



School-based collaboration as a learning context for teachers: A systematic review

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ABSTRACT

Although teachers' collaboration might be tightly connected to their professional learning, its implementation is challenging. The goal of this review study was to provide an overview of the factors that enable or frustrate school-based teacher collaboration in secondary schools. Based on the collaborative learning activities that were central to 50 studies, three categories were distinguished including sharing, experimenting, and designing. Differences between categories in the way that personal, group, process, guidance, organizational, and structural factors enable or frustrate teacher collaboration were addressed. Overall, factors relating to the process of working and learning together are emphasized in all three categories. Practical implications concern creating possibilities for teachers to explore and critically analyze vital aspects of teaching and student learning.

1. Introduction

Over the past 25 years, in-service teacher learning has evolved from an emphasis on off-site reflective practice such as teacher participation in external workshops and lectures, to on-site reflective practice such as teacher participation in school-based peer coaching and lesson design (Borko, 2004; Hargreaves, 2019; Van Veen, Zwart, & Meirink, 2012). Teacher-centered collaborative practices in school are specifically effective for teacher learning, because they allow teachers to engage in-depth discussions about teaching approaches and student learning that are relevant in their context (Akiba & Liang, 2016; Lecat, Raemdonck, Beusaert & März, 2019; Opfer & Pedder, 2011). Because of research findings that school-based teacher collaboration can increase student achievement, collaboration initiatives are purposefully organized in secondary schools (Hargreaves, 2019). In a systematic review, Vangrieken, Meredith, Packer and Kyndt (2017) point to the learning opportunities that are associated with teacher collaboration, located at the level of students (e.g. improved student understanding), teachers (e.g. improved teacher instruction), and the school organization (e.g. adaption and innovation of curriculum). When collaborating, teachers can inspire each other by sharing practices, help each other with feedback, and collectively develop innovative teaching materials (Meirink, Meijer and Verloop, 2007; Durksen, Klassen & Daniels, 2017; Little, 1990; Thurlings & den Brok, 2017). However, as Hargreaves (2019) argues, "while time away from class is usually a necessary condition for effective collaboration, it is not sufficient" (p. 617) and the implementation of formal collaboration structures sometimes even impede effective collaboration. With their multiple case study, (De Jong, Meirink, & Admiraal, 2019) highlight a number of situational factors that stimulate (or hinder) teacher collaboration in the context of a short-term

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collaboration project in secondary schools, including teachers' learning needs, the availability of (internal or external) support, and the prior existence of a collaborative school culture. Consequently, the collaboration in which different teacher groups engage can take various forms in terms of teachers' perception of the collaboration, their conversations, and their aspirations for follow-up. Effective implementation of development strategies and systems for collaboration in secondary schools, in the sense that it fosters teacher and curriculum development, requires alignment with the teachers involved and their school context (c.f. [Opfer & Pedder, 2011](#)). To gain insight into how school-based teacher collaboration (i.e. teachers that collaborate with teacher colleagues in their school) can be properly organized, we must look at how teacher collaboration in secondary schools is supported or hindered. This review aims to contribute to our understanding of the factors that influence school-based teacher collaboration as a learning context for teachers. In the remainder of this study, we use the label teacher collaboration for school-based teacher collaboration.

2. Theoretical framework

2.1. Teacher collaboration

Teacher collaboration can be understood as joint interaction in all activities of a group that are needed to perform a shared task ([Vangrieken et al., 2015](#)). Influencing factors of teacher collaboration that are frequently addressed include for example teachers' self-efficacy beliefs, the structure that is adopted in teacher meetings, and norms of autonomy and facilitation in school ([Hindin, Morocco, Mott & Aguilar, 2007](#); [Prenger, Poortman & Handelzalts, 2017](#); [Puchner & Taylor, 2006](#)). In this study, we use [Vangrieken, Dochy, Raes and Kyndt \(2015\)](#) classification of factors that they created on the basis of a review study on teacher collaboration. [Vangrieken et al. \(2015\)](#) distinguish six types of factors, that can either facilitate or hinder teacher collaboration, including personal, group, process, guidance, organizational, and structural factors. *Personal factors* refer to individual group members' attitudes, personalities or capacities. For example, teachers' curiosity and non-judgmental attitude can help colleagues to engage in conversations in respectful ways ([Ciampa & Gallagher, 2016](#)). *Group factors* are specific to a particular group and include for example skills on the group level and group leadership. An atmosphere of trust among participants is considered a group factor that supports teachers' engagement in collaboration ([Ciampa & Gallagher, 2016](#); [Owen, 2016](#)). According to [Vangrieken et al. \(2015\)](#), most facilitating factors of teacher collaboration relate to the process of working together such as task emphasis and interdependence. Examples of *process factors* that catalyze teacher collaboration mentioned in previous research include goal clarity ([Alles, Seidel & Gröschner, 2018](#)), engagement in effective learning activities such as experimentation and conflict processes that question one's beliefs ([Achinstein, 2002](#); [Owen, 2016](#); [Schipper, Goei, de Vries & van Veen, 2017](#); [Tam, 2015a](#)), and the availability of specific and complete representations of teachers' practice ([Levine & Marcus, 2010](#)). Process factors differ from group factors because the latter are features concerning the group as such, while process factors occur in the collaborative process and thus are more dynamic in nature ([Vangrieken et al., 2015](#)). *Guidance factors* include training, feedback, and support. Research shows that external facilitators can contribute to teachers' professional growth in collaboration by providing the necessary resources, supporting professional relationships among colleagues, and stimulating critical reflection ([Ciampa & Gallagher, 2016](#); [Furtak & Heredia, 2014](#); [Schipper et al., 2017](#); [Wardrip, Gomez & Gomez, 2015](#)). *Organizational factors* are features of the school as an organization that influence the functioning of collaborative grouping, such as school leadership ([Imants, 2003](#); [LeChasseur, Mayer, Welton & Donaldson, 2016](#); [Opfer, Pedder & Lavicza, 2011](#); [Schipper, de Vries, Goei & van Veen, 2019](#)). *Structural factors* entail structural component and relate to the availability of time and facilities for teachers to meet (e.g. [Ciampa & Gallagher, 2016](#)).

