LEADING COLLABORATIVE INNOVATION in SCHOOLS

Angela de Jong

Leading collaborative innovation in schools

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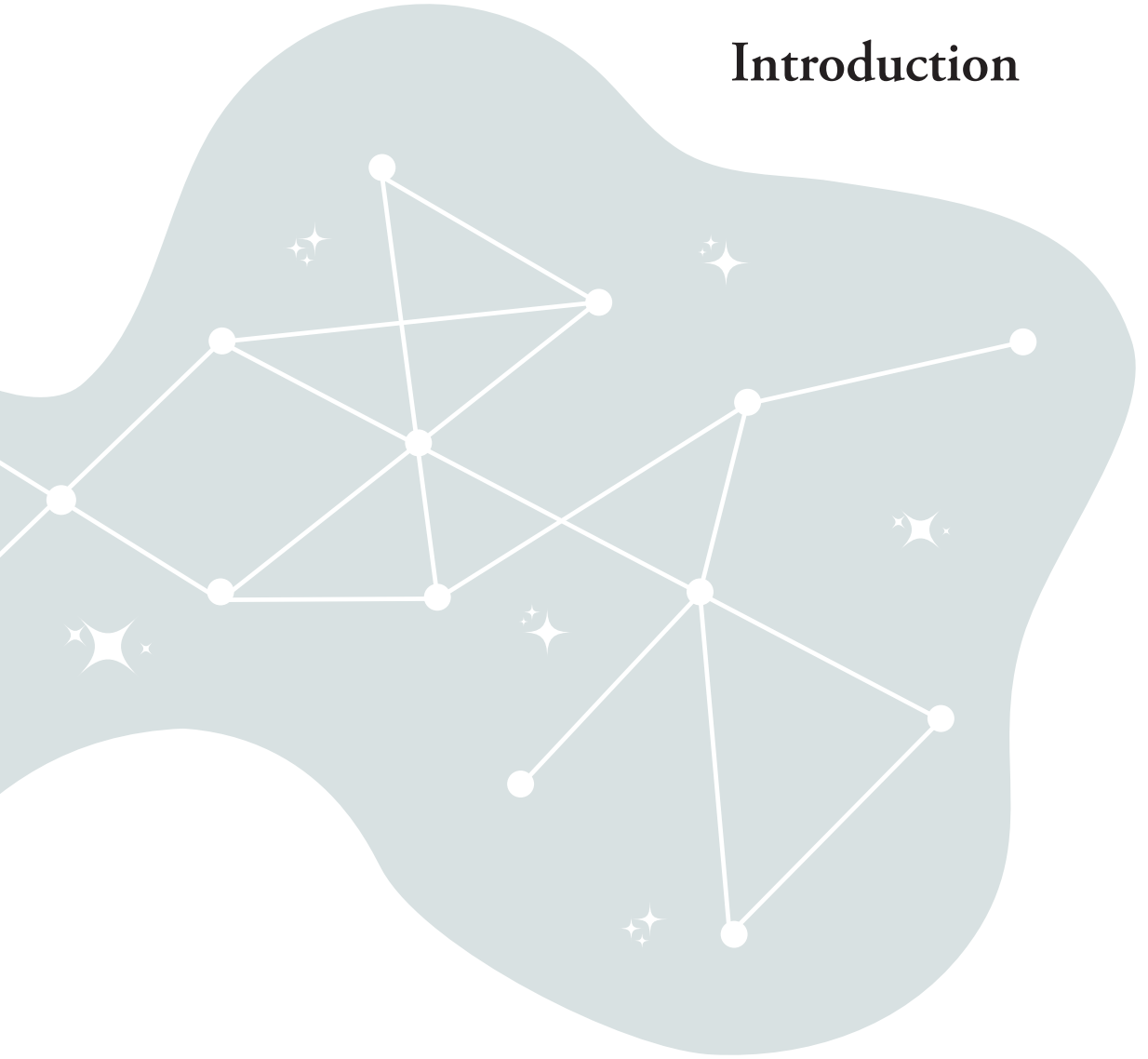
Introduction



1.1. Introduction

1.1.1. Searching for innovation

Across the world, school principals, school boards and their organizations, teachers, policy makers, and politicians are searching for innovative ways to improve education. When innovations are initiated, schools encounter many challenges and innovations often do not turn out as intended. These innovations can happen at multiple levels and can relate to different aspects of the educational process. Innovations can be initiated on a national level as nation-wide policy innovations, but they can also happen on regional or local levels, as innovations within schools. Moreover, innovations can focus on substantive elements of educational practices, such as curriculum change, or on improving organizational processes. In the literature, there is an increasing emphasis on investigating how various types of educational innovations turn out (Boyd, 2021; Den Brok, 2018; Fullan, 2008; Vanlommel, 2021; Verbiest, 2021; Wubbels & Van Tartwijk, 2018).

In the Netherlands, we have seen multiple nation-wide educational innovations in the last thirty years, which have generally been considered unsuccessful. These unsuccessful innovations prompted a parliamentary investigation, referred to as the 'Dijsselbloem committee' (2008), by the name of its chairman. This committee identified a number of problems such as government over-steering in the pedagogical-didactical domains in schools (Tweede Kamer der Staten Generaal, 2008). This resulted in a lack of professional space for teachers and school principals to play a role in the innovations. Teachers felt the innovations were enforced upon them. On the other hand, the committee highlighted that schools did not always take the professional space that was given to them by the government (Tweede Kamer der Staten Generaal, 2008; see also Van Eck & Bollen, 2014; Wubbels & Van Tartwijk, 2018). A more recent example of a nation-wide innovation is an attempt to renew the curriculum for Dutch primary and secondary education. Even though the coordinating committee of this innovation aimed to put "teachers in the lead" – amongst others, by selecting a number of them to participate in development teams at the national level – most teachers in Dutch schools do not feel that they had a say in the innovations.

When professionals such as teachers perceive a low degree of influence on shaping the content and implementation of national policies, such as certain innovations, in schools they can feel alienated from a policy (Tummers, 2012; Tummers et al., 2013). In case of more local innovations within schools, the same dynamic of perceiving too little professional space and influence on shaping innovations can arise. In this dissertation, we analyze whether and how school principals and teachers shape and lead local innovation processes in schools.

1.1.2. Collaboration in and around innovation

A well-known international example of an educational innovation that gives more professional space to school principals and teachers is Ontario's approach (Boyd, 2021; Mourshed et al., 2010). This approach has positive results and is based on a theoretical framework derived from Fullan (e.g., 2010). One essential element of this approach is that responsibility and professional space are given to teachers to improve education collaboratively (Boyd, 2021). Teachers are regarded as professionals who are critical partners in leading innovations. They share responsibilities in achieving educational goals and intentionally collaborate with colleagues to improve education (Boyd, 2021; Hargreaves et al., 2018).

The number of such *collaborative* forms of jointly led innovations is increasing in the Netherlands and elsewhere (Inspectie van het Onderwijs, 2018; Leithwood et al., 2020; Onderwijsraad, 2018). These collaborative forms are in line with the advice of the OECD (2016) for Dutch schools to further improve their educational quality by strengthening staff collaboration. Improving education through more collaboration requires a change in professionalism. Teachers must change from being isolated in classrooms towards collaboratively innovating education (e.g., Koeslag-Kreunen et al., 2018; Ros, 2022; Vangrieken et al., 2015). Moreover, school principals must change from being leaders (with many if not all responsibilities) to sharing responsibilities and leadership with teachers, providing teachers with professional space. In the Netherlands, this interest in their professionalism is reflected in the "Knowledge agenda",[1] focusing on the school as a professional organization (e.g., Ros, 2022; Van Tartwijk, 2022) and a new initiative called "Developmental force"[2] that connects educational practice and research to innovate education (Rijksoverheid, 2022). Recently, additional financial resources have been invested in the professional development of school principals and teachers (Rijksoverheid, 2022; VO-raad, 2022). Moreover, this interest in professionals and changing professionalism fits a wider development in many other public and non-profit domains (e.g., Martin, 2021; Noordegraaf, 2020; Stone & Travis, 2011). In the medical domain, for example, the classic image of professionalism, with the doctor as the professional with autonomy, changes into modern images of organizing medical action aimed at treating complex cases, prioritizing patients, and accounting for actions. Patient treatments become more complex, and multiple patients and critical environments exert strong pressures (Noordegraaf, 2020).

[1] Kennisagenda [Knowledge agenda] of the Netherlands Initiative for Education Research (NRO).

[2] Ontwikkelkracht [Developmental force] of the Ministry of Education, Culture and Science and Nationaal Groeifonds [National Growthfund].

Questions arise for schools, scholars, and policy makers on how to organize and lead more collaborative forms of innovating education (e.g., Vanlommel, 2021). Secondary school teachers who were interviewed for the research presented in this dissertation, for instance, noted: "We wanted to improve our lessons and education but how to do that was unknown to us. We had conversations with each other but didn't really get anywhere". A school principal mentioned: "I noticed there was room to improve our education, but I did not want the change to be dependent on my formal role". These quotes illustrate that many Dutch teachers and school principals together search how to improve their education and how to lead these innovation processes. All schools that we studied chose to work with a two-year program of Foundation leerKRACHT, implemented by schools locally.[3] This independent foundation aims to structure collaboration in schools to improve education.[4] It stimulates school principals to be involved in innovation processes and to share responsibility for the success of the innovation with teachers. Furthermore, it stimulates teachers to collaborate and take the professional space provided by their school principals to innovate education.

1.1.3. Leading collaborative innovation

In both educational practice and literature, the focus is still mainly on teacher collaboration, such as in professional learning communities and data teams (Admiraal et al., 2021; Hargreaves & O'Connor, 2017; Schildkamp et al., 2016). In organizational literature, however, scholars try to go beyond this. They have introduced the notion of *collaborative innovation*. Collaborative innovation is characterized by a multi-actor approach to innovation. A specific feature of this notion is that it involves both horizontal and vertical working relations (Bekkers & Noordegraaf, 2016; Sørensen & Torfing, 2018). Horizontal relations refer to working relations between persons and organizations at the same hierarchical level. In this dissertation we study relations between teachers. Vertical relations pertain to working relations that cut across different organizational levels, functions, and hierarchies (Torfing, 2019). In this dissertation we study relations between teachers and school principals.

These horizontal and vertical working relations in schools need to be led (Angelle, 2010; Bason, 2010; Ospina, 2017). There is growing public and scholarly awareness of the importance of leadership and leading innovation processes in schools (AVS

[3] leerKRACHT means "Learning force" and also "Teacher" in Dutch (usually referring to teachers in primary schools).

[4] https://stichting-leerkracht.nl/.

& VO-raad, 2021; Fullan, 2016; Knies et al., 2018; Knies & Leisink, 2014; OECD, 2016; Onderwijsraad, 2018). In particular, based on the Dutch Education Agreement, 10 million euros will be invested per year in the professional development of school principals (Rijksoverheid, 2022). However, leading innovation processes in schools involve school principals and teachers, referring to forms of *distributed leadership*. Distributed leadership means that multiple team members can be considered leaders and leadership is a fluid co-performance process (Daniëls et al., 2019; Harris & Spillane, 2008; Spillane, 2005). Such collaborative approaches to innovation in schools raise new situations of leadership and call for new roles, attitudes, and acts among school principals and teachers. It is yet unclear how leading collaborative innovation actually happens, and what it asks from both teachers' and school principals' leadership practices in day-to-day working contexts. That is why we initiated this study.

1.2. Research objective and question

The aim of this dissertation is to understand better how collaborative innovation is led in schools by school principals and teachers. Working on collaborative innovation in schools calls for changes in leadership practices of both school principals and teachers, going beyond more traditional "cultures of individualism" (Vangrieken et al., 2015, p. 36). Insights into their leadership practices will contribute to scholarly knowledge on leading collaborative innovation in schools and on school practices in which collaborative innovation can be designed, initiated, and led. Against this background we will answer the following main research question:

How do school principals and teachers lead collaborative innovation in schools?

In order to answer this main research question, we have set up four related studies, each with a specific sub-question.

The first study focuses on working relations among teachers and between teachers and school principals and how these affect collaborative innovation practices in schools:

1. *How do horizontal and vertical working relations in school affect collaborative innovation practices?*

The second study examines the role of school principals in leading collaborative innovation:

2. *How do school principals enact leadership practices in leading collaborative innovation?*

The third study focuses on the role of both school principals and teachers in leading collaborative innovation by studying how to describe and measure distributed leadership:

3. *How can distributed leadership in school teams be described and measured by applying a social network perspective?*

The fourth study builds on the previous studies and examines how distributed leadership is embedded in the sociocultural context on three levels – individual, team, and school level:

4. *How can differences in distributed leadership between collaborative innovation-oriented teacher teams be understood from multiple sociocultural context levels?*

1.3. Research perspective

In order to answer the main research question, we have used and related various key concepts derived from different bodies of knowledge. By bringing these bodies of knowledge together, we have tried to develop a more overarching perspective on educational innovation in which multiple levels of analysis (school, teams, individuals) and multiple factors (organizational, cultural, educational) are interwoven. The key concepts we used are changing professionalism, collaborative innovation, leadership, networks, and sociocultural contexts. Below, the key concepts are briefly explained.

1.3.1. Changing professionalism

The changing roles of teachers and school principals fit into a wider development of changing professionalism, as is studied in organizational literature (e.g., Martin, 2021; Noordegraaf, 2020; Stone & Travis, 2011). For instance, Noordegraaf (2020) argues that professionalism is not 'made' by professionals themselves, but is dependent upon many actors, their interactions, and contextual factors. Due to internal and external changes, professional fields are becoming less stable and professional work is being reconfigured. Professional work is embedded in organizational contexts and connected to outside worlds. Such changing forms of professionalism occur in education and many other public and non-profit domains, such as the medical and judicial domains, as outlined earlier.

