is the most promising for PTs learning. This is in line with the theoretical frameworks that suggest Third Spaces as a condition for professional learning (Cochran-Smith & Lytle, 2009; Zeichner, 2010). In particular, we would like to stress that little attention is paid to the role of teacher educators, which is identified as crucial (Lunenberg, Dengerink, & Korthagen, 2014; Zeichner, 2010). Only Rigelman and Ruben (2012) explicitly state and define the role of the teacher educator. They are found to have an important role in supporting the learning of IT and PT, and supporting IT and PT in their partnership when confronted with struggles. We argue that teacher education should invest in sustainable collaborative teacher research partnerships. Teacher educators should take the responsibility to close the gap between schools and institutions. Lunenberg's et al. (2014) literature review identifies this as role as a 'broker'. A teacher educator needs to be prepared to coach PTs on the social skills needed to foster collaboration. It is the responsibility of the teacher educator to encourage the dialogue of all actors in order to achieve a successful partnership. The sense of creating a 'we' is critical in taking risks and trying out new things. Intrinsic rewards for teachers are not enough, however, to sustain their motivation for collaborative teacher research. Mertler (2013) states that incentives should not be misjudged and both extrinsic rewards (e.g., exemptions from other duties, grants, promotions), as well as intrinsic rewards should be considered. Recognition such as participation in an 'innovation conference' where teachers share their work (Mertler, 2013) or the development of agency as a sense of 'we' and ownership (Schussler, 2006) could be valuable intrinsic incentives. Avidov-Ungar (2016) identifies two dimensions of professional development incentives: intrinsic and extrinsic motives, and lateral and vertical professional development aspirations. They argue that principals should investigate teachers' particular needs and design professional development programs and incentives that correspond. The role of the principal is crucial in both dimensions of incentives. Further research into contextual factors, such as principal support and types of incentives for teacher research is recommended.

We argue that further research should adopt a more holistic approach. Cochran-Smith and Lytle (2009) state that teacher research is aimed at preparing teachers for effective teaching in a complex social context, but few studies empirically investigate this topic. Further research should study whether teacher research is effective in reforming teachers' interpretative frameworks that guide their classroom actions for a more democratic society. In order to understand how PTs' collaborative and inquisitive stance evolves after leaving teacher education, more longitudinal studies are essential, encompassing the stages of initial teacher education, induction and continuing professional development. Data triangulation is recommended in which data on teacher thinking and teacher classroom practices are combined. Also, further investigation is needed on the complex interactions of the multiple actors, in particular those of PTs and ITs with teacher educators. This calls for triangulation of the perspectives of different stakeholders. Such rich data can help us to gain insight into the complex collaboration between PTs, ITs, and teacher educators.

Our call for increased partnerships should be situated within the current socio-political climate in the US as well as in Europe. The US and many places in Europe are faced with budget cuts and increased accountability demands (The Organisation for Economic Cooperation and Development [OECD], 2016). As a response, many alternative routes into teaching have emerged, focussing primarily on technical skills, measurement outcomes and standardized testing (Kretchmar & Zeichner, 2016). This revival of the technical view of teaching has not resulted in increased equity because it does not require PTs to develop a holistic understanding of teaching for democracy and it "de-emphasizes the intellectual and relational aspects of teaching" (Cochran-Smith, 2015; par. 20). If teacher education has the ambition to contribute to equity, we need collaborating teachers who are able to adapt to diverse pupils' needs and make decisions based on inquiry into their pupils learning.

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Appendix A. Supplementary data

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