2.2. Teacher collaboration as a learning context

Central to this review is teacher collaboration as a learning context for teachers. Teacher learning is any ongoing work-related process that leads to a change of cognition and/or behavior ([Bakkenes, Vermunt & Wubbels, 2010](#); [Meirink, Meijer & Verloop, 2007](#) ([Meirink, Meijer, & Verloop, 2007](#)); [Zwart, Wubbels, Bolhuis & Bergen, 2008](#)). [Opfer and Pedder \(2011\)](#) point to the interdependent and reciprocal relation between different levels of teachers' learning context that determines the learning potential of teachers' (collaborative) activities. Individual teachers are heavily influenced by the context in which they participate, and vice versa. This means that teachers' personal factors (e.g. beliefs and knowledge) are formed by, among other things, the access, support, and encouragement that surrounds them. For example, teachers' positive attitude towards collaboration is enhanced by a collegial atmosphere in school. Moreover, teacher groups and schools reflect its members. Thus, a collegial atmosphere in school is formed by its teachers' actions and attitudes. In other words, a group and school context influences and is influenced by individual teachers. Following [Opfer and Pedder \(2011\)](#), factors that influence teacher collaboration are manifested at roughly three interdependent and reciprocal levels, including the level of individual teachers (i.e. personal factors), teacher groups (i.e. group, process, and guidance factors), and schools (i.e. organizational and structural factors).

3. Purpose of the study

In secondary education, teacher collaboration is an acknowledged learning environment for teachers and deliberately designed teacher collaboration is widespread ([Hargreaves & O'Connor, 2017](#)). Yet, deeper forms of collaboration such as providing feedback based on classroom observations and engaging in joint activities across different classes are less prevalent than simple exchanges and co-ordination between teachers ([OECD, 2020](#)). The aim of the study is to contribute to understanding how to support teacher collaboration. We do so by providing an overview of empirical outcomes regarding the relevant factors that influence teacher

collaboration in secondary schools.

With their review study, Vangrieken et al. (2015) provide a holistic picture of teacher collaboration in primary, secondary, and higher education, and set out different types of collaboration, including superficial and deep-level collaboration. Teacher collaboration is often focused on practical affairs such as the planning of teaching activities and the nature and content of testing (i.e. superficial collaboration). Deep-level collaboration, such as a critical examination of teaching and discussing each others' functioning, "influences the opportunities collaboration provides for teacher learning to occur" (p. 27) but is a rare form in secondary schools (Vangrieken et al., 2015). Our research approach adds to the approach of Vangrieken et al. (2015) because we specifically focus on teacher collaboration as a learning context for teachers in secondary schools. Moreover, in their review, Vangrieken et al. (2015) excluded the search term 'communities' because they argue that studies discussing communities often speak of school-wide community and it can be questioned to what extent such communities actually collaborate. Yet, in the present study teacher (professional learning) communities are included as these represent a form of teacher collaboration that has often been associated with in-service teacher learning (e.g. Liu, 2019; Popp & Goldman, 2016; Prenger et al., 2017).

With this systematic review, we try to answer the following research question: What personal, group, process, guidance, organizational, and structural factors impact teacher collaboration as a potential learning context for teachers in secondary schools? The following sub-questions are formulated:

- 1) What types of teacher collaboration as a learning context can be distinguished?
- 2) What factors impact teacher collaboration per type of teacher collaboration?

4. Method

We employed the guidelines of the PRISMA statement for systematic review (Moher, Liberati, Tetzlaff, Altman & Group, 2009) to conduct the literature study. The eligibility criteria, information sources, search, study selection, data collection, data items, and synthesis of results as recommended by Moher et al. (2009) are described in the following sub-sections.

4.1. Search

Literature was collected until November 2021¹ using the collection of databases Web of Science ($n = 1044$) and EBSCO Host (including ERIC, PsychInfo, PsychArticles, and Academic Search Premier; $n = 672$). A search query was used combining search terms referring to 'teacher', 'collaboration', 'learning', 'meeting', and 'secondary education'.² The searches were limited to full-text, English language, peer-reviewed papers, the categories of education educational research, psychology educational, education scientific disciplines, or education special, and the document types of article or book (chapter).

An overview of the number of sources generated is shown in Fig. 1. A first selection was carried out on the basis of the titles and abstracts. Sources that did not refer to any of the search terms were eliminated. To further assess the relevance of the articles, we checked whether the full-texts met the selection criteria (see subsection selection criteria).

4.2. Selection criteria of full-texts

The following selection criteria apply to the full-texts: First, following Vangrieken et al. (2015) definition of teacher collaboration, the study had to involve school-based collaboration between a minimum of three teachers or student teachers. Second, the collaboration had to be aimed at teacher learning or professional development. Third, the collaboration between teachers had to be (part of) the primary focus of the study. Fourth, the methods of the study included observation data (i.e. recordings or researcher's notes on teacher collaboration). This selection criterion was applied because observation data has the potential to yield (ecologically) valid and authentic results that enables researchers to grasp teachers' (collaborative) practice. It enables researchers to gather 'live' data from naturally occurring situations. In this way, researchers can also examine what is taking place in situ rather than relying on self-report (such as questionnaires or interviews) only. It furthermore enables researchers to study specificity and completeness of everyday behavior that otherwise might be taken for granted and left unmentioned by teachers themselves (Cohen, Manion, Morrison & Morrison, 2007; Derry et al., 2010). As a fifth selection criterion, studies were included when factors that impacted collaboration were mentioned in the results and/or conclusion. Overall, the literature search resulted in 50 sources being selected, including 46 qualitative, and 4 mixed-method studies.

To ensure the quality of the selection process, the first and second author discussed the selection criteria on the basis of a subsample of 12% of the articles. As a result, selection criteria two, three, and five required further specification from the authors. Regarding

¹ In the literature search, a starting year was not defined.

² TS=(teacher*) AND TS=(team* OR group* OR communit* OR collaborat* OR department* OR interaction* OR network*) AND TS=(learn* OR develop*) AND TS=(discuss* OR conversation* OR meeting* OR session*) AND TS=("secondary education" OR "secondary school*" OR "pre-vocational education" OR "pre-vocational school*" OR "pre-university education" OR "pre-university school*" OR "senior general education" OR "senior general school*" OR "higher general education" OR "higher general school*" OR "middle school*" OR "high school*") NOT TS=("primary education" OR "primary school*" OR "vocational education" OR "vocational school*" OR "higher education") NOT TS=(forum* OR web-based OR online OR web OR asynchronous OR computer-supported OR CSCL) NOT TI=(child* OR pupil* OR student* OR adolescent*)