In this dissertation, we focus on teachers and school principals as modern professionals working together in collaborative innovation. Together with other school staff and school board members, teachers and school principals might collectively contribute to the quality of education (Grissom et al., 2013; Leithwood et al., 2020).

Therefore, teachers and school principals need opportunities to maintain their professional knowledge and skills and must be encouraged to professionalize – i.e., to develop their knowledge and skills, as well as ways of working, standards, and routines. They will have to be supported by the organization – i.e., by school principals and HR-officials (e.g., Knies, 2019; Knies et al., 2018). Supported by the organization, teacher professionalism might be enacted (Evans, 2008). Instead of prescribing what teachers should do, how, why, and when, teachers can shape professional work (Van Tartwijk, 2022). Teachers will then have more autonomy, beyond individual autonomy in the classroom.

1.3.2. Collaborative innovation

Innovation in the public sector can be defined as an effort to respond to challenges, develop new ideas that disrupt established practices, and transform the way that things are usually done (Torfing, 2019). Collaborative innovation is a relatively new organizational notion that is based on a combination of recent research on collaborative governance (Ansell & Torfing, 2014; Emerson et al., 2012) and new theories of innovation (Hartley et al., 2013; Sørensen & Torfing, 2011). Roberts (2000) conceptually compared collaborative, hierarchical, and competitive approaches, concluding that a collaborative approach to innovation is superior when it comes to developing and implementing innovative solutions.

A problem with the hierarchical approach is that solutions devised by formally appointed leaders fail to benefit from the knowledge sharing and mutual learning that arise from interaction with relevant and affected actors inside or outside the organization. A problem with the competitive approach is that competing innovators tend to waste valuable resources on bitter conflicts and on duplicating their efforts to develop and test new products and technologies (Roberts, 2000). The major strength of the collaborative approach is the broad inclusion of relevant and affected actors who possess significant expertise for the challenge at hand (Bommert, 2010). A collaborative innovation approach facilitates the exchange of knowledge, competences, and ideas between relevant actors. It stimulates processes of mutual learning that may improve understanding of the challenge at hand and extend the range of creative ideas about how to solve it (Roberts, 2000).

Underlying this argument is the idea that collaboration involves the constructive management of differences in order to find joint solutions (e.g., Gray, 1989). Educational literature also states that collaboration brings school organizations the opportunity to benefit from the capacities and resources, knowledge, and ideas of multiple members, referring to social exchange (Sinnema et al., 2020). Social exchange tends to disturb the established practices and their cognitive and normative underpinnings, thereby building joint ownership and shared responsibility for solutions (Fullan, 2016; Sinnema et al.,

2020). In sum, collaborative innovation is characterized by a multi-actor approach to innovation in which social resources are exchanged, resulting in mutual development (Owen et al., 2008; Torfing, 2019).

1.3.3. Leading (collaborative) innovation

Collaborative innovation processes need to be supported, guided, and led (e.g., Bason, 2010). Most empirical studies in the organizational literature have found positive relationships between leadership and the performance of public organizations (e.g., Knies et al., 2016). Educational literature acknowledges the vital role of school principals in creating suitable conditions for innovation processes and in leading these processes (Bush & Glover, 2014; Fullan, 2007, 2016; Hallinger & Heck, 2010). School principals can build organizational climate and culture, trust, and collaboration (Daniëls et al., 2019). Leadership is commonly defined as individuals exerting influence over others to structure activities and relationships, knowledge, and skills (Daniëls et al., 2019; Yukl, 2002). It is argued, mostly theoretically, that leadership of collaborative innovation is essentially distributive, horizontal, and adaptive, and that leaders need to respect the self-regulating character of collaborative innovation processes. Thus, in relation to collaborative innovation, there are limits to the enactment of traditional leadership theories based on command and control (Angelle, 2010; Ospina, 2017).

A growing body of literature acknowledges a crucial role of distributed leadership for successful innovations in schools (Brown et al., 2020; Daniëls et al., 2019; Fullan, 2016; Hulpia et al., 2009; Jambo & Hongde, 2020; Law et al., 2010; Meijer, 2014; Ricard et al., 2017; Sullivan et al., 2012; Tian et al., 2016; Tummers & Knies, 2013; Vogel & Masal, 2015). Distributed leadership theory postulates that multiple team members – thus both school principals and teachers – can be considered leaders. They can influence the motivation, knowledge, or practices of other team members (Daniëls et al., 2019; Harris & Spillane, 2008; Spillane, 2005). Leadership results from interactions between leaders and followers and the situation in which these interactions are embedded (Jackson & Temperley, 2007; Murphy, 2005; Spillane, 2005).

In order to gain more specific insights into leadership in collaborative innovation in schools, we use the concept of *leadership practices* applied in the organizational (e.g., Raelin, 2016) and educational literature (Alqahtani et al., 2020; Noman et al., 2018). This refers to actions that shape leadership (Chreim, 2014). The focus on practices means that leadership revolves *less* around individuals, personal leadership behaviors, and styles such as transformational leadership (Crevani & Endrissat, 2016), and *more* around practices that are the outcome of relations and interactions (Gronn, 2002; Harris & DeFlaminis, 2016;

Spillane et al., 2004). This means that leadership practices are not the privilege of formal leaders but can also be conducted by informal leaders such as teachers. This leadership-as-practice approach fits with the notion of collaborative innovation, which implies practices such as exchanging resources in interaction in horizontal and vertical working relations. Furthermore, the approach resonates with distributed leadership (Raelin, 2016). Both the leadership-as-practice approach and distributed leadership theory acknowledge leadership as a social phenomenon that is enacted in interactions and networks.

1.3.4. Leading (collaborative innovation) in networks

Studying leadership as a social phenomenon of leadership practices that are enacted in interactions between several persons, fits with a social network perspective. This perspective can be used to understand relations between persons or groups and interactions of organizational and relational processes (Freeman, 2004; Raelin, 2016; Wasserman & Faust, 1994). Therefore, this perspective is considered promising for studying interactions that shape leadership practices in schools (Azorín et al., 2020; Liou & Daly, 2020). The relationships between persons and their resources, such as information, knowledge, and support (Coleman, 1988), shape a social network structure. Within this network structure, persons have access to and can mobilize the resources (Lin, 1999). This is interpreted as social capital (Brouwer et al., 2020; Coleman, 1988; Lin, 1999, 2001; Liou & Daly, 2018, 2020).

Within education, communities of practice (COP) and professional learning communities (PLC) are network forms in which (mainly) teachers exchange social resources (Admiraal et al., 2019; Giles & Hargreaves, 2006; Prenger et al., 2017; Wenger, 2011). PLCs refer to groups of people who engage in interaction processes of collective learning in a shared domain of interest to develop shared practices (Wenger, 2011). In the Netherlands, PLCs are increasingly established with the aim of enhancing teacher quality and school improvement – for instance, by helping teachers to keep their expertise up-to-date and to improve practices in their schools together with colleagues (Prenger et al. 2017; Schaap et al., 2018). Admiraal et al. (2019) stress the importance of teacher PLCs in which teachers informally share practices, support each other, and collaborate. They studied interventions that Dutch secondary schools implemented aimed at enhancing a school as a PLC, finding that schools focus most on professional learning opportunities, collaborative work, and teachers' learning. Interventions focused on leadership, such as activities of teacher leaders, team leaders and school principals, were rare. In this regard, less attention still seems to be paid to (distributed) leadership practices in learning and innovation processes in networks such as PLCs. Studying how collaborative innovation is led by school principals and teachers might contribute to insights in the literature on PLC's, COPs, and other networks of collaboration.

1.3.5. Sociocultural contexts of (leading) collaborative innovation

Leading collaborative innovation in networks is embedded in a wider sociocultural context. Teachers and school principals act in school organizations and interact with each other. Their interactions are mediated by aspects of the wider sociocultural context (Pea, 1993; Rogoff, 1990). This means that leadership practices have to be understood in the contexts in which they are embedded (Powell & DiMaggio, 1991).

Sociocultural activity theory states the importance of sociocultural contexts for leadership and other practices in schools (Rogoff, 1990; Spillane & Sherer, 2004; Tian et al., 2016). This theory examines the link between activities, such as leadership practices, and the social contexts in which these activities occur (Pea, 1993). It advocates studying various contextual levels since these are linked to one another. There are no clear boundaries between contextual levels, such as individual (teachers and the horizontal level that the collaborative innovation notion refers to), interpersonal (teacher teams), and institutional (school level) levels (Giddens, 1984; Orton & Weick, 1990; Rogoff, 1990; Spillane & Sherer, 2004).

While these theoretical underpinnings suggest that the sociocultural context needs to be considered when studying leadership practices in collaborative innovation, so far only a few educational researchers have done so and those who did mainly focused on *one* contextual level (Liou & Daly, 2014; Liu, 2021; Liu et al., 2018; Tam, 2019). The studies focused on individual (e.g., Liou & Daly, 2014; Tam, 2019), team (e.g., Mehra et al., 2006), school (e.g., Liu, 2021; Liu et al., 2018), or national contexts (e.g., Liu, 2020), meaning that relationships between contextual levels have hardly been addressed empirically. Therefore, several researchers on distributed leadership have highlighted the importance of future studies to identify characteristics of sociocultural contexts that are critical in constituting leadership practices (Daniëls et al., 2019; Liu, 2020; Liu et al., 2018; Or & Berkovich, 2021; Tian et al., 2016). They view the school context as a factor influencing leadership practices aimed at successfully improving the overall school performance. It is thus important to take context into account when investigating leadership (e.g., Daniëls et al., 2019).

1.4. Research context

In this dissertation, we study schools that work with an educational program called "leerKRACHT" (see https://stichting-leerkracht.nl/). Studying a large number of schools that use the same program provides us with a unique sample to pursue research on leading collaborative innovation. This dissertation aims to provide insights into leadership practices in collaborative innovation. By providing these insights, we aim to contribute

to a research project focused on the effects of the leerKRACHT program in schools (De Jong et al., 2021).[5]

Mourshed et al. (2010) conducted an international comparative study on the development of education systems, recommending that we primarily focus on improving the position and professionalism of teachers and allow teachers to learn from each other through school-wide peer exchange. These recommendations formed the basis for a two-year program that Foundation leerKRACHT developed for Dutch schools to improve the quality of their education. In the 2012-2013 school year, the program was implemented for the first time by 15 schools from primary, secondary, and vocational education. Up to 2022, more than a thousand Dutch schools have implemented this program. The aim of the program is to initiate a transformation to a learning school culture with the aim to improve education. To achieve this, the program uses a team-based approach, including the teachers and school principal(s), to improve processes step by step (see Rigby et al., 2016).

The program's method is based on four practical tools that are all methods of collaboration. Firstly, *stand-up sessions* of fifteen minutes, where ideas are translated into joint goals and action plans are agreed upon (see Figure 1.1 for examples of white boards that are used during the sessions). Secondly, within-school *lesson visits* by team members: after the lesson visit, they have a brief conversation and receive feedback from the observer. Thirdly, *codesigning lessons* with team members, in which teachers share experiences and knowledge and improve their lessons. Fourthly, *students' voice*, a structured approach to get the students' view as a source of inspiration to improve education and specific lessons. We consider this program to stimulate collaborative innovation, since both teachers and school principals are expected to collaborate and share resources, knowledge, and ideas and thus ask for an (other) approach to innovation.

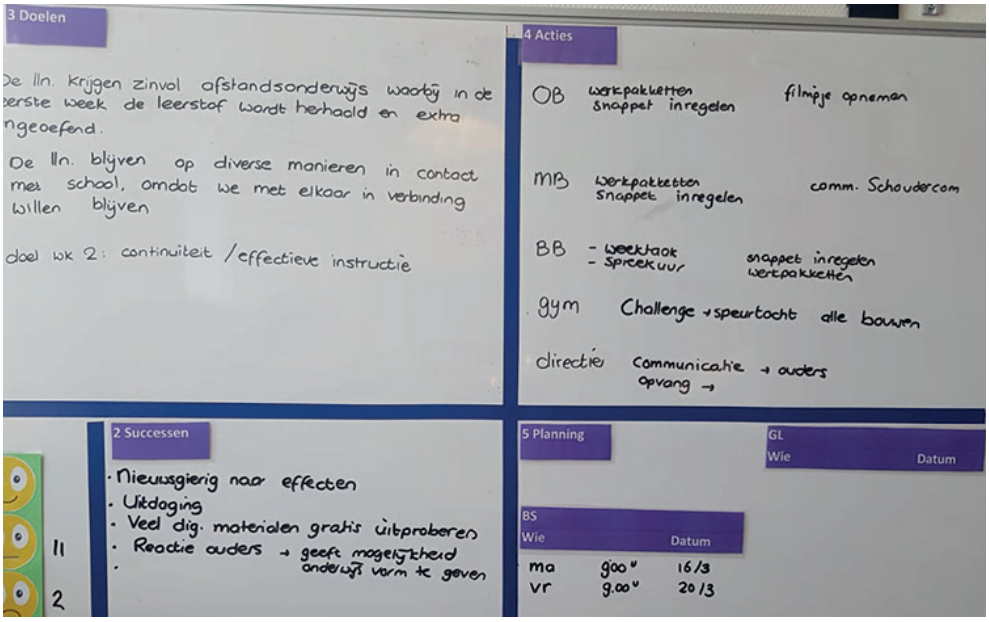
The implementation process starts with training of a *start team* by a coach from the external program. This coach is called an *external advisor*. These advisors often have a change management and/or organizational background (see Figure 1.2). The guidance from the external advisor is scaled down in the second year of the program so that the school can continue to work independently when the two-year guidance from Foundation leerKRACHT ends. The start team includes two teachers, called coach-teachers since they have a coaching role in this program, and their school principal. Smaller groups of 8-10 teachers are then formed, and within each team a coach-teacher helps the other teachers to work collaboratively with the four tools in a weekly routine. The school principal is expected to be quite actively involved in the teams and in practicing the tools but is also expected not to steer too much. In primary schools, the school principals who are involved are often those with the final responsibility; in secondary schools, it

[5] This project was funded by the Netherlands Initiative for Education Research (NRO).

depends whether the whole school or a unit is working with leerKRACHT and thus whether the school principal (with final responsibility) and/or the middle manager is involved. In vocational education, the school principal is often the program manager.