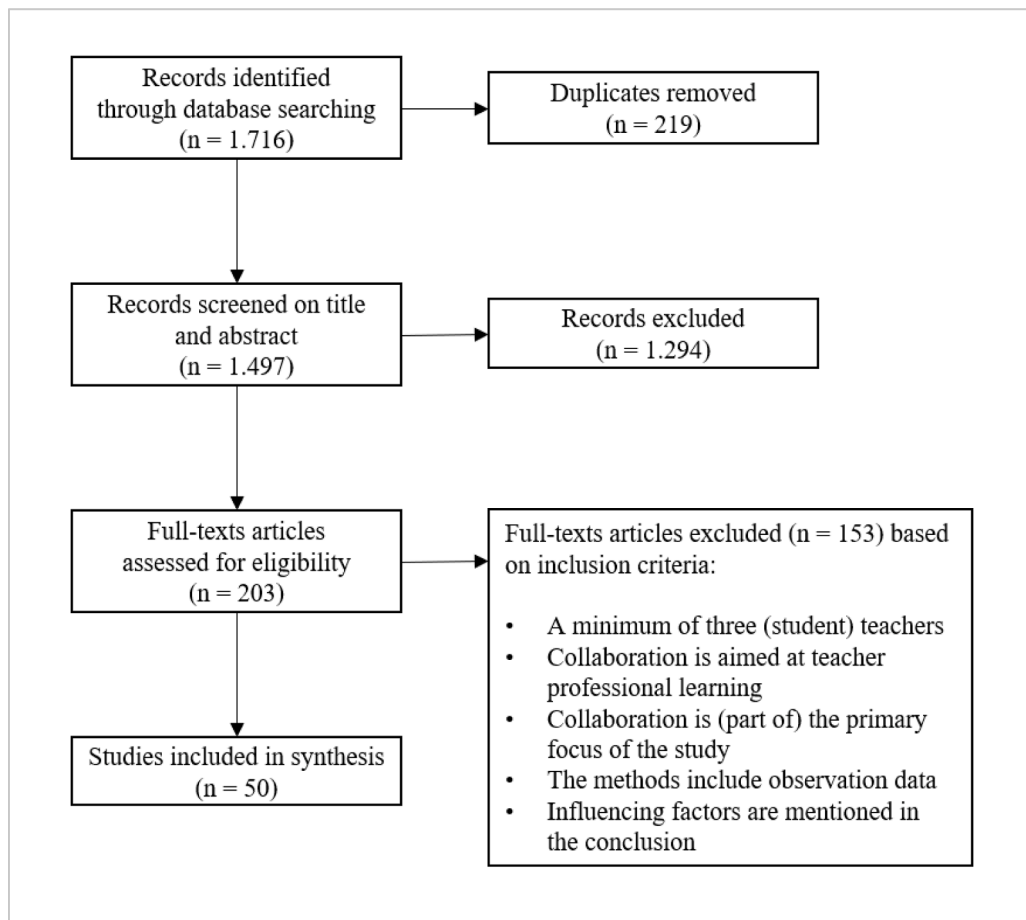


Fig. 1. Visual representation of literature selection.

criterion two (the collaboration had to be aimed at teacher learning), articles that focused on teachers who participated in teacher collaboration that was initiated in the context of school-wide reform, and whose learning process was addressed in the study, were included. This means that in the studies included in this review, the types of teacher collaboration are considered a learning context for teachers. However, this does not necessarily mean that teacher learning was explicitly mentioned as the aim of the collaboration. Regarding selection criterion three it was decided that articles that described teacher collaboration as a 'tool' for learning but did not investigate the collaboration itself were excluded because these sources did not contribute to answering the research question. Regarding selection criterion five it was decided that influencing factors that were not traceable back to the results of the study, because they were based on previous research or concerned implications of the study, were excluded from our analysis. In line with our research question, we only included factors influencing teacher collaboration itself. Thus, factors that impacted the outcomes of the collaboration (e.g. instructional change made in the classroom) were not included. Factors that influenced aspects of the collaborative process (e.g. teachers' conversations about classroom practices or joint experimentation in the classroom) were included.

4.3. Analysis

4.3.1. Categorization

To answer the first research question, the types of collaboration were addressed. Vangrieken et al. (2015) stress that research on teacher collaboration should provide a clear picture of the type of teacher collaboration under study. At the same time, the authors point to the conceptual confusion in research on teacher collaboration because terminology it is ill-defined, different interpretations are assigned to the same term, or different terms are used for the same type of collaboration. Although it is relevant for this review to distinguish between different forms of collaboration types, it is not useful to rely on the authors' original terminology as a term can be used for different types of collaboration. The first author categorized all 50 studies on the collaborative learning activities in which the teachers (mainly) engaged.³ This categorization has been verified by the second author.

³ Whether certain collaborative learning activities are more or less valuable to teacher learning than others, is beyond the scope of this review.

4.3.2. Influencing factors

While analyzing the results and conclusion of each article, we searched for relevant personal, group, process, guidance, organizational, and structural factors (i.e. research question 2). This classification enabled us to discriminate between the varying nature of influencing factors. To this end, a coding scheme was developed (based on [Vangrieken et al., 2015](#)). Within this scheme, we specified whether factors were reported as either beneficial/positive (+), deleterious/negative, or neutral (no sign). Positive factors facilitate the collaboration between teachers, negative factors hinder the collaboration, and neutral factors are shown to be influential to the collaborative process although not explicitly mentioned in a facilitating or hindering manner. In some instances, both the positive and negative impact of a factor was mentioned (+, -). An overview of all factor types and associated subtypes is shown in [Table 1](#).

A second subsample of 12% of the articles was used by the second author to verify the first author's analysis on influencing factors. The coding of teachers' experience was complicated and therefore discussed by all three authors. It was decided that experience that is independent of the group, i.e. experience that can be gained without the other group members (such as experience with the lesson study format), is considered the subtype Knowledge, skills or experience of Personal factors. Experience concerning the teacher group (such as experience with collaboration in the specific group composition), is considered the subtype Experience of Group factors.

5. Results

5.1. Background information

The studies were conducted in various countries, spread over four continents (Northern America: 52%, Europe: 24%, Asia: 22%, and Africa: 2%), ranging from 1995 to 2021, and reflect different types of collaboration, mainly labelled as teacher communities (18%), lesson study (18%), and teacher inquiry (14%).⁴ More than half of the articles investigated one teacher group at one school (54%). The remaining studies concerned two groups from one school (14%), two groups from two schools (12%), three groups from one school (4%), three groups from three schools (4%), six groups from one school, five or six groups from two schools, three groups from three schools, four groups from three schools, six groups from six schools, and 12 groups from 12 schools (each represented by one study). The majority of studies employed both observational data and interviews (74%), supplemented with documents and/or artefacts (i.e. student work) (34%), teacher forms (i.e. logs or questionnaire) (26%), instructional quality measures (e.g. classroom observations) (22%), and/or e-mail correspondence (4%). Other studies combined observational data with documents and/or artefacts (6%), teacher forms (4%), and/or instructional quality measures (2%), or no other data at all (14%).

5.2. Collaboration categories

Based on the collaborative learning activities central to the 50 studies, three categories are distinguished: 1) sharing; 2) experimenting; and 3) designing. An overview of the selected articles and associated collaboration categories is shown in [Table 2](#).

The first category Sharing ($n = 23$) concerns studies in which teachers (mainly) share teaching experiences, discuss student learning, and/or exchange instructional strategies. These studies mainly built on theory regarding professional learning communities (PLCs) from, for example, [DuFour and Eaker \(1998\)](#), [Horn \(2010\)](#), [Little, 1990, 2003](#), [McLaughlin and Talbert \(2001\)](#), and [Stoll, Bolam, McMahon, Wallace and Thomas \(2006\)](#). Within this category, most studies concern existing teacher groups that are part of the school structure (e.g. based on grade or discipline).

The second category Experimenting ($n = 23$) includes studies on teachers (re)developing teaching practices and implementing them in practice. As such, several studies concern lesson study initiatives and built on theory from [Fernandez \(2002\)](#) and [Puchner and Taylor \(2006\)](#). Within this category, most studies concern (top-down) implemented 1-year interventions. An outlier within this category is the study of [Goodyear and Casey \(2015\)](#) in which teachers experimented with an existing teaching model and did not develop teaching themselves.

The last category Designing includes studies ($n = 4$) that focus on teachers designing teaching practices without implementing these practices. References that are central to these studies also reflect the professional learning community literature (e.g. [Little, 1990](#)). Furthermore, the literature on co-design ([Penuel, Roschelle & Shecht, 2007](#)), curriculum design ([Voogt, Jules, Pieters & Handelzalts, 2016](#)), and activity theory ([Engeström, 2001](#)) is addressed. Similar to the category Experimenting, these studies concern (top-down) implemented initiatives.

5.3. Influencing factors

First, we describe general findings on influencing factors that relate to the entire selection of studies. Subsequently, we provide findings per category, together with illustrative examples from a small number of studies that reported on different factor types. An overview of the number of factors reported per (sub)type in each category is provided in [Table 3](#).

The most prevalent factor type is the Process factor, followed by Guidance, Personal, Organizational, Group, and finally Structural factors. The studies that report on Process factors most commonly mention the subtypes Critical analysis ($n = 12$) and Focus ($n = 16$).

⁴ Collaboration types (e.g. teacher communities, lesson study) reflect the terms used by the original authors of the study. In some cases, forms of teacher collaboration that are indicated by different terms can refer to more or less similar ways of functioning. For example, teacher collaboration in lesson study and teacher inquiry both reflect inquiry-based working.

Table 1
Factor types and corresponding subtypes.

Factor subtype	Description	Examples
Personal Factors		
Attitude	Teachers' stances towards certain aspects	Open to new ideas; Readiness to experiment
Beliefs	Teachers' beliefs about certain aspects	Ideologies towards teaching; Sense of competence
Knowledge, skills, or experience	Teachers' knowledge, skills, or experience in certain domains (independent from the teacher group)	Experience with action research; Knowledge of classroom interventions
Professional identity	Teachers' professional identity	Being a teacher and a learner simultaneously
Group Factors		
Experience	The experience that teachers have as a group	History of shared participation in professional development
Group atmosphere	The atmosphere that is present in the teacher group	Non-threatening atmosphere; Shared trust
Heterogeneity	Differences that exist within the teacher group	Differing teaching ideologies; Differing interests
Process Factors		
Collectiveness	Joint, shared, collaborative or collective aspects of collaboration	Shared goal (additional subtype Focus); Collective design (additional subtype Lesson design)
Critical analysis	Inquiry-related activities that take place in the collaboration	Challenge the value of good/bad judging practice (instead of exploring); Inquiry cycle
Focus (on teaching aspect)	Teachers have a focus when collaborating	Overarching goal; Focus on students' needs
Implementation	Teachers try out new teaching practices when collaborating	Implementation of new lesson plan; Action experimentation
Integration (of own teaching or school context)	Teachers' teaching practices or school context that are shared when collaborating	Teaching replays and teaching rehearsals; Rendering classroom events in conversations
Lesson design	Teachers engage in aspects of lesson design when collaborating	Develop a new lesson; Lesson planning
Participation	The way in which teachers participate in the collaboration	Teachers' absence; Teachers who join late
Guidance Factors		
Facilitation (aligned with teachers' context)	Availability of support of (internal or external) actors	Senior teacher as a facilitator; External support
Feedback	Feedback that is provided to the teachers	Intermediate feedback
Protocol	Protocols, tools, structures, models that are adopted in the collaboration	Activity-structuring tool; Systematic protocol of lesson study
Organizational Factors		
Knowledge resources	Specific ways of understanding and putting knowledge to use in the school	Favoring standardization and control of knowledge acquisition
Priorities	Aspects that are prioritized by the school	Credit-driven instruction; Exam-oriented culture
Recognition	The extent to which effort is recognized by the school	In-school recognition for teachers' innovative behavior
Responsibility	The way responsibilities are organized in school	Special educators' dominance in taking responsibility
School atmosphere	Atmosphere in the school	Collegial atmosphere; Mistrust among teachers
School leadership	Leadership of principals or team leaders in school	Leadership styles; Team leaders' vision
Shared vision or mission	The school's vision and mission are shared	Common vision and mission
Structural Factors		
Administrative support	Available administrative support for teachers in school	Infrastructural support; Manpower
Professionalization structure	Existing structures of professionalization for teachers in school	Decentralization; Distinct types of team planning

The literature shows that critically analyzing teaching and student learning is beneficial to teacher collaboration because it, for example, supported teachers' shifting from a judgmental to an explorative and positive stance that created trust in the group (Baecher, Rorimer & Smith, 2012) and inspired discussions in which the teacher group took a closer look at how their classroom practices impacted students' abilities (e.g. Logan & Mountain, 2018). Regarding Focus, the literature illustrates how having certain foci when collaborating is often but not always beneficial to the collaborative process because in some cases it can narrow teachers' explorative stance. For example, Marsh, Bertrand and Huguet (2015) found how an overwhelming focus on dialogue about data limited the flow of ideas about instruction, constraining the possibilities for teacher learning. In a similar vein, Molle (2020) shows that a focus on student outcomes in available student data limits teachers' attention to the complexity of student thinking. A positive finding on having a focus is, for example, that the overarching goal guided teachers' work to generate new lesson ideas and forced the teacher group to think about their teaching ideals (Lawrence and Chong, 2010)). In terms of Guidance factors, the influence of Facilitation in teacher collaboration stands out ($n = 13$). With their multiple case study, Wong (2010a) highlight the influence of external supported teachers to share their views and reflect on their individual practice at a more academic and holistic level. Another example comes from Goodyear and Casey (2015) who found that the external facilitator supported teachers' use of action research.