Figure 1.1

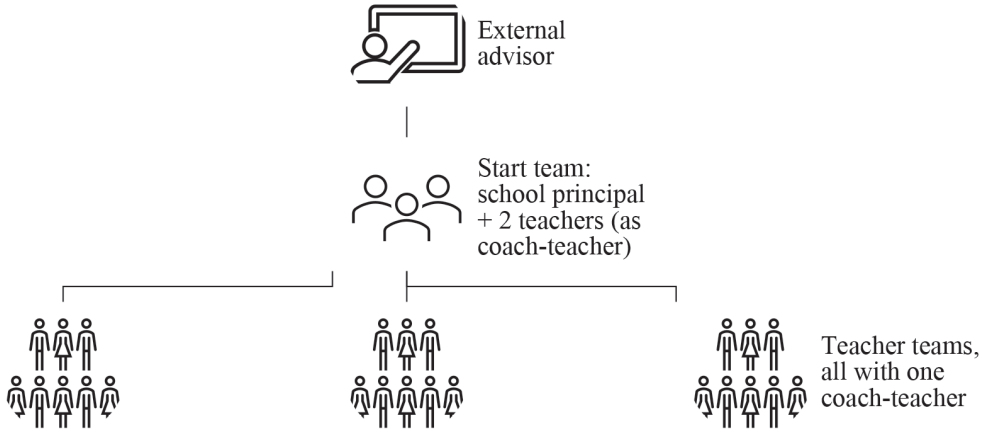
Examples of White Boards that are Used During Stand-Up Sessions[6]



[6] Copied from: Foundation leerKRACHT (2020): https://stichting-leerkracht.nl/direct-aan-de-slag-met-een-bordsessie-over-afstandsonderwijs/ and https://stichting-leerkracht.nl/zelf-aan-de-slag/aan-de-slag-met-je-team/bordsessies/.

Figure 1.2

Representation of Coaching from the Program to a School



1.5. Relevance

The aim of this dissertation is to better understand how collaborative innovation is led by school principals and teachers in order to further stimulate collaborative innovation in schools.

This dissertation aims to contribute to scholarly literature by providing more insights into specific leadership practices of school principals in collaborative innovation. It also seeks to provide more insights into how distributed leadership can be described and measured in collaborative innovation. Furthermore, it aims to contribute insights into how leadership practices in collaborative innovation are embedded in sociocultural contexts. These insights will help us to understand better the roles and specific leadership practices of teachers and school principals in leading collaborative innovation in schools. Moreover, it will further refine our scientific understanding of collaborative innovation. We will combine insights that often remain disconnected, such as organizational, cultural, and educational factors, using a mixed-methods design and multiple levels of analysis (individuals, teams, schools) to develop an overarching perspective on leading collaborative innovation. The urgency of these insights is confirmed by several scholars, specifically on school principals' leadership (e.g., Leithwood et al., 2020), distributed leadership (Daniëls et al., 2019; Liu & Werblow, 2019; Tian et al., 2016), and leading collaborative innovation (e.g., Torfing, 2019).

More practically, we intend to provide insights that help schools to lead and further stimulate collaborative innovation in schools. Insights into specific leadership practices

can help school principals and teachers to reflect on how they lead their educational innovations and inspire them to approach innovation processes collaboratively. Furthermore, insights into how distributed leadership practices are related to their sociocultural contexts might help school principals and teachers to be aware of context and to take contextual factors into account. Teacher and school principal professional development programs can help teachers and school principals learn how to enact leadership in relation to the context and how to distribute leadership on a day-to-day basis.

1.6. Overview of chapters

In order to answer our main research question, this dissertation presents four empirical studies, each contained within its own chapter. The data were gathered in two cohorts of schools, the first form September 2017 to June 2019, the second from September 2018 to June 2020. We describe hereafter the focus and method of each study.

In the first paper (sub-question 1; see **Chapter 2**), we describe a study on teachers' perspectives on what plays a role in horizontal and vertical working relations for collaborative innovation. We answer the following research question: *How do horizontal and vertical working relations in school affect collaborative innovation practices?* We use a mixed-methods design, including a questionnaire on horizontal and vertical working relations (n = 1,200 teachers from 124 schools) and on collaborative innovation practices (n = 2,036 teachers from 157 schools), as well as group interviews with 53 teachers from 20 schools. The two questionnaires are part of the program and thus developed by the Foundation leerKRACHT.

In the second paper (sub-question 2; see **Chapter 3**), we describe a study in which we dive deeper into leadership practices of school principals in collaborative innovation. We answer the following research question: *How do school principals enact leadership practices in leading collaborative innovation?* We conduct interviews with 22 school principals (of 22 schools) about their leadership.

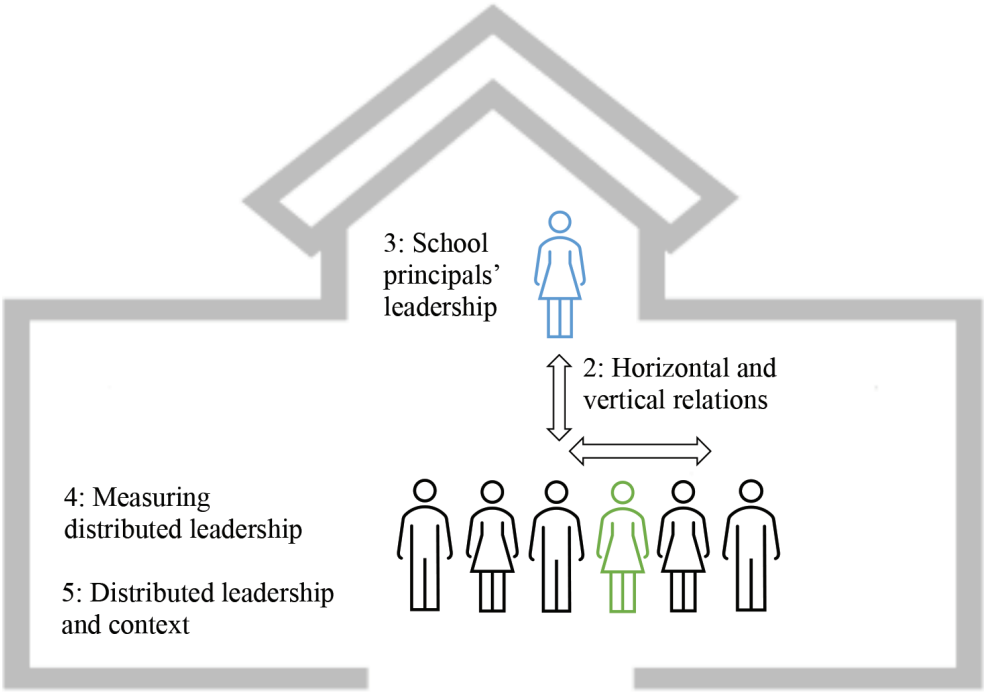
Since studying the role of formal leaders only does not fit with the approach of collaborative innovation, we use a social network perspective to describe and measure distributed leadership in our third paper (sub-question 3; see **Chapter 4**). We answer the following research question: *How can distributed leadership in school teams be described and measured by applying a social network perspective?* We conduct a social network questionnaire within 14 school teams, including 118 teachers and 12 school principals.

In our fourth paper (sub-question 4; see **Chapter 5**), we continue by studying the sociocultural contexts of teacher teams and how these relate to degrees of distributed leadership. We answer the following research question: *How can differences in distributed leadership between collaborative innovation-oriented teacher teams be understood from multiple sociocultural context levels?* This study has a mixed-methods design, including the social network questionnaire (Chapter 4), the questionnaire on horizontal and vertical relations (Chapter 2), interviews with school principals (from Chapter 3), a questionnaire for the external advisors, and cognitive student outcomes on the school level. Within this study, 130 teachers and 12 school principals are included.

In Figure 1.3, we illustrate how the four studies help us to understand how teachers and school principals lead collaborative innovation practices in schools. The numbers of the chapters are mentioned in the figure.

Figure 1.3

Overview of the Set-Up of the Studies of This Dissertation



Note. Blue person is a school principal, green is a coach-teacher.

2

Collaborative approaches: Studying horizontal and vertical working relations in schools and how they affect collaborative innovation practices

This chapter is based on De Jong, W. A., De Kleijn, R. A. M., Lockhorst, D., Van Tartwijk, J. W. F., & Noordegraaf, M. (under review). Collaborative approaches: Studying horizontal and vertical working relations in schools and how they affect collaborative innovation practices.

Author contributions: All authors designed the study. WAdJ collected and analyzed the data. Next to WAdJ, DL was involved in the coding of the interviews for reliability, RdK in the multilevel analyses. WAdJ wrote the paper. DL, RdK, MN, JvT critically reviewed the paper.

Abstract

Previous research has mainly focused on teacher collaboration for educational innovation. However, in *collaborative innovation* processes *all* teachers *and* school principals within a school are expected to take responsibility and address challenges together, referring to horizontal and vertical working relations. In this paper, we describe a study investigating how both horizontal and vertical working relations within schools affect collaborative innovation practices. We used longitudinal questionnaire data (2036 teachers, 157 schools) and interview data (53 teachers, 20 schools) and conducted qualitative and quantitative analyses. These data were gathered in Dutch schools participating in the large-scale 'LeerKRACHT' program. Teachers reported multiple horizontal and vertical factors and how they relate to collaborative innovation. Furthermore, School Principals' Leadership positively predicted collaborative innovation. Our study shows that how horizontal and vertical working relations are *stimulated* by school principals and coach-teachers is important to transform to more collaborative innovation. Finally, we discuss implications and draw conclusions.

2.1. Introduction

Schools operate in demanding and rapidly changing environments. As a result, teachers and school principals are expected to continuously innovate their school practices with the aim to maintain the quality of the education they provide (Lopes & Oliveira, 2020; Serdyukov, 2017). However, innovation in schools is often an isolated activity of one teacher or a small group of teachers (Paju et al., 2021; Sales et al., 2017; Vangrieken & Kyndt, 2020). According to Vangrieken et al. (2015), in education, a strong-rooted culture of individualism, autonomy, and independence is dominant. A 'culture of collaboration', however, has many advantages. It can result in more 'school democracy' and more appropriate ideas and solutions for the challenges faced by schools (Fullan, 2016; Sahlin, 2022; Snoek et al., 2019). A growing number of schools have begun to initiate types of teacher collaboration, such as 'professional learning communities' and 'data teams' (Admiraal et al., 2021; Hargreaves & O'Connor, 2017). Such collaborations represent mainly horizontal working relations, i.e., collaboration between teachers.

Consequently, scholars have called for more 'networked' and 'collaborative' approaches to school innovations (e.g., Liou et al., 2020). In the organizational literature, the notion of *collaborative innovation* is used for such approaches, which is characterized by both horizontal *and* vertical working relations (Bekkers & Noordegraaf, 2016; Sørensen & Torfing, 2017; Torfing, 2019). Thus, in addition to focusing on teachers' working relations (horizontal), the working relations between teachers and school principals also need to be studied (vertical). Previous research has mainly focused on horizontal working relations and its effects on innovation practices (Admiraal et al., 2016; De Jong et al., 2019, 2021; Vangrieken et al., 2015; Zhang & Zheng, 2020). A focus on vertical working relations in these studies remains rare. Therefore, we aim to study how both horizontal and vertical working relations within schools affect the degree of collaborative innovation practices (CIP). To do so, we study CIP in Dutch primary, secondary, and vocational schools with a mixed-methods design both at the start and when working on collaborative innovation. All these schools participate in a large-scale program called 'LeerKRACHT', aimed at forming and stimulating CIP. The program is used by over a thousand schools in the Netherlands, and the data used in the current paper are gathered as part of a larger research project in which this program was evaluated.

2.2. Theoretical framework

2.2.1. Collaborative innovation practices in schools

The notion of collaborative innovation was developed in research studying innovation in public sector contexts (Bekkers & Noordegraaf, 2016; Sørensen & Torfing, 2018). It is characterized by a multi-actor approach to innovation, with both vertical and horizontal working relations, wherein resources, knowledge, and ideas are exchanged, resulting in mutual development (Owen et al., 2008; Torfing, 2019). Vertical relations pertain to working relations that transverse different organizational levels, functions, and hierarchies (Torfing, 2019), which in schools would refer to teachers and school principals. Horizontal relations imply working relations between persons and organizations at the same hierarchical level, which would be teachers within a school or teachers affiliated with various schools.