Overall, the results imply that both Process and Guidance factors are important facilitators of teacher collaboration. For the remaining factor types, our findings show a more equal distribution of facilitating and hindering factors. Regarding Personal factors, the literature emphasizes the facilitating influence of teachers' positive Attitude (Chong & Kong, 2012; Ni Shuilleabhain & Seery, 2018; Tam, 2015b; Thomas, Wineburg, Grossman, Myhre & Woolworth, 1998; Tronsmo, 2019; Wong, 2010b), while a hindering influence is a lack of Knowledge, skills, or experience Hundal, Levin & Keselman, 2014; Meng, 2014; Rubinson, 2002; Slavit & Nelson,

Table 2
Overview of selected articles and associated collaboration categories.

Code	Category	Author(s)/Year
a	Sharing	Abbate-Vaughn, 2004
b	Designing	Andrews-Larson, Wilson, & Larbi-Cherif, 2017
c	Sharing	Baecher, Rorimer, & Smith, 2012
d	Sharing	Brown & Benken, 2009
e	Experimenting	Cajkler, Wood, Norton & Pedder, 2014
f	Sharing	Campbell & Lee, 2017
g	Experimenting	Canonigo, 2016
h	Experimenting	Chandler-Olcott & Hinchman, 2015
i	Sharing	Cheng & Pan, 2019
j	Experimenting	Chong & Kong, 2012
k	Sharing	Cook & Faulkner, 2010
l	Sharing	Curry, 2008
m	Experimenting	(De Jong, Meirink, & Admiraal, 2021)
n	Experimenting	Goodyear & Casey, 2015
o	Experimenting	Hauge & Norenes, 2009
p	Sharing	Horn, 2005
q	Sharing	Horn, 2010
r	Sharing	Horn, 2007
s	Sharing	Horn & Little, 2010
t	Sharing	Horn, Garner, Kane & Brasel, 2017
u	Designing	Hundal, Levin, & Keselman, 2014
v	Experimenting	Karlsen, 2019
w	Experimenting	Karlsen & Helgevold, 2019
x	Experimenting	Kumar & Subramaniam, 2015
y	Experimenting	Lau, 2021
z	Experimenting	Lawrence & Chong, 2010
aa	Experimenting	Logan & Mountain, 2018
ab	Sharing	Louie, 2017
ac	Experimenting	Marsh, Bertrand, & Huguét, 2015
ad	Sharing	Meng, 2014
ae	Experimenting	Molle, 2020
af	Experimenting	Mon, Dali, & Sam, 2016
ag	Experimenting	Ni Shuilleabhain & Seery, 2018
ah	Sharing	Rigby, Andrews-Larson & Chen, 2020
ai	Sharing	Rubinson, 2002
aj	Experimenting	Seleznyov, 2019
ak	Experimenting	Slavit & Nelson, 2010
al	Sharing	Stosich, 2020
am	Sharing	Tam, 2015b
an	Sharing	Thomas, Wineburg, Grossman, Myhre, & Woolworh, 1998
ao	Designing	Tronsmo, 2019
ap	Experimenting	Tronsmo & Nerland, 2018
aq	Experimenting	Vrikki, Warwick & Rødnes, 2021
ar	Designing	Waitoller, Kozleski, & Gonzalez, 2016
as	Experimenting	Watson & de Geest, 2014
at	Sharing	Weddle, 2020
au	Sharing	Weinstein, Madison, & Kuklinski, 1995
av	Sharing	Wong, 2010a
aw	Sharing	Wong, 2010b
axe	Experimenting	Woolway, Msimanga, & Lelliott, 2019

2010). Another reoccurring factor that limits teacher collaboration is a lack of Administrative support (Structural factor; Chong & Kong, 2012; Mon, Dali & Sam, 2016; Seleznyov, 2019; Thomas et al., 1998; Weddle, 2020; Weinstein, Madison & Kuklinski, 1995). More ambiguous findings concern the Heterogeneity in teacher groups (Group factor), which can, similarly to having certain foci, either benefit or hinder teacher collaboration (Abbate-Vaughn, 2004; Chandler-Olcott & Hinchman, 2015; Curry, 2008; Hundal et al., 2014; Kumar & Subramaniam, 2015; Watson & de Geest, 2014).

5.3.1. Sharing

5.3.1.1. *Process factors.* Regarding Process factors, all subtypes except Lesson design (i.e. Critical analysis, Implementation, Focus, Integration, and Participation) are found in the category Sharing. Compared to the Process factors of the categories Experimenting and Designing, the subtype Integration (of own teaching or school context) is emphasized, which refers to the attention that is addressed to teachers' context when sharing, discussing, and reflecting upon teaching. In an interdisciplinary group of high school teachers that focused on effective instructional practices for English-language learners, the public sharing of what is normally private teaching through video viewing supported teachers' sense of trust in the collaborative process and reduced their feelings of anxiety (Baecher

Table 3
Number of studies that reported on each of the subfactors, per collaboration category.

Factor Subtypes	Category			Total
	Sharing (n = 23)	Experimenting(n = 23)	Designing (n = 4)	
Process Factors				
Collectiveness	3	7*	0	10
Critical analysis	5	7*	0	12
Focus (on teaching aspect)	5	9	2	16
Implementation	1	1	0	2
Integration (of own teaching or school context)	5*	1	0	6
Lesson design	0	4*	0	4
Participation	1	5	0	6
Guidance Factors				
Facilitation (aligned with teachers' context)	6	5	2	13
Feedback	0	2*	0	2
Protocol	3	5*	1	9
Personal Factors				
Attitude	3	2	1	6
Beliefs	3	1	0	4
Knowledge, skills, or experience	5	3	0	8
Professional identity	2	0	0	2
Organizational Factors				
Knowledge resources	0	0	1	1
Priorities	3	1	0	4
Recognition	0	1	0	1
Responsibility	0	1	0	1
School atmosphere	1	2	0	3
School leadership	3	1	0	4
Shared vision or mission	1	0	0	1
Group Factors				
Experience	2	2	0	4
Group atmosphere	1	1	0	2
Heterogeneity	2	4	1	7
Structural Factors				
Administrative support	3	3	0	6
Professionalization structure	2	1	0	3

Note. A total of 123 influencing factors were detected in the 50 studies, which were divided into subfactors. Some factors concern multiple factor subtypes, and each factor subtype is counted maximally once per study. The number of studies indicated with an asterisk (*) relates to studies that are based on the same dataset (i.e. studies j and z, studies p, q, r, s, and studies v and w).

et al., 2012). Similar findings are reported by Brown and Benken (2009). Based on a case study on teacher learning about mathematics teaching, these authors found that as soon as teachers started communicating their school circumstances and found a shared trust, they became more engaged.