Collaborative innovation practices imply shared responsibility. Fullan (2016) and Sinnema et al. (2020) argue that shared responsibility is essential for innovations to succeed. Shared responsibility gives school organizations the opportunity to benefit from the capacities and resources, knowledge, and ideas of multiple members, called a social exchange of resources. Researchers argue that CIP can have a powerful impact and facilitate more democratic, mutual, and appropriate solutions for school challenges (Azorín et al., 2020; Sinnema et al., 2020; Snoek et al., 2019).

2.2.2. Horizontal relations in collaborative innovation

In this study, we conceptualize horizontal relations as relations between teachers. Previous research examining horizontal relations indicates that the prior existence of a certain degree or intensity of collaboration helps to further enhance the degree of future collaboration (Hargreaves & O'Connor, 2017; Vangrieken et al., 2015). Vangrieken et al. (2015) state that "without an essential amount of openness to collaborate, every effort pushing teachers towards collaboration may become lost in a culture of contrived collegiality" (p. 36). This also concerns a mindset of collaboration and involves teachers' work style and routine. Organizational researchers recognize the complexity of how working together benefits from the prior existence of collaboration by emphasizing that cultural dynamics, i.e., how people are used to work and working together ('This is how we work around here') influences working relations (Noordegraaf et al., 2016; Thumlert et al., 2018).

In addition, a safe organizational climate, including trusting relationships and respect, supports risk taking and the exploration of innovative ideas (Zhang & Zheng, 2020). Avalos-Bevan and Flores (2021) interviewed teachers and found that horizontal relations require a climate marked by safe relationships and being open to each other. A study on informal learning indicated that teachers needed to feel safe to share their problems and collaborate (Grosemans et al., 2015), and research on team learning revealed that psychological safety is the most important and consistent predictor of learning occurring within teams (Boon et al., 2013; Dochy et al., 2014).

2.2.3. Vertical relations in collaborative innovation

In this study, we conceptualize vertical working relations as relations between teachers and school principals. Previous research on teacher collaboration acknowledges that school principals can support and guide teacher collaboration (Sørensen & Torfing, 2017; Torfing, 2019) by, for instance, inspiring and supporting staff and the facilitation thereof (Admiraal et al., 2016; de Neve & Devos, 2017; Van Schaik et al., 2019, 2020). Avalos-Bevan and Flores (2021) found specific positive leadership practices that teachers experience that facilitate collaboration, namely emotional and informational support, encouragement of and respect for professional development, and setting direction. Previous studies on school principals' role in collaborative innovation are largely theoretical or describes leadership practices only from the perspective of a school principal. Torfing (2016) theoretically identified three types of leaders who can stimulate collaborative innovation in the public sector: *Conveners* (e.g., spur interaction), *Facilitators* (e.g., promoting collaboration), and *Catalysts* (e.g., prompting actors to think out of the box). Furthermore, in our own research, as is presented in Chapter 3 (De Jong et al., 2020), we empirically studied leadership practices of school principals. We found variation between school principals, ranging from principals who were *distant* to those who were quite *involved* in CIP. Insights from the perspective of a teacher within the context of CIP are, however, lacking.

2.2.4. Current study

The aforementioned studies, which were in the context of teacher collaboration, identified three factors vital for teacher collaboration. Two of these factors pertained to horizontal working relations: Intensity of collaboration and Safety. One of these factors was related to school principals and in this way referred partly to vertical relations: Leadership

practices of school principals. We aimed to study whether the three factors were relevant in collaborative innovation, which other horizontal and vertical factors were perceived by teachers, how these factors affected CIP, and how horizontal and vertical working relation factors were associated.

To realize this aim, we could use a unique sample of schools that all participated in the same program aimed at stimulating CIP; we thus studied them at the start of and during their work on collaborative innovation. The research question that guided our study was: *How do horizontal and vertical working relations in schools affect collaborative innovation practices?*

2.3. Methods

2.3.1. Research design

To study both the horizontal and vertical relations in schools and how they affect CIP, we used both qualitative data (interviews) and quantitative data (two questionnaires). In the design of our study, several steps can be distinguished. In the first step, we interviewed teachers and analyzed the interviews, with the aim of identifying which horizontal and vertical factors teachers experience that affect CIP. In the second step, we gathered teachers' questionnaire data and analyzed how the prior intensity of teacher collaboration (horizontal), safety (horizontal), and school principals' leadership (vertical) affected CIP. For these analyses, we used a multilevel analysis. In the third step, we analyzed the link between the horizontal and vertical factors in their relation to collaborative innovation. To do this, we combined the results from the first and second steps. Because of this, the design of our data collection was a convergent parallel design and the analyses an embedded design (Burke Johnson & Onwuegbuzie, 2004). We subsequently explain these steps in detail but first we present information on the study context.

2.3.2. Context of the study: Program aimed at collaborative innovation practices

In 2016, the OECD highlighted that the educational quality of Dutch schools could be further improved by strengthening collaboration within schools. An independent Dutch foundation developed a program to achieve this aim. So far, more than a thousand Dutch primary and secondary schools and schools for vocational education have implemented this program. The program is based on a team-based approach, including teachers and school principal(s) to improve processes step-by-step, referring to the 'agile' principles

of working in teams with short cycles (see Rigby et al., 2016). The program's method consists of four tools: (1) Stand-up sessions of 15 minutes, where ideas are translated into goals and action plans; (2) Within-school lesson visits; (3) Codesigning lessons; and (4) Students' voices, a structured approach to obtain students' views as a source of inspiration. This program aims to stimulate CIP, since both teachers and school principals are expected to collaborate and share resources, knowledge, and ideas and thus asks for at least one manner of working together.

In terms of the time allocation, firstly, a start team is trained by a coach from the external program, who remains involved for two years. The start team includes two to three coach-teachers (teachers with a coach role) and their school principal. Then, smaller groups of teachers are formed (8-10 persons) and within each team a coach-teacher helps the other teachers to collaboratively work on education with the four tools in a weekly routine. The school principal is expected to be quite actively involved in the teams and the practicing of the tools but not steering.

2.3.3. Participants and sampling procedure

Within the program, teachers completed questionnaires at several moments in time (see Figure 2.1). For the current study, we used data from a questionnaire on CIP and a questionnaire on horizontal and vertical working relations.[7] The schools from which teachers answered these questionnaires were representative of Dutch schools in their urbanity, denomination, and school size (De Jong et al., 2021) and were from the primary, secondary, and vocational educational sectors.

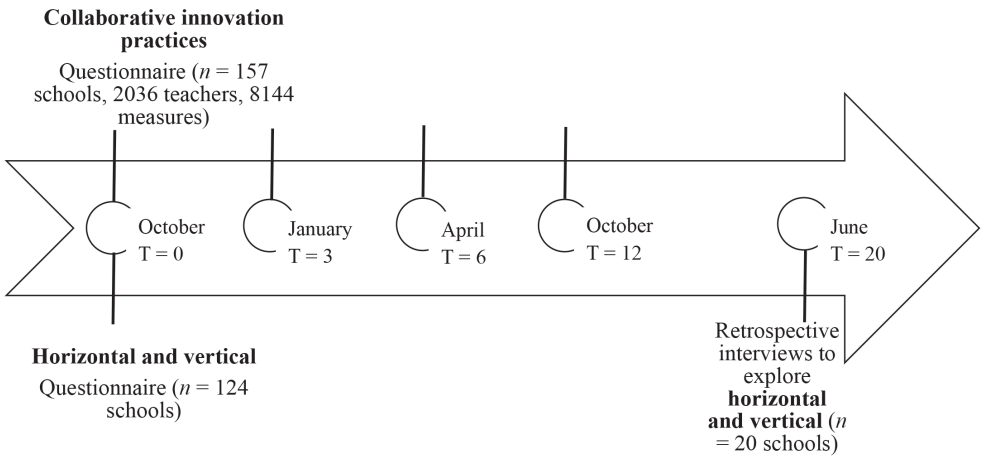
Furthermore, we conducted group interviews, including two to three teachers and one coach-teacher, with a total of 53 teachers across 20 schools. These schools were randomly selected and participated in the program in 2017 (n = 10, face-to-face interviews in 2019) or 2018 (n = 10, online interviews in 2020, due to Covid).

This study was approved by the Ethical Review Committee for social and behavioral sciences of our university (20-056). The teachers signed informed consent forms.

[7] Questionnaire on CIP (M = 15 teachers per school completed the questionnaire), Questionnaire on horizontal and vertical working relations (M = 10 teachers per school).

Figure 2.1

Overview of Data Collection over Time



Note. T is time in months.

2.3.4. Measures

2.3.4.1 Collaborative innovation practices

We measured the degree of CIP with four questionnaire items examining the program tools forming a coherent scale at all four measurement points (α = 0.73-0.81, see Appendix 2.1 for the items in question).

2.3.4.2 Horizontal and vertical relations

Retrospective group interviews

We openly asked teachers: "What affected collaborative innovation practices in your school?" The interviews were retrospective, and Covid-related answers were excluded. Interviews were audiotaped, transcripts were written, and member checks were conducted. The latter only led to minor changes.

Questionnaire: Prior intensity of teacher collaboration, safety, and leadership

Using a confirmatory factor analysis, three scales were developed using items from a questionnaire administered by the program, which was completed by teachers. The scales had sufficient to good internal consistencies: Working on Lesson Practices (measuring the intensity of teacher collaboration on lesson practices, α = 0.73, 7 items), Safe to

Share (measuring whether teachers felt safe to share their problems with colleagues; α = 0.85, 7 items), and School principals' leadership (measuring the involvement of school principals with teachers and how much they stimulate teachers to improve education; α = 0.92, 10 items, see Appendix 2.2 for the items).

2.3.5. Analysis

2.3.5.1 Step 1: What affects CIP

Three researchers independently coded two interviews with teachers exploring what affected teachers' CIP, as well as coded factors, using an open coding approach (Corbin & Strauss, 2008). Then, the first author coded all interviews and discussed all coded factors with the third author. A factor was included when it was named in more than one school (factors are presented in the results, Table 2.1). Lastly, all authors jointly interpreted whether the factors pertained to horizontal or vertical relations.

2.3.5.2 Step 2: How horizontal and vertical working relations affect CIP

To further study how horizontal and vertical working relations affect collaborative innovation, we conducted a multilevel analysis using the Safe to Share, Working on Lesson Practices, and School Principals' Leadership predictors. The ICC (see M0 in Table 2.2) illustrated that a multilevel analysis fits our data, since we found that 12% of the variance in CIP was attributable to factors at the school level, 67% at the teacher level, and 21% at the repeated measures level. We measured the effect of the predictors both at the start of CIP in schools (time coded 0) and over time. Additionally, the assumptions, sufficient sample size, linear relationships, absence of multicollinearity, and normality for the dependent variable (Hox et al., 2018) were met. The missing values on CIP over time were assumed to be missing at random since 70 teachers with all four measurements did not score significantly different from teachers with three or less measurements.[8] Missing values were not imputed, since multilevel analyses can effectively manage missing values under the missing-at-random assumption, and for outcome measures this is not necessary (Hox et al., 2018). Scatterplots indicated a quadratic development of CIP. Consequently, we computed a squared time variable (Time2) next to the Time variable (in months, see Figure 2.1). Lastly, 33 schools were missing from the questionnaire that measured the three predictors.

[8] M0: F (1.1189)= 0.189, p = 0.664; M1: F (1.863) = 0.808, p = 0.369; M2: F (1.1024) = 2.999, p = 0.084; M3: F (1.1087) = 0.217, p = 0.641.

The multilevel analysis was conducted with full maximum likelihood in HLM 8. We added the predictors at the same time because, based on the literature, we did not expect one of the predictors to be more important than the others. We grand mean centered the predictors to allow the intercept to obtain a comprehensible value (being the mean of CIP when all independent variables are at their mean).

2.3.5.3. Step 3: How horizontal and vertical working relations are associated

To explore how the horizontal and vertical relations are associated in how they affect CIP, we combined the horizontal and vertical factors mentioned by teachers from step 1 and the significant results of the multilevel analysis of step 2. We included schools in separate lines within one table. Three schools were dismissed from this analysis since their questionnaire data was missing. Out of the 17 schools, we selected extreme case studies, as this increases the reliability of the analyses (Seawright, 2016). As stated by Seawright (2016), selecting extreme cases in the context of the main independent or dependent variable results in a better performance than other case-selecting approaches. Thus, to select extreme cases, we ordered the schools to come to a relative order. The ordering was based on their score on CIP and the scale(s) that resulted from the multilevel analysis (step 2). Since these multilevel results (step 2) are presented in the results, the next steps of the ordering are presented in step 3.

2.4. Results

2.4.1. Factors of horizontal and vertical relations affect CIP

The first analysis step resulted in an overview of both horizontal and vertical factors that teachers reported in interviews as affecting CIP in their schools. They mentioned three factors on the horizontal level: Collaborative mindset, Safety, and Learning attitude. On the vertical level, they also mentioned three factors: Leader (as leadership from school principals), Stimulator (as leadership of coach-teachers), and Sharing responsibilities (as leadership of teachers) (see Table 2.1 for a description). The teachers also noted the Facilitate and Organize teams factors. Since these could not be interpreted in terms of horizontal or vertical relations, they were excluded from further analyses. In sum, teachers thus experienced both horizontal and vertical working relation factors as being important for CIP.