5.3.1.2. Guidance factors. Two subtypes of Guidance factors are mentioned, including Facilitation and the use of a Protocol. In general, facilitation refers to the (external) support that is available when collaborating. Protocols refer to existing formats on how to learn and collaborate in a group. Brown and Benken (2009) show how participating teachers initially questioned the Facilitation, in terms of the level of respect, commitment, and understanding from the facilitator. Throughout the collaboration, the facilitators became more involved in the school context, communicated shared concerns (e.g. about students' needs and the school building), and contextualized the mathematical content more, which supported teachers' engagement and productiveness of the working relationships. Based on Brown and Benken's (2009) results, this shift seems to reflect an interplay between the Guidance and Process factors. On the one hand, the teachers' integrated their school context more. On the other hand, the facilitation changed. Baecher et al. (2012) also report on Guidance factors that relate back to the previously described Process factors. Namely, the authors illustrate how using the language of a coaching Protocol (e.g. recommendations such as 'do not interrupt' and 'frame questions positively'), although perceived as awkward and unnatural by the teachers, supported an explorative stance instead of passing judgement on the teachers. Similar results are found by Curry (2008) who conducted a study on six 'critical friends groups' with a focus on collaboration, inclusion, and technology. The author found that the use of conversation tools, which outline the oral inquiry process, engaged teachers in substantive conversations about issues of teaching, learning, and reform, de-privatized teacher practice, and supported critical collegiality. At the same time, however, it potentially limits the pursuit of important emergent issues and narrowed the depth of inquiry (Curry, 2008).

5.3.1.3. Personal factors. Within the category Sharing, the influence of Personal factors on teacher collaboration is emphasized, compared to the categories Experimenting and Designing. All four subtypes of Personal factors (i.e. Attitude towards collaborative learning, Beliefs such as self-efficacy, Knowledge, skill, or experience regarding teaching or collaborative learning, and Professional identity) were mentioned in the selected studies. Tam (2015b), who compared a school's English and Chinese department that both aimed to improve the quality of their curriculum, points to several factors that impacted teachers' receptivity to the collaboration. Firstly, their comparative case study shows that teachers with Experience in collaboration were more receptive. Secondly, teachers' positive Attitude towards developing a collaborative work culture stimulated their willingness to try different things to improve students' outcomes. Thirdly, teachers' positive Beliefs did not only support their receptivity but also regulated their time and energy, and enabled the group's development towards a community. The remaining subtype of Personal factors is addressed by Brown and Benken (2009). According to these authors, disengagement of teachers was fostered by a Professional identity that was shaped by competing forces of maintaining the public perception of mastery and being one's teacher, while simultaneously being an adult learner and trying to figure out how to engage students and help them learn. Cheng and Pan (2019) also mention Professional identity as influencing factor of teacher collaboration. According to these authors, group members tend to take different roles and demonstrate different aspects of their identity in teacher collaboration. In that study, the participation of group members differed in terms of turns, dominance and leadership.

5.3.1.4. Organizational factors. Four subtypes of organizational factors are identified in the literature, including Priorities (i.e. prioritized educational aspects in school), School atmosphere, School leadership, and a Shared vision or mission in the school. According to Tam (2015b), School leadership labelled as democratic (e.g. power and decision-making were shared with colleagues) supported teachers' commitment and sense of ownership whereas the managerial School leadership (e.g. overseeing all teaching) kept everyone working in isolation, striving for individual excellence in teaching.

5.3.1.5. Group factors. Regarding Group factors, the Group atmosphere, Experience as a group, and Heterogeneity in the group are identified as subtypes influential to collaboration. With regard to the Group atmosphere, Brown and Benken (2009) found that teachers became more engaged (e.g. openness to explore and implement new pedagogy, share insecurities about their understanding of mathematics) in the collaborative process when they achieved a level of comfort, liking, and trust. Another example relates to the Heterogeneity in the group. Curry (2008) found that due to the interdisciplinary nature of the group composition, a concrete content-specific focus was missing which disappointed the teachers.

5.3.1.6. Structural factors. The structural factors appointed in the literature of the category sharing concern the school's Administrative support and Professionalization structure, which entail the availability of support in terms of time, space and money for teachers to collaborate, and the existing structure present in school to professionalize, respectively. With regard to the Professionalization structure, Curry (2008) points to its beneficial and limiting influence. On the one hand, a variety of collaborative activities with distinctive functions and goals attracted a diverse membership of teachers (in terms of instructional practice). On the other hand, participation in one specific collaborative activity created a struggle for teachers to stay focused on the bigger (teaching) picture.

5.3.2. Experimenting

5.3.2.1. Process factors. Similar to studies from the category Sharing, studies in the category Experimenting most often report on process factors. Within this category, all subtypes of Process factors are found. The subtype Lesson design refers to a sub-phase of experimenting and is reported several times. Lawrence and Chong's (2010) study on three subject groups involved in lesson study, shows how collective Lesson design contributed to teachers' motivation in the group and created a sense of joint ownership and responsibility for their teaching. This multiple case study also illustrates other supporting factors, including deciding on an overarching goal (i.e. Focus) that guided teachers towards a specific lesson plan, hands-on experiences (i.e. Implementation) which stimulated teachers' openness and receptiveness to pick up new knowledge and skills and try out unfamiliar instructional skills, and the observation of peers that helped teachers to identify gaps in teacher and student learning (i.e. Critical analysis; Lawrence & Chong, 2010). Regarding Critical analysis, Slavit and Nelson (2010), who studied a group of mathematics teachers engaging in collaborative inquiry, emphasize that teachers' interpretations were rarely challenged whenever critical dialog was channeled to issues of instruction in general, and away from specific examples of student thinking. As soon as the teachers moved to discussions of specific student work, their assumptions became clear and open to challenge.

5.3.2.2. Guidance factors. Besides Process factors, Guidance factors are emphasized in the category Experimenting, including all subtypes. A commonly mentioned subtype is the Protocol that was used when collaborating. Chong and Kong (2012) and Lawrence and Chong (2010), who conducted research on the same teacher sample, found that the lesson study Protocols promoted teachers' sense of efficacy and openness to adopting new teaching approaches, group accountability, and ownership. Furthermore, Chong and Kong (2012) provide insight into how Facilitation impacts the quality of the collaborative process as a whole. Namely, the senior teachers who facilitated the subject groups ensured that teachers adhered to the adopted Protocol of lesson study and provided relevant subject-content knowledge when needed (Chong & Kong, 2012). Thus, similar to factors found in the category Sharing, Facilitation and Protocols seem to be related to Process factors. One subtype that has not been mentioned in the category Sharing, entails the Feedback that teachers receive on their teaching. Chong and Kong (2012) and Lawrence and Chong (2010) describe how providing intermediate

Feedback impacted the foci that the teachers adopted when observing each other, and therewith the quality of the observation itself. Initially, the collegial observations were unfocused and rather sporadic. Subsequent group Feedback gave the observing teachers information about the pertinent things to look out for which eventually helped them to refine the lesson (Chong & Kong, 2012; Lawrence & Chong, 2010).

5.3.2.3. Personal factors. Three subtypes of personal factors are identified in the literature, including Attitude, Beliefs, and Knowledge, skills, or experience. In those instances where teachers expressed readiness to experiment and innovate and persevered in developing engaging lessons, teachers' observations were more to the point and critical, including clear suggestions for improvement (Chong & Kong, 2012). Slavit and Nelson (2010) show how teachers' discussions regarding interpretations of students' work were limited, due to a lack of Experience in the group with protocols and other techniques for looking at student work. Woolway, Msimanga and Lelliott (2019), on the other hand, illustrate how teachers' Experience with certain teaching content stimulated teachers' participation in reflection activities over a two-year period.

5.3.2.4. Organizational factors. Organizational factors include School leadership, Priorities, School atmosphere, Recognition, and Responsibility. The latter two subtypes concern the extent to which teachers' efforts are recognized by the school and the way responsibilities concerning students are organized in school, respectively. An example comes from Mon et al. (2016) who investigated two lesson study groups and describe how the teacher-directed and bottom-up approach that lesson study required were conflicting with the exam-oriented culture. Due to these divergent Priorities, teachers were unable to put enough time and commitment to the implementation of lesson study.

5.3.2.5. Group factors. Three subtypes were mentioned, including Experience, Group atmosphere and Heterogeneity. Due to a non-threatening Group atmosphere, teachers involved in lesson study felt comfortable to rationalize approaches, evaluate their ideas, and provide insight where it was not evident to others (Lawrence & Chong, 2010). Karlsen (2019) shows that teachers can achieve the full potential of their collaborative activities (i.e. observation and interpretation of teaching) when they have become more familiar with each other as a group.

5.3.2.6. Structural factors. The structural factors include the subtypes Administrative support and Professionalization structure. With regard to Administrative support, Chong and Kong (2012) and Mon et al. (2016) show how a lack of time, logistical support, manpower, and infrastructural support lead to overall frustration in the group and limited the implementation of the lesson study process.

5.3.3. Designing

In the category Designing, Process, Guidance, Personal, Organizational, and Group factors were reported.

5.3.3.1. Process factors. The studies of (Andrews-Larson, Wilson and Larbi-Cherif, 2017) and Hundal et al. (2014) point to the influence of having a Focus. (Andrews-Larson, Wilson and Larbi-Cherif, 2017) conducted a study on five teacher groups that focused on co-planning and show how this Focus impacted teachers' engagement in pedagogical reasoning. Namely, the teachers engaged in discussions on common student struggles when designing, but did not elaborate on or justify the ideas they brought forward (Andrews-Larson, Wilson & Larbi-Cherif, 2017). Hundal et al. (2014) case study about co-design on environmental health curriculum points to the impact of teachers' (additional) Focus of enhancing student interests, besides the primary focus of facilitating students' understanding. Consequently, the teachers wanted to make the design 'fun' for the students by moving at a fast pace across a range of topic, which conflicted with the primary Focus.

5.3.3.2. Guidance factors. Andrews-Larson et al. (2017) and Waitoller, Kozleski and Gonzalez (2016) report on the impact that Facilitation and Protocols have. First of all, Andrews-Larson et al. (2017) point to the added value of a co-design Protocol for structuring discussions on key aspects of a lesson which was beneficial to the facilitators' questioning and opened learning opportunities for the teachers. Second, in relation to the Process factors described above, the authors stress the facilitator's role in establishing purpose and context because it enhanced teachers' engagement. Furthermore, the facilitator created space for teachers to contribute to conversations in meaningful ways (e.g. by asking for detailed representations of teachers' practice and rationales for their instructional decisions). Waitoller et al. (2016) study on a group of teachers who developed a two-week unit, also stresses the role of the facilitator. Namely, the teachers participated more actively once the facilitators aligned their university tools to the expertise of the teachers.

5.3.3.3. Personal factors. In terms of Attitude, Tronsmo (2019) points to teachers' agency in the form of responsibilities as influencing factor. Her case study shows how a teacher group that is engaged in developing a subject-specific curriculum manages to handle dilemmas (e.g. determining the right method of assessment), which required their extended responsibility.

5.3.3.4. Organizational factors. Besides a personal factor, Tronsmo (2019) highlights an organizational factor that influences teacher collaboration, namely Knowledge resources in school. Knowledge resources refer to the learning orientation underlying the tools, procedures, texts, models, research evidence, and educational technologies that are available in school. Knowledge resources are not neutral as they incorporate knowledge and beliefs and reflect particular logics and intentions. For example, student tests often

originate from control orientation marked by standardization and generic validation for all student learning whereas other resources may originate from experience orientation which are more context dependent. Tronsmo's (2019) findings show how knowledge resources in school influence teacher groups' decisions.

5.3.3.5. *Group factors.* Hundal et al. (2014) describe how Heterogeneity in the expertise of a teacher group was beneficial to their co-design because different aspects of the design could be covered by different teachers, depending on their expertise.

6. Discussion

The aim of this systematic review was to identify factors that impact teacher collaboration as a learning context for teachers in secondary schools. Most frequently reported forms of teacher collaboration in the 50 included studies were teacher communities, lesson study, and teacher inquiry. Yet, the original terminology of teacher collaboration does not always reflect the actual nature of teacher collaboration which complicates the interpretation of research findings (c.f. Vangrieken et al., 2015). Therefore, we distinguished between the collaborative learning activities that the teachers (mainly) engaged in (i.e. Sharing, Experimenting, and Designing).

Our findings correspond partially with the findings of Vangrieken et al. (2015), who conducted a review study on teacher collaboration in primary, secondary, and higher education. Vangrieken et al. (2015) found that teacher collaboration was facilitated by mainly group and process factors, and hindered by mainly personal and group factors. These patterns of facilitating and hindering factors are not present in our findings. Overall, our results emphasize the influence of factors relating to the process of working and learning together in teacher groups. Moreover, a coherence between the process of collaboration and the guidance that is available to teacher groups when collaborating is notable, as these factors are reported simultaneously in several studies. The availability of tools or facilitation presumably promotes the process of collaboration of teachers and vice versa. For example, groups that have a clear focus might adopt tools or facilitation that contribute to this focus. These findings imply that if schools want to support teacher collaboration, it is worthwhile to invest in facilitation, feedback, and protocols and that these forms of guidance should adequately address process elements such as collectiveness, critical analysis and teacher participation.