Table 2.1

Factors Mentioned by Teachers in Interviews that Affect CIP

Horizontal	
Collaborative mindset	A certain intent for and attitude towards collaboration. Teachers mentioned that they believe it is better to approach school challenges together, e.g., by sharing knowledge and feedback.
Safety	Mutual trust, safe atmosphere or climate, commitment. Teachers mentioned this is necessary before they dare to provide feedback or conduct lesson visits. Some teachers form a pair and visit each other as this feels safer.
Learning attitude	Wanting to learn from others, helping each other (to learn), and acknowledging other's expertise. Teachers mentioned mutual short- and long-term learning goals, professional development, and whether they believe they can learn from younger teachers.
Vertical	
Leader	Practices of school principals. Providing space and sharing responsibility, providing frameworks and structures, being connected to teachers, involved, and addressing that collaboration and innovation processes are not optional.
Stimulator	Boosting or nudging other teachers to collaborate and school principals to be involved and collaborate. Teachers mentioned that Stimulators, in the role of coach-teachers, provide the needed stimulus, inspiration, and structure to collaborate and reflect.
Sharing responsibilities	The professional space teachers experience when making decisions and pioneering innovative processes. Teachers mention whether their school principal intentionally provides space.

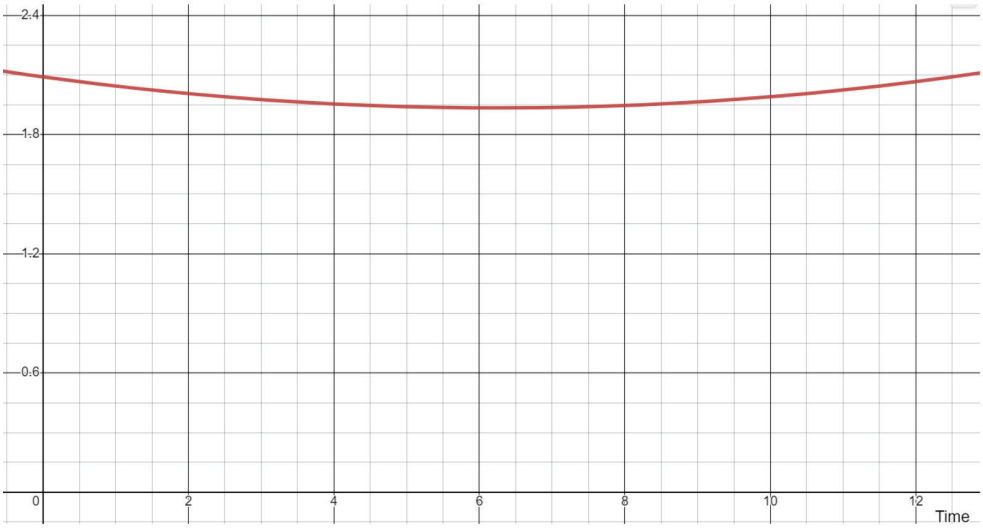
2.4.2. How horizontal and vertical relations affect CIP

The second analysis step included a multilevel analysis. The first model (see Table 2.2, M1) indicated that CIP develops in a slightly quadratic manner (see Figure 2.2). We tested whether the Working on Lesson Practices, Safe to Share, and School Principals' Leadership scales predicted CIP. School Principals' Leadership significantly predicted CIP when Safe to Share was also included (see the fixed model, M2).[9] Safe to Share worked as a suppressor in the sense that it led to an increase in the predictive validity of School Principals' Leadership (for suppressors, see Ludlow et al., 2014). This means that when the variance in School Principals' Leadership that is shared with Safe to Share was blocked by including Safe to Share in the regression equation, the remaining variance in School Principals' Leadership predicted CIP. Variance in the Working on Lesson Practices and Safe to Share scales did not predict CIP either alone or together.

[9] SPs' Leadership alone: $b = 0.109$, $p = 0.14$; Safe .. alone: $b = -0.003$, $p = 0.97$.

Figure 2.2

Quadratic Development of Collaborative Innovation Practices (CIP)



Note. Quadratic function is $y = 2.09 – 0.05x + 0.004x2$.

Lastly, we identified that schools differ in their development of CIP over time (see random model M3b). Therefore, we tested whether the differences between schools can be predicted with Working on Lesson Practices, Safe to Share, and School Principals' Leadership. The results showed that these three scales cannot predict the random variances between schools.[10] Given the higher AIC (10794.62) and to improve the readability of the table, this model was not included in Table 2.2.

[10] Time: SPs' Leadership $b = -0.015$, $p = 0.75$, Safe .. $b = 0.034$, $p = 0.69$, Working .. $b = -0.058$, $p = 0.52$. Time2: SPs' Leadership $b = -0.001$, $p = 0.74$, Safe .. $b = -0.003$, $p = 0.69$, Working.. $b = 0.008$, $p = 0.24$.

Table 2.2

Multilevel Model Predicting CIP with Horizontal and Vertical Working Relations

	M0: Empty	M1: With 1st level predictors	M2: With 1st and 3rd level predictors	M3a: Random (level2)	M3b Random (level3)
	b (se)	*b* (se)	*b* (se)	*b* (se)	*b* (se)
Intercept	1.993*** (0.043)	2.087*** (0.051)	2.086*** (0.051)	2.086*** (0.050)	2.072*** (0.058)
Time		-0.053*** (0.015)	-0.053*** (0.015)	-0.053* (0.014)	-0.049* (0.020)
Time2		0.004*** (0.001)	0.004*** (0.001)	0.004* (0.001)	0.004* (0.002)
Working ..[a]				-0.053 (0.191)	-0.027 (0.188)
Safe ..[a]			-0.180 (0.131)	-0.158 (0.181)	-0.140 (0.178)
SPs' Leadership[a]			0.198* (0.097)	0.215* (0.099)	0.179 (0.098)
Variance					
Measurement level	0.963 (0.034)	0.957 (0.034)	0.957 (0.034)	0.915 (0.063)	0.847 (0.032)
Teacher level	0.377*** (0.037)	0.378*** (0.037)	0.378*** (0.037)	0.279*** (0.083)	0.423*** (0.036)
Time				.005 (0.027)	
Time2				.0001 (0.002)	
School level	0.185*** (0.032)	0.187*** (0.032)	0.180*** (0.031)	0.184*** (0.031)	0.258*** (0.053)
Time					0.024*** (0.015)
Time2					0.0002*** (0.001)
Model fit					
Deviance	10858.10	10844.20	10840.13	10827.03	10763.34
AIC[b]	10866.10	10856.20	10856.13	10855.03	10791.34

Note. b values are the unstandardized coefficients. [a] Centered on grand mean. *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$. N of schools: 157, teachers: 2036, level 1 measures: 8144. [b] AIC = Deviance + two times the number of parameters (Hox et al., 2018, p. 39).

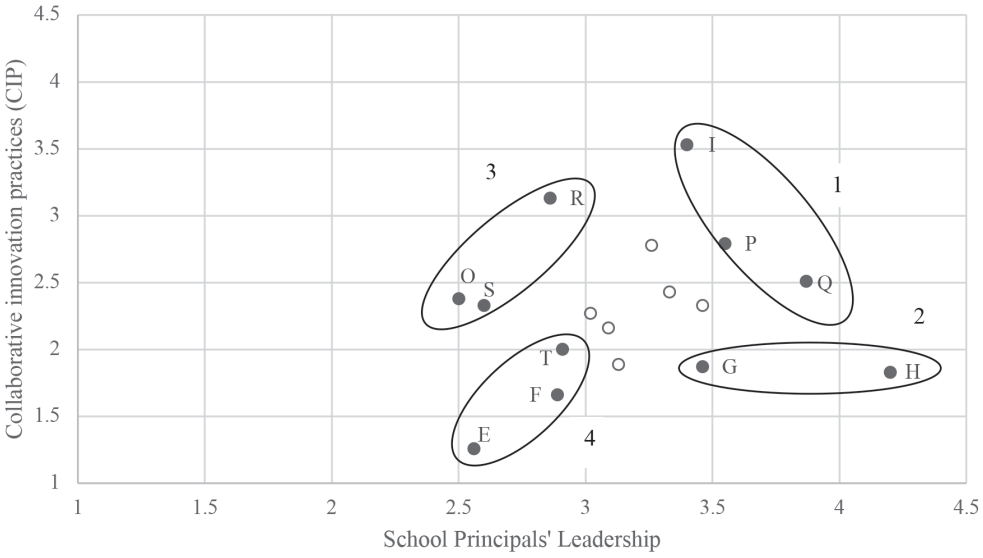
2.4.3. Association between horizontal and vertical working relations

With the third step, we aimed to better understand the association between horizontal and vertical working relations. We combined the horizontal and vertical factors from step 1 and the positive predictor School Principals' Leadership[11] on the CIP of step 2. We subsequently plotted the schools on School Principals' Leadership and CIP (see Figure 2.3) and selected extreme case studies, resulting in four groups:

1. High on both scales
2. High on School Principals' Leadership, low on CIP
3. Low on School Principals' Leadership, high on CIP
4. Low on both scales

Figure 2.3

Case Selection on School Principals' Leadership and CIP (n = 11, out of 17 schools)[12]



We scored how the teachers within the groups experienced each factor in terms of their positive (+), medium (+/-), and negative experiences (-) (see Table 2.3). Regarding

[11] Safe to Share is not included.

[12] To maintain continuity, we used the same letters for schools in Chapter 2, 4, and 5. Schools are ordered on different characteristics in these chapters and thus the letters are not in alphabetical order here.

leadership of school principals, we found that teachers who achieved high scores on the questionnaire scale on leadership (School Principals' Leadership) were also positive in the interviews about their school principal (Leader factor) and vice versa. Teachers, in the interviews, were positive about how school principals provided frameworks and professional space. In the questionnaire, the School principals' leadership scale indicated to what extent school principals stimulated teachers to improve their education collaboratively.

We compared groups 1 and 2 (high on School Principals' Leadership) with groups 3 and 4 (low on School Principals' Leadership). Table 2.3 illustrates that groups 1 and 2 all obtained positively scored factors (with one ambiguous score), while groups 3 and 4 achieved negative, medium, and ambiguous scores. We thus found how teachers experienced their School Principals' Leadership related to teachers' own experiences of the horizontal and vertical factors.

We did not find such a relationship between the degree of CIP and how teachers experience the horizontal and vertical factors. We compared groups 1 and 3 (high on CIP) and groups 2 and 4 (low on CIP) and observe that both groups 1 and 3 and groups 2 and 4 had a variety of experiences (+, +/-, -). However, we could not explain why group 2, namely schools with high scores on School Principals' Leadership and all positive factors, scored relatively low on CIP.

In step 2, we found that Safety was a suppressor of how School Principals' Leadership predicted CIP. Similarly, step 3 also showed an association between safety and leadership of school principals, since groups 1 and 2 (high on School Principals' Leadership) had positive scores on Safety and groups 3 and 4 (low on School Principals' Leadership) had medium and negative scores on Safety.

Lastly, Stimulator was the only factor that was experienced positively by all groups. When teachers mentioned the Stimulator role, they always referred to the coach-teacher keeping the CIP alive, guiding, preparing, and organizing stand-up sessions, and stimulating teachers to collaborate. Since Stimulator was experienced positively by groups that had both high and low scores on School Principals' Leadership, it seemed that the role of a Stimulator is needed in addition to the role of school principals in CIP. In the interviews, teachers mentioned that a Stimulator had an even more important role when school principals are partially or not involved with the CIP. For instance, a teacher from School R, with lower scores on School Principals' Leadership (and high CIP) described the relation between the role of a Stimulator and the school principal: "As a coach, I discuss the session beforehand and steer it in the right direction. But I said to the school principal that I don't want to be solely responsible, that he should also participate".

In most of the schools with high scores on School Principals' Leadership, it was mentioned that their Stimulator became part of the teacher team and that the organizing tasks were shared with the teachers. A teacher from School H (high leadership, low CIP) said:

> The coaches say that they know a bit more about the program but do not have all the answers and thus we will search for them together. What they knew they shared with us in a concrete way. It wasn't like they know everything and we do not. They really took us in.

However, while the Stimulator was positively experienced by teachers for the degree of CIP, this factor did not seem to be enough in relation to CIP. Within groups 2 and 4, we still found low degrees of CIP.

Table 2.3

Experiences Per Factor for Four Groups on School Principals' (SP) Leadership and CIP

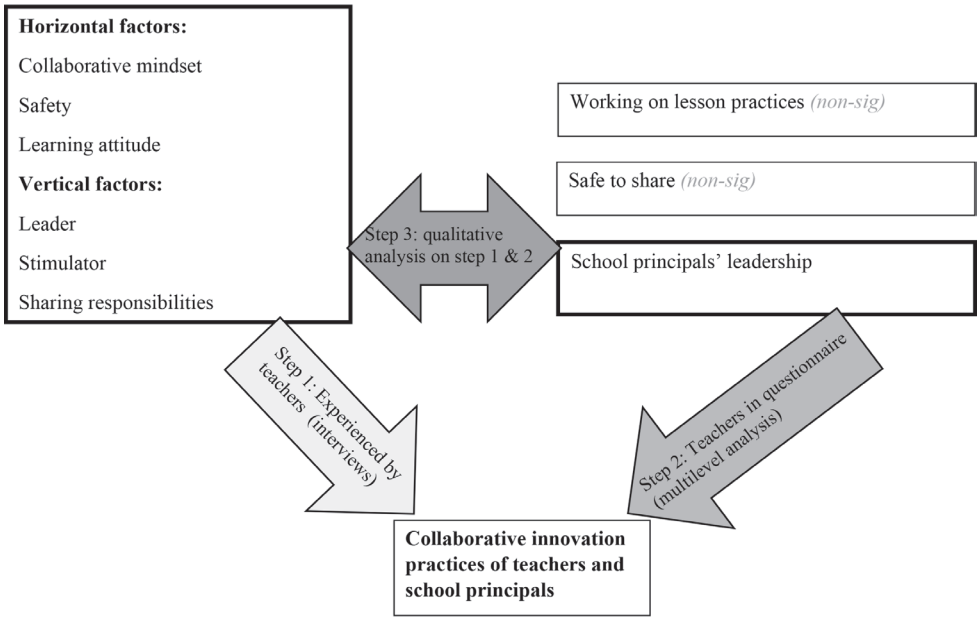
Factors	1. High on SPs' leadership and CIP *Schools I, P, Q*	2. High on SPs' leadership, low CIP *Schools G, H*	3. Low on SPs' leadership, high CIP *Schools R, S, O*	4. Low on SPs' leadership and CIP *Schools* T*, E, F*
Horizontal				
Collaborative mindset	+	+	+	*Amb.*[a]
Safety	+	+	+/-	-
Learning attitude	+	+	*Amb.*[a]	-/+
Vertical				
Leader	+	+	-	+/-
Stimulator	+	+	+	+
Sharing responsibilities	*Amb.*[a]	+	+/-	+/-

[a] Ambiguous scores: The experiences of the schools included in the group were not alike.

We provide an overview of the results in Figure 2.4. The first and second step studied what affects CIP, in two different manners (see on the left and right of the figure). The third step studied how the factors that teachers experience to affect CIP (from step 1) relate to School Principals' Leadership (the significant predictor of step 2) and degree of CIP.

Figure 2.4

Overview of Results of The Three Steps



2.5. Discussion

Previous research has mainly focused on horizontal working relations by studying teacher collaboration (Admiraal et al., 2016; De Jong et al., 2019, 2021; Vangrieken et al., 2015; Zhang & Zheng, 2020). Following the notion of collaborative innovation, the current study addressed the role of horizontal *and* vertical working relations and how these affected schools' CIP. Overall, we conclude that, in teachers' experiences, both horizontal and vertical working relation factors are important for practicing collaborative innovation. In other words, we observe that practicing collaborative innovation involves both horizontal and vertical levels, forming a complex social system which can be adaptive. In order to work on collaborative innovation, it seems relevant for teachers, school principals, and researchers to be aware of influence processes within and between these working relations.

More specifically, we found that perceived school principals' leadership practices positively predict CIP. Our study provides insights into which leadership practices should be included in the role of school principals to have such a positive influence. Teachers mentioned they prefer school principals who are connected, affiliated, have a stimulating attitude, and are not too controlling, but set clear frameworks and provide professional

space for enhancing CIP. Through these leadership practices, school principals seem to steer the agency of teachers. Steering the agency of teachers is also described by Mentink (2014), who theoretically discussed the role of school principals' leadership in professional learning communities (PLC). He stated that school principals need to strongly outline the lower limit or minimum teacher functioning in PLCs, as well as being more stimulating and facilitating and more from a distance when it comes to teacher development. This is in line with the concept of 'distributed control,' as mentioned by Zimmerman et al. (1998). Furthermore, De Jong et al. (2020) found that school principals seek a balance in their role of providing frameworks, direction, and space. They identified a variation in the leadership of school principals from a school principal perspective, ranging from school principals who were distant to those who were quite involved in the CIP. The current study contributes the perspective of teachers. Teachers also experienced variation between school principals, ranging from quite distant school principals to school principals who were stimulating to teachers and involved in CIP.

Another finding relating to school principals' role was that the horizontal and vertical working relation factors mentioned by teachers are associated with school principals' leadership practices. School principals are found to be central 'shapers' of school culture, including a safe climate (Daniëls et al., 2019). Furthermore, research on collaborative innovation approaches argues that safety and mutual trust are necessary for persons to be convinced that it is worthy and safe to be involved in working relations (Sahlin, 2022; Torfing, 2019). These previous findings from the literature can be linked to our study, since we found a positive association between school principals' leadership practices and the safety of working relations. Our study seems to indicate that school principals create the right 'climate' – a positive and safe spirit that sets working relations for CIP in motion. At the same time, situational leadership theory (Hujala, 2004; Thompson & Glasø, 2018) discusses how the leadership practices of school principals are influenced by other factors. In the example of safety, we assume that certain degrees of safety in working relations call for different leadership practices. Several cultural theories also address that sociocultural contexts affect leadership practices (Rogoff, 1990) and contexts are transformed through leadership practices (Spillane & Sherer, 2004).

Another main finding was the role of coach-teachers as *stimulators*, in addition to the school principal, in CIP. While teachers mentioned that coach-teachers sometimes replace school principals who are less involved in CIP, we found that coach-teachers have an additional role next to the direct and positive influence of school principals. Based on the interviews, we see that the coach-teachers play a role in horizontal relations by structuring and preparing collaboration sessions, and by stimulating teachers to

collaborate. They play a role in vertical relations by addressing school principals on their role in CIP and connecting teachers and school principals. This coach-teacher role is a component of the program that schools implement, with the aim of stimulating their CIP. Our study clearly indicates that they have a vital role, but we cannot claim that a coach-teacher as a stimulator is indispensable. Therefore, further exploring whether a coach-teacher is always necessary for CIP and, if so, what this role should entail is a possible avenue for future research. Moreover, we it might be relevant to further explore the impact of the (well-defined) role of coach-teachers on how school principals decide to enact their leadership role within the school. Such future research is also relevant for studies on the role of teacher leaders (i.e., teachers with (in)formal leadership roles in combination with teaching duties; Schott et al., 2020; Struyve et al., 2018). Researchers in this field discuss the skills required and whether it should be a defined or distributed, and thus informal, role (Snoek et al., 2019). Furthermore, Struyve et al. (2018) state that there is a lack of insight into the interactions between teacher leaders and their school principal and found that some school principals find it hard to change the structures and distributions of control to facilitate teacher leadership.

The coach-teacher and school principal are two roles which are experienced by teachers to stimulate collaborative innovation, but we found that these two are not sufficient for higher degrees of CIP and the same applies for the influence of other horizontal and vertical working relation factors. This became especially apparent in our findings when certain schools had positive scores on all horizontal and vertical working relation factors, but still had low degrees of CIP. Our study thus indicates the *complexity* of how working relations do not necessarily result in CIP. There are additional underlying mechanisms that we have not yet identified. Based on the literature, we might assume the influence of the fact that working relations are socially and culturally pre-programmed: 'This is how we work around here' (Noordegraaf et al., 2016). Changing working relations into working together, i.e., CIP, does not start from scratch and is a complex process (e.g., Schein, 1989; Schein & Schein, 2016). The degree of CIP might depend on the prior existence of CIP, as well as the prior existence of a collaborative mindset within the working relations. In addition, in terms of social exchange, teachers mentioned in the interviews that a collaborative mindset and exchange of resources is of importance. We had no insights into whether all teachers and all formal leaders engaged in social exchange in the working relations. Including this information by asking about this in interviews or questionnaires might be helpful to further understand the results. Indeed, this is hindering for innovation processes if only a minority of teachers exchange social resources (e.g., Paju et al., 2021; Sales et al., 2017; Vangrieken & Kyndt, 2020).

2.5.1. Limitations

Firstly, our sample might have been slightly biased, since schools chose to participate in the program and to complete questionnaires, and the teachers voluntarily joined the group interviews. The possible slight bias is, however, partly tackled by enhancing the reliability of the results with a mixed-methods design and triangulation of data, such that teachers responded the same to their school principals' leadership in the interviews and questionnaire.

Secondly, while teachers mentioned in the interviews that they experience a collaborative mindset influencing CIP, this was not found to predict collaborative innovation in the multilevel analysis. This might be due to measurement, since the questionnaire's scale of working on lesson practices measured collaboration activities, while in interviews teachers mentioned more of an attitude of collaboration.

Thirdly, regarding the interviews, we did not specifically or comprehensively ask about associations between horizontal and vertical working relation factors. Future research with an in-depth character on this aspect would be relevant to understand the working relation factors and their association even better.

Fourthly, we were not able to predict the random multilevel models. However, the development was flat, which might be a reason why we were not able to predict this weak relation.

2.5.2. Future research

Firstly, safety and collaboration between teachers was studied confirmatively with a multilevel analysis and was mentioned by teachers in interviews as part of the horizontal relation. However, collaborative innovation also consists of vertical working relations. It might be relevant for future research to include quantitative measures of safety and collaboration in the vertical relation. Besides this, including multiple factors in a multilevel analysis would help to more resolutely state how horizontal and vertical factors associate and in which combinations these can help to enhance CIP. Furthermore, the insight that both the school principal and the coach-teacher should be actively involved is relevant for future research and especially the research area of teacher leaders. Future research could further study what it means for school principals' leadership when teachers with such a defined role are or are not involved and whether involving teachers with such a defined role is at odds with developments such as distributed leadership and control. Lastly, studying the interaction between school board members (viz., district leaders in USA research) and school principals as part of the broader vertical relation would

be an interesting contribution to understanding vertical relations of CIP, partly within and partly outside the school building. Until now, this role of school board members in relation to school principals has rarely been studied (e.g., Hooge & Honingh, 2014; Honig & Rainey, 2020).

2.5.3. Implications

Overall, our findings aim to motivate schools to not only focus on and initiate forms of horizontal working relations but also vertical working relations between teachers and school principals to change into more collaborative approaches. For teachers, this means that they should have a collaborative and learning attitude and take and share responsibilities together with other teachers and their school principal(s). For school principals, this means that they need to provide a safe work environment and relations, frameworks, and professional space, be involved in the collaborative innovation process, and be stimulating to teachers and their teaching. Furthermore, school principals must be aware that their leadership alone is not sufficient to stimulate CIP. Coach-teachers as a kind of teacher leaders with a defined role seem to be essential in addition to school principals to keep the CIP alive.

2.6. Conclusion

The current study builds on the somewhat new notion of both horizontal *and* vertical working relations to be included in CIP. We showed that teachers perceive both horizontal and vertical working relations as being important for CIP; in particular, the stimulating role of school principals and coach-teachers, as well as teachers who engage in social exchange, when they experience a safe working climate and relations were notable. However, our study also indicated the complexity of how working relations do not necessarily result in CIP and points to several avenues for future research. Thus, if we want to support schools in changing an individual culture into a more collaborative approach to innovation, understanding how horizontal and vertical working relations can be stimulated seems highly promising.

Appendix 2.1 Questionnaire scale on collaborative innovation practices

	Item (The last four weeks, I have …)	Norm from the program
Stand-up session	X times visited a stand-up meeting	4
Codesigning lessons	X times designed a lesson with a colleague	2
Conducting lesson visits	X times conducted a lesson visit and provided feedback	2*
Receiving lessons visits	X times received a lesson visit and received feedback	

* *Note.* The program did not distinguish between conducting or receiving lesson visits.

Appendix 2.2 Questionnaire scales on horizontal and vertical relations

Working on Lesson Practices (also used in Chapter 5)

1. I provide feedback to colleagues on what is going well
2. I provide feedback to colleagues on what could be better
3. I regularly talk with colleagues about education
4. I regularly exchange lesson practices with colleagues from other schools
5. I design new lesson practices together with colleagues
6. I ask colleagues to visit my lessons and give feedback
7. My colleagues and I collaborate on studying our own lesson practices

Safe to Share

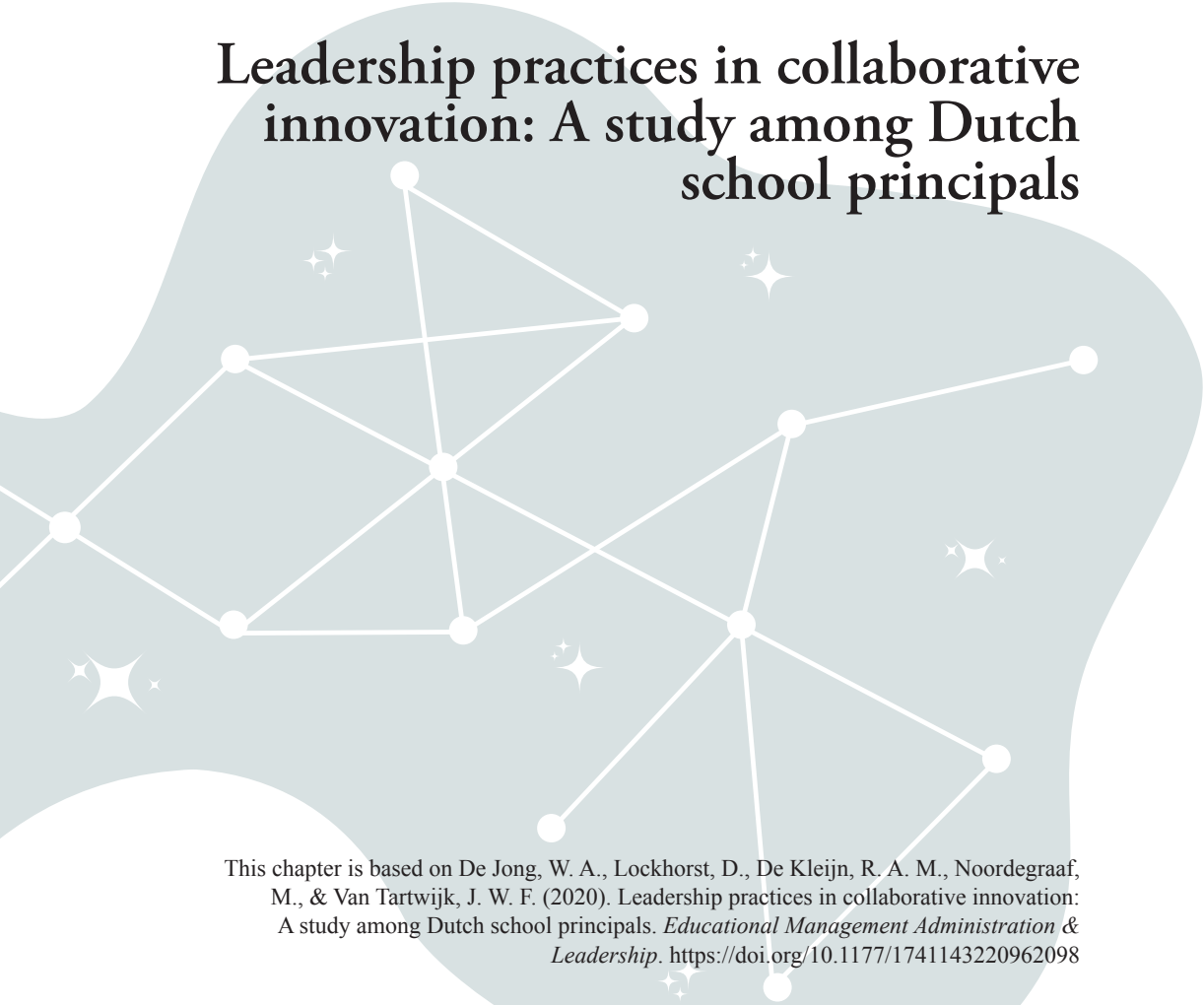
1. I share problems from my teaching practice with colleagues
2. I regularly talk about educational content with colleagues
3. I am open to feedback from my colleagues
4. I feel safe enough to share with colleagues problems that I encounter in my work
5. In difficult situations I can count on the support of my colleagues
6. I feel like I am not alone with regard to teaching my class
7. My colleagues are genuinely interested in how I am doing as a teacher