The categorization of Sharing, Experimenting and Designing enabled us to differentiate in the influence of factors relating to individual teachers, teacher groups, and school by different types of teacher collaboration. Within the category Sharing, the influence of Personal factors (i.e. teachers' attitude, beliefs, knowledge, skills, experience, and professional identity) stands out. When teachers share stories and ideas, they are informed by what group members bring up regarding teaching and student learning. In contrast to teacher groups that engage in experimenting or designing, teachers have no shared practice to build on and their conversations are especially dependent on group members' attitudes, beliefs, experience, and identity. When teachers collaborate on differentiated teaching, for example, teachers' conversations are guided by teachers' knowledge of differentiated teaching and commitment to tackle challenges in their teaching practice. The influence of teachers' individual experience in the category Sharing is also visible from the emphasis on the subfactor Integration of own teaching or school context (Process factor) in this category. The results show that the public sharing, of what is often private teaching, supports teacher collaboration. When teachers engage in sharing experiences, discussing student learning, and/or exchanging instructional strategies, we recommend that they carefully explore each other's characteristics and teaching practice, possibly under the guidance of an (external) facilitator. This way, teachers' learning needs, insecurities or doubts can be adequately addressed.

When teachers design or experiment with new or adapted forms of teaching, their conversations are less dependent on personal characteristics due to shared experiences in the teacher group. Then, teachers' collaboration is informed by their shared practice of designing and experimenting with teaching, and not solely by teachers' individual knowledge and beliefs regarding teaching and student learning. Teachers' joint experience with teaching automatically involves certain levels of specificity and completeness of their teaching practices that is assumed to promote teacher learning (Little, 2003). Not surprisingly, Process factors are emphasized more in the category Experimenting compared to the category Sharing. Studies that focus on forms of teacher collaboration in which teachers (re)develop teaching practices together and implement these in practice, highlight the role of Process factors such as Collectiveness and Critical analysis in teacher collaboration.

The findings of this study also show how similar factors can have a different impact on teacher collaboration. In most cases, the presence or absence of factors enabled or frustrated teacher collaboration, respectively. For example, supportive school leadership enabled teacher collaboration, and the absence of supportive school leadership frustrated teacher collaboration. However, this presence-absence interpretation cannot be generalized to all factors. In some studies, it remained unclear whether teacher collaboration was facilitated or hindered. For example, the review points to the influence of teachers' beliefs on teachers' conversations, but insights into the way beliefs have an impact remain unknown. Furthermore, our findings indicate that heterogeneity and having a focus in a group both facilitate and hinder teacher collaboration. Regarding heterogeneity, Vangrieken et al. (2015) report similar findings and explain how some heterogeneity in a group can be beneficial and how too much heterogeneity can impede collaboration. This literature review makes clear that factors work out differently due to the context-dependent nature of teacher collaboration. It can be assumed that teacher collaboration is influenced by the interaction between factors at the level of individual teachers, the teacher group, and the school (c.f. Opfer & Pedder, 2011). In one context, differences in, for example, teachers' expertise promoted teacher collaboration because teachers were enabled to move toward more thorough explanations of student learning (Kumar & Subramaniam, 2015). In another context, heterogeneity in teachers' expertise impeded teachers' engagement (Chandler-Olcott & Hinchman, 2015), which was possibly related to teachers' frequent absence and their unsupportive school culture. In order to promote

teacher collaboration, we recommend that school leaders and other facilitators of teacher collaboration should consider individual-, group-, and school-level factors simultaneously instead of focusing their attention on one level and therewith neglecting the other levels.

7. Limitations and recommendations for future research

Each systematic review goes with a publication bias. It is likely that the reviewed articles mostly report on supportive factors of teacher collaboration. Factors that have a negative or no impact on teacher collaboration, are possibly reported to a lesser extent. Due to this publication bias, insights in why factors have a negative or no impact might be incomplete, while these insights are relevant for practice as well. A recommendation for future research is to conduct a systematic review on the reasoning underlying research on influencing factors. Systematic reviews generally incorporate results and conclusions of reviewed articles. It would be worthwhile to explore what factors are mentioned in the introduction and theoretical frameworks of empirical studies, and to what extent these factors are also addressed in the results and conclusion of the study. Our suggestion is that this research approach would be a valuable addition to our systematic review.

The most prominent factor influential to teacher collaboration found in this review concerns the Process factor. Other factors are also important in how collaboration unfolds in teacher groups but are less emphasized. Possibly, factors that are not manifested at the group level (i.e. Personal, Organizational, and Structural factors) have not been given sufficient attention in the empirical studies included in this systematic review. More extensive studies are needed to further explore the context-dependent nature of collaboration. In this review, more than half of the studies investigated one teacher group of one school. One way to investigate the impact of organizational and structural factors is, for example, by incorporating multiple school sites. However, it is challenging to develop research strategies that allow for a useful balance between attending to both the contextual specificity of systems and their common affordances and patterns (Opfer & Pedder, 2011). Already in 2004, Borko illustrated how single-site studies dominated research on teacher professional learning. In the context of teacher collaboration, single-site research seems still dominant. Therefore, we recommend that in future research on teacher collaboration, clearer descriptions of the context are provided such that research findings can be interpreted more validly. Another explanation for the dominance of single-site studies is our criteria of including studies that incorporated observational data. Research that did not include observation data, and possibly concerns large-scale research focusing on multiple school sites, is disregarded.

8. Concluding remarks

This review addressed the Personal, Group, Process, Guidance, Organizational, and Structural factors that impact teacher collaboration as a learning context for teachers in secondary schools. We agree with Hargreaves (2019) that less top-down control or more available time is *not* sufficient in stimulating teacher collaboration. Especially factors that relate to the process of working and learning together are important. Therefore, we recommend creating sufficient possibilities for teachers to explore and critically analyze vital aspects of teaching and student learning. Although teacher collaboration is a common, popular, and promising learning context for teachers, this review also shows how challenging its facilitation is because similar factors can have varying impact. We conclude that collaborative approaches to teacher learning and development do not take place in context but *are* context. School leaders and other facilitators of collaborative learning practices in schools are recommended to pay attention to the current state of affairs in school before adopting promising and innovative collaboration strategies and systems. More specifically, the exploration and acknowledgement of teachers' school context (e.g. administrative support and priorities in school) and personal characteristics (e.g. knowledge and beliefs) should be structurally integrated in collaborative practices.

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Declaration of Competing Interests

None.

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