School Principals' Leadership (also used in Chapter 5)

1. The school principal(s) challenges me and my colleagues to examine problems in our teaching practice
2. The school principal(s) regularly visits my lessons
3. The school principal(s) regularly visits team meetings
4. The school principal(s) removes obstacles allowing me to focus on my classes
5. The school principal(s) develops the school's vision in collaboration with all teachers
6. The school principal(s) adjusts their own actions in response to feedback
7. The school principal(s) discusses my personal goals with me
8. The school principal(s) encourages me and my colleagues to be the best teachers we can
9. The school principal(s) encourages me and my colleagues to implement solutions to problems in our teaching practice
10. The school principal(s) asks me for feedback

3

Leadership practices in collaborative innovation: A study among Dutch school principals



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Author contributions: All authors designed the study. WAdJ collected the data. WAdJ analyzed the data and DL was involved in the coding of the interviews for reliability. WAdJ wrote the paper. DL, RdK, MN, JvT critically reviewed the paper.

Abstract

School principals and teachers are expected to continuously innovate their practices in changing school environments. These innovation processes can be shared more widely through collaboration between school principals and teachers, i.e., *collaborative innovation*. In order to gain more insight into how school principals enact their leadership practices in leading collaborative innovation, we interviewed 22 school principals of primary, secondary and vocational education in the Netherlands. All participants have implemented the same program aimed at collaborative innovation, thus enhancement of collaboration between teachers and school principals within schools. This program has already been implemented by 900 Dutch schools. The school principals were interviewed twice during the implementation year. Interview transcripts were analyzed using an open coding strategy looking for leadership practices. Based on 11 leadership practices, we described three leadership patterns. School principals enacting leadership practices as *Team player*, *Key player*, or *Facilitator*. We conclude that our findings suggest a wider repertoire of leadership practices than is reported in previous studies. Future studies would need to address the generalizability of the practices and patterns as found in this specific context of collaborative innovation.

3.1. Introduction

Schools operate in demanding and rapidly changing environments. Therefore, school principals and teachers are expected to continuously innovate their school practices to maintain their educational quality (Serdyukov, 2017). In his theoretical work, Fullan (2016) argues that shared responsibility is essential for innovations to succeed. This sharing of responsibility in turn requires work on innovations to be collaborative (Fullan, 2007, 2016; Hill et al., 2014), an approach that has been described as *collaborative innovation* in recent organizational literature (Bekkers & Noordegraaf, 2016; Sørensen & Torfing, 2016). In this paper, we study primary, secondary, and vocational education schools in the Netherlands that all implement the same large-scale program aimed at stimulating collaboration between school principals and teachers. These program's innovation processes focus directly on enhancing collaboration and shared responsibility that both indirectly may lead to improved approaches to "classroom-based teaching, learning and assessment, as well as changes in the school organisation" (definition of OECD in Looney, 2009, p. 5).

School principals have a vital role in creating suitable conditions for innovation processes and in leading these processes (Bush & Glover, 2014; Fullan, 2007, 2016; Hallinger & Heck, 2010). However, school principals often struggle with their role in innovation and collaborative school processes (Drago-Severson, 2012; Wildy & Louden, 2000). On the one hand, they are expected to collaborate with teachers and to be democratic and participative (Wildy & Louden, 2000). On the other hand, they have to decide and direct, and assume overall responsibility for their school's educational quality and the establishment of essential innovation conditions (Fullan, 2016; Wildy & Louden, 2000). This paper aims to explore Dutch school principals' leadership practices in leading collaborative innovation. We study their leadership practices during the first year schools work with the program, as this year entails the implementation phase. This intensive implementation year provides an interesting opportunity to study how school principals enact leadership practices when challenged with searching for how they should (re)form and enact their leadership in collaborative innovation.

3.2. Theoretical framework

3.2.1. Collaborative innovation in schools

The concept of collaborative innovation is mainly used in the public sector context (Bekkers & Noordegraaf, 2016; Sørensen & Torfing, 2016). It is characterized by a multi-actor approach to innovation, both vertical and horizontal, wherein resources,

knowledge, and ideas are exchanged, resulting in mutual development (Owen et al., 2008; Torfing, 2019). *Vertical* processes pertain to collaboration that cuts across different organizational levels, functions, and hierarchies (Torfing, 2016), which in schools would be between teachers and school principals. *Horizontal* processes imply collaboration between persons and organizations at the same level, which in schools would be between teachers.

Collaborative innovation is argued to strengthen and improve all different phases of an innovation process, namely the phases of problem definition, idea generation, idea selection, implementation, and diffusion (Sørensen & Torfing, 2016; Torfing & Triantafillou, 2016; Van de Ven et al., 1999). However, collaboration is not easily fostered in the educational context, since schools are loosely coupled systems (Orton & Weick, 1990). It is common for teachers to mainly focus on their own classroom (practice) and tasks, resulting in their work activities being largely autonomous and isolated (e.g., Admiraal et al., 2012). Consequently, innovation in schools is often seen as an isolated activity of one teacher or a minority of teachers who decide to initiate change (Sales et al., 2016). This hinders innovation, since we know that teachers in schools with collaborative structures and cultures tend to learn more from each other as compared to schools without collaboration (Drago-Severson, 2012).

3.2.2. Leadership and leadership practices in collaborative innovation

In both organizational and educational theories, leaders are thought to have a vital role in leading innovation processes (Bush & Glover, 2014; Fullan, 2016; Torfing, 2019). A recent review of twenty years of effective school leadership literature has demonstrated the importance of an active support of instruction and effective communication, as well as the positive influence of school principals' leadership on building organizational climate and culture, trust, and collaboration (Daniëls et al., 2019).

In the context of collaborative innovation, Torfing (2016) for instance theoretically studied leadership. He identified three types of leaders who can stimulate collaborative innovation in the public sector: *Conveners* (e.g., spur interaction), *Facilitators* (e.g., promoting collaboration), and *Catalysts* (e.g., prompting actors to think out of the box). Sørensen & Torfing (2016) and Torfing (2019) acknowledge the guiding role of leaders in collaborative innovation and call for further research on leadership in collaborative innovation (e.g., Torfing, 2019).

In order to gain more insights into leadership of school principals in collaborative innovation, we use the concept of *leadership practices*. Leadership practices of school

principals can be defined as the actions that shape their leadership (Chreim, 2014). A significant discussion in studying leadership is which theoretical framework helps to understand leadership practices. Several researchers (e.g., Aas & Brandmo, 2016; Daniëls et al., 2019; Leithwood et al., 2020) argued that leadership practices should be studied from an integrative perspective, combining theories such as those of instructional, distributed, and transformational leadership, instead of studying solely one fixed leadership theory. For instance, Alqahtani et al. (2020) and Noman et al. (2018) chose the integrative perspective of leadership practices and explored the leadership practices of school principals in Saudi Arabia and Malaysia respectively. In addition to this focus on leadership practices, Leithwood's et al. (2020) review showed that there is little understanding of *how* school principals enact leadership practices, and call for further exploration of how school principals enact certain practices.

Previous research has established well-known categorizations of leadership practices. The first categorization entails top-down and bottom-up leadership practices. *Top-down* refers to a leadership practice characterized by a high degree of control, resulting in the restriction of teachers' views. *Bottom-up* refers to a practice based on cooperative interactions and efforts to include various views (Draaisma et al., 2018; Fullan, 2016). The second long-standing categorization is task- and relation-oriented leadership practices (Lee & Carpenter, 2018; Leithwood, 1994). The *task practices* emphasize the achievement of organizational goals, by organizing and directing others' work. The *relation practices* emphasize positive interpersonal interactions by showing warmth, help, and giving the appearance of trust and open communication (Lee & Carpenter, 2018). The third categorization is based on a study of Leithwood et al. (2020). They indicated four core categories of leadership practices in relation to student achievement, namely: *Setting direction*, *developing people*, *redesigning the organization,* and *managing the instructional program*.

In the current paper, we empirically explore leadership practices of school principals, with the aim of providing insights into leadership in collaborative innovation within schools. We inductively investigate which leadership practices are enacted by school principals in collaborative innovation and how school principals enact these practices. We focus on the vertical processes, as school principals are argued to have a vital role in leading innovation (e.g., Fullan, 2016). Our study is guided by the following research question: *How do school principals enact leadership practices in leading collaborative innovation?* Based on previous literature, to which we compare our findings in the discussion section, we expect to encounter the well-known categorizations of leadership practices mentioned in the previous paragraph.

3.3. Methods

The research described in this paper has an exploratory and qualitative research design. Data were gathered by interviewing school principals about their leadership practices during collaborative innovation. The research described here is the first study of a larger research project on the effects of a Dutch school program, which is further explained under the heading 'Sample'. We will proceed with studying the relation between leadership practices and outcome measures such as distributed leadership, teachers' teaching skills, and student achievement in follow up studies.

3.3.1. The Dutch context

We explain two characteristics of the Dutch educational system that may reinforce school principals' struggles in leading collaborative innovation: School autonomy and educational sectors.

3.3.1.1. School autonomy

Dutch schools operate in a highly autonomous and responsible policy context (OECD, 2014), which has consequences for the role of school principals. Schools are free to pursue educational visions of their choice (Waslander, 2010), and everyone has the right to establish a school (Hooge, 2017). Schools can have their own school board or be part of a larger association of schools, that share a board. School boards in turn mandate school principals to take responsibility for their school's quality. Due to this highly decentralized form of governance, school principals have a range of responsibilities, including for financial matters and for ensuring that teaching and learning follow the school's educational goals as well as a national framework developed by the government. The Inspectorate of Education, under the responsibility of the Minister of Education, monitors both the quality of education and compliance with statutory and financial rules and regulations (De Wolf et al., 2017).

3.3.1.2. Educational sectors

The Dutch educational system consists of four educational sectors: Primary (students aged 4 to 12), secondary (students aged 12 to 18), and vocational and higher education (students aged 16 and older) schools. Secondary schools are divided into streams, and primary schools recommend a specific stream to each final-year student. Students can choose any secondary school that offers their recommended stream, which provokes a competition among schools for student numbers and corresponding school funds.

This further increases school principals' responsibilities since they are responsible for attracting new students. In this paper, we study school principals in primary, secondary, and vocational educational sectors.

3.3.2. Sample

3.3.2.1. School program aimed at collaborative innovation

In the current paper, leadership practices were studied in the context of a program that aims to stimulate collaborative innovation between teachers and school principals. The program uses a methodology that is partly based on Agile principles, meaning a team-based approach to improving processes step by step. The methodology consists of weekly stand-up meetings, sprints, and retrospectives, amongst other things (see Rigby et al., 2016) and consists of two phases. Firstly, an intensive implementation phase during one school year. External advisors of the program help schools to learn the methodology. The expected outcomes of this phase are enhancement of collaboration and shared responsibility. Secondly, a phase towards independence and sustainability of the collaborative innovation processes in school. The period of this second phase is school-dependent. An independent foundation initiated the program in response to the international study of the OECD (2016), which highlighted that the educational quality of Dutch schools is more than sufficient but could be further improved by enhancement of collaboration within schools. So far, approximately 900 Dutch primary, secondary, and vocational education schools have implemented the methodology of this program.

3.3.2.2. Participants

Each school year, around 120 new primary, secondary, and vocational education schools choose to implement the methodology of this program. We randomly selected schools that started working with the program in September 2017 and 2018. The school principals received a short explanation about the investment required and the benefits of participating in the study. This resulted in 11 schools participating in our study in September 2017 and 11 schools in September 2018.

In Table 3.1, we provide an overview of our sample of 22 school principals. Two school principals of secondary schools and all vocational education school principals were responsible for a department of a larger school, the other school principals were responsible for the whole school. The schools were well-spread throughout the Netherlands and were all in the implementation year (Sørensen & Torfing, 2016). In this year, schools learn how to apply and work with the methodology.

Table 3.1

Sample Information per Cohort

	1st cohort	*2nd cohort*
Start of innovation	School year 2017-2018	School year 2018-2019
First interview round	September 2017 (*n* = 11)	September 2018 (*n* = 11)
Second interview round	July 2018 (*n* = same 11)	July 2019 (*n* = same 11)
Gender	5 females, 6 males	3 females, 8 males
Educational sector	4 primary, 5 secondary, 2 vocational education schools	6 primary, 1 secondary, 4 vocational education schools

3.3.3. Data collection: Interviews

The first author conducted one-hour face-to-face interviews twice with every school principal, at the beginning and end of the implementation year (see Table 3.1) to study possible differences within the implementation year. We interviewed them twice to obtain a thorough understanding of the rationale of the leadership practices shown. Informed consent forms were signed before the interview started. The interview questions were developed as part of the larger research project, which aims to study context and intervention variables, including leadership practices, in relation to effects of the program. In order to explore leadership practices, in this study we used the following broad and open questions: 'How do you see your role as a school principal, regarding the implementation of the program and in general?', 'Who is responsible for leadership in this school?', and 'What is the responsibility of teachers regarding innovation and leadership?'. We asked the school principals to describe their practices in detail and to illustrate them with examples.

To decrease the researchers' influence on the data collection (Varpio et al., 2017), interviews were audiotaped, and transcripts were written during the interview by an assistant, and member checks were conducted by asking all school principals to check their transcript. This process led to negligible changes in the transcripts of five interviews.

3.3.4. Data analysis

Our analyses are inspired by the grounded theory approach (Glaser & Strauss, 1967; Thornberg et al., 2014), using constant comparative analysis by multiple rounds of coding and two cohorts of interview data. The two cohorts were treated as a split sample in the analyses (Watling & Lingard, 2012). In this way, we used the concept of saturation to reach a 'good enough' information power, following Varpio et al.'s (2017) criticisms on the challenges "about whether theories, data or themes can ever be truly saturated" (p.

45). Our data analysis involved three rounds that will be further explained below: Open, axial and selective coding.

3.3.4.1. Open and axial coding to study leadership practices

The first author read all interviews for open coding, using N-Vivo Pro 12. To include the context of the answer, the unit of analysis was the whole interview question together with the answer of the school principal. Data were coded on whether the units were about leadership practices or not, based on Chreim's (2014) definition of leadership practices. Interview units that were not about leadership practices were mainly covering themes like expectations of the innovation and school background information. The first and second author coded two not yet coded interviews and reached consensus with sufficient reliability (Cohen's Kappa .64) on the main code leadership practices.

Then axial coding was applied (Corbin & Strauss, 2008) to inductively identify leadership practices, resulting in a coding scheme. Multiple codes could be scored on one unit. The first and second author had three rounds of peer debriefing and formulated indicators of each code. Afterwards, no new codes were needed to code the interviews. The reliability of this coding round was good (Cohen's Kappa .81). Table 3.2 depicts the coding scheme.

3.3.4.2. Selective coding to study the how of leadership practices

To explore how school principals enact their leadership practices, selective coding was entailed by rereading the leadership practices, found in the open and axial rounds of coding. By doing this, we aimed to identify meaningful differences between school principals' leadership practices. The differences we found concerned school principals' involvement in collaborative innovation processes in their schools.

Indicators that helped us to discover leadership practices of more involved school principals were words such as: 'Us', 'we', 'together', 'collectively', 'our process' and verbs like: 'Being present', 'being up to date', 'asking questions', 'advising', 'listening', 'cooperating', 'thinking along', 'coaching', 'showing vulnerability', 'providing professional space', indicating the involvement in leadership practices. Less involved leadership practices were indicated by words such as: 'Teachers among each other', 'their process', 'they', and verbs like: 'Hearing', 'steering', 'letting go', 'being at a distance', 'controlling', 'working commercially', 'focussing on management'. We also scored the explanations school principals gave about why they acted a certain way and whether they acted consciously.

We did not find substantial differences within the implementation year in school principals' enactment of leadership practices. The preliminary findings of the first cohort were thus confirmed in the second cohort of data. The results are therefore assembled in one results section.

3.4. Results

3.4.1. School principals' leadership practices

Based on the open and axial coding, we identified a repertoire of school principals' leadership practices in collaborative innovation. Next to the bottom-up and top-down leadership practices that can be recognized directly, we identified nine other leadership practices. In Table 3.2, the 11 leadership practices are ordered from most to least often.

Table 3.2

Coding Scheme and Resulting Leadership Practices

Leadership practice codes	Definition statements of SP referred to	Indicators** for coding (and/or)	Total score (out of 44 interviews)	Quotes
Bottom-up	Providing professional space	Consulting, involving teachers and/or working on/ verifying support for innovation	40/44	"I let teachers organize school meetings on topics they want" (SP4)
Involvement	Being interested and involved with teachers and/or the program	Present during meetings, ask questions, provide help, show interest, invest time	34/44	"I ask how my colleagues are doing and listen to them" (SP6)
Facilitation	Facilitating teachers so they can work	Time, money (material, experts, replacement)	31/44	"I ensure teachers can work without distractions (e.g., parents)" (SP16)
Top-down	Deciding and steering in school	Decisions, mainly without involvement of others	23/44	"I picked the teachers who I wanted to become coach in the innovation" (SP17)
Motivation	Motivating teachers to work (on the innovation)	Passionate for education, stimulating, enthusiastic, showing positivity	19/44	"I show my enthusiasm about the program to motivate them" (SP3)

Leadership practice codes	Definition statements of SP referred to	Indicators** for coding (and/or)	Total score (out of 44 interviews)	Quotes
Vision focus	Keeping track of the (long term) vision	Keep track, goals, checking whether school activities are in line with the vision	16/44	"It is my responsibility to keep track of the long-term vision" (SP5)
Progress	Keeping track of the process and progress of the innovation implementation	Keep track of the innovation progress	16/44	"I try to be up to date about the progress, to know how it is going" (SP2)
Role model	Deliberately showing behavior they want of their teachers	Aware of showing their behavior, example	14/44	"I try to show in my behavior how I want teachers to behave. For example, I ask teachers for feedback" (SP15)
Student focus	Being focused on students in their work	Choices based on students' wellbeing, passionate to work with students	9/44	"The ultimate goal is to provide good education to students" (SP5)
Transparency	The belief that it is important to be clear in their actions	Clear in actions and decisions. Transparency in school buildings (e.g., glass)	5/44	"I try to be clear in what I do and why I do it some way" (SP16)
Connect	Working on connecting teams	Connect teams and people, see a lack of connection	5/44	"I try to connect all teacher teams" (SP12)

Note. SP = school principal, SP*number* = unique identifier per school principal. ** Not all indicators needed to be mentioned by school principals.

3.4.2. School principals' leadership patterns

The selective coding resulted in the identification of two leadership patterns. The term leadership pattern was chosen because this term indicates a focus on behavior and practices, and because it helps to maintain our integrative approach to studying leadership practices.

Table 3.3 illustrates the differences between the two patterns, based on four leadership practices. We found this distinction for 10 leadership practices. One of the 11 codes, Student focus, did not provide a distinctive nor meaningful insight. All school principals mentioned being focused on students but did not further explain how they enacted their leadership regarding students. This code is therefore not included in the leadership patterns. We labelled the two leadership patterns as 'Our' and 'Their' to indicate how school principals' involvement in collaborative innovation varies.

Table 3.3

Illustration of Two Main Patterns of Leadership Practices using Quotes

Codes	Pattern 1: 'Our'	Pattern 2: 'Their'
Bottom-up	"I **ask** teachers to organize school meetings on topics they want, to enhance **shared responsibility**" (SP4)	"I expect **all teachers** to actively participate in the implementation process and the **internal school coaches** to check this. At the end of the year, I will discuss their work" (SP22)
Involvement	"I am **present** during meetings because I want to show we have a **shared responsibility**. I **act** a bit **as a team member** then" (SP16) "I have been one of the **coach**es" (SP3, 5, 7)	"I am **mainly not present** during meetings. It is the **process of the teachers** and actually I am too busy" .. "I think I **should be more present,** but I don't want to clear my agenda for this" (SP9)
Motivation	"I **ask questions** and **motivate** teachers to experiment by **giving examples**" (SP16)	"For teachers to work with the innovation, they need enthusiasm. I try to provide that by giving a **plea**, but **only at the beginning** of the school year (SP12)
Progress	"I am **part of the innovation team**; I work together with the coaches, and I **ask** how it is going and/or **steer** a bit when necessary" (SP16)	"I am **not totally up to date** about how the process of implementation is going. I **hear this from** the coaches, who are mainly **leading** this" (SP9)

Note. Indicators that helped us to understand the differences between the patterns are presented in bold as mentioned in the Methods.

3.4.2.1. Leadership pattern 'Our'

The first leadership pattern is characterized by school principals showing more involved leadership practices (see Table 3.3). These school principals are characterized by their willingness to share the responsibility for implementation of the program. Furthermore, they are actively involved in meetings and stimulate teachers to take responsibility, so the processes become shared, with teachers able to determine their own share. Therefore, we labelled this as leadership pattern *'Our'*.

A notable finding regarding the 'Our' pattern was that 2 out of the 13 school principals differed from the other 11 in their leadership practices in one important aspect. These school principals stressed that innovation is 'collaboratively owned' by teachers and the school principal, which fitted with the Our-pattern. However, they also mentioned that they were doing all the work and were too deeply involved. These school principals evaluated their own practices as too involved but state that they aim to share the responsibility more in the future. As an illustration, one school principal said:

> Actually, I am involved too much. When I am not here, the program meetings do not take place and that will be the end of the innovative processes in our school. I promised the teachers that I will pull them through (...) that is why I do this now. I do not feel like I can step back now. (SP6)

These school principals seem to represent leadership practices that claim the innovation is an 'Our' process but is actually led by the school principal. Therefore, we distinguish two sub-patterns: *Key players* representing school principals who say: "I am leading our innovation", and *Team players* representing school principals who consider themselves to be part of the team with the teachers, and consciously prioritise being present and sharing responsibility with their teachers. Table 3.4 presents descriptions of these two (sub)patterns. We described the leadership (sub)patterns based on two or more leadership practices. In the left column, each line is explained by a summary of the description's meaning.

3.4.2.2. Leadership pattern 'Their'

The second leadership pattern is characterized by school principals showing less involved leadership practices (see Table 3.3). These school principals identify teachers and internal school coaches (i.e., trained teachers) to be responsible for the implementation of the methodology of the program. Furthermore, they are more distant from the innovation process. Therefore, we labelled this as the leadership pattern *'Their'*. Because we found no clear sub-patterns within the Their-pattern, we refer to school principals with this leadership pattern as F*acilitators* (see Table 3.4).

These *Facilitator* school principals evaluated their practices mostly as too uninvolved. Most school principals attributed this to a lack of time. Only two school principals mentioned that they sometimes choose to be more distant to enable teachers to share responsibility for the program's execution. All *Facilitator* school principals mentioned that they see their main task in collaborative innovation as facilitating the teachers to work with the program.

Table 3.4

Description of Main Patterns and Sub-patterns of Leadership Practices

Leadership practices	'Our' (n = 13)		'Their' (n = 9)
	Team player (n = 11) *It is our innovation* *(*6 primary, 3 secondary, 2 vocational education)	*Key player* (n = 2) *I am leading our innovation* (primary education)	*Facilitator* (n = 9) *It is their innovation* (2 primary, 3 secondary, 4 vocational education)
Whether school principals attend meetings or not	School principals are often till always present at meetings to show involvement. When they are not present, they often consciously choose for teacher professional space *(Involvement)*	School principals are always present at meetings and take all responsibility. Prepare and lead all these meetings *(Involvement, Top-down)*	School principals are mainly not present at meetings or state to be present to control and steer the process (*Involvement, Top-down)*
Whether school principals know about progress or not	School principals ask questions about the innovations' progress and share their insights *(Involvement, Progress, Transparency)*	School principals know (almost) everything and first-hand (*Involvement, Progress)*	School principals are quite unknown to the innovations' progress *(Progress)*. They mainly hear about it via school coaches *(Bottom-up, Top-down)*
Whether school principals share responsibility or not	School principals state to be as much responsible as the teachers for the program's success. They provide teachers with ideas and want development to be independent of the school principal *(Bottom-up, Connect, Progress)*	School principals mention the program is from all of them but also acknowledge they are too involved. The development is dependent on the school principal *(Bottom-up*, *Top-down, Connect)*	School principals state that coaches and teachers are mainly responsible for the program's success. School principals steer in direction and decide who joins the program *(Bottom-up*, *Top-down, Connect, Progress*).
Whether school principals invest time in the program or not	School principals are involved and invest some of their time (e.g., by being a coach *(Involvement, Facilitation)*	School principals invest too much time, according to themselves, in organizing and facilitating *(Involvement, Facilitation)*	School principals do not invest their time, keep more distance, mainly facilitate the processes *(Involvement, Facilitation)*
Whether school principals motivate teachers for the program or not	School principals stimulate teachers to try and experiment and keep positive about the innovation *(Motivation)*	School principals want teachers to try but do not believe, yet, that teachers will work on the innovation themselves *(Motivation)*	School principals try to be a role model by showing up at innovation meetings now and then *(Motivation, Role model)*
Whether school principals steer on the school's vision or not	School principals keep track of the vision and try to collaboratively develop vision plans *(Vision focus)*	School principals steer on the vision. There are small opportunities for teachers to think along *(Vision focus)*	School principals keep track of the vision without the influence of teachers *(Vision focus)*

3.4.2.3. Recognition of Bottom-up and Top-down practices

Although we identified distinct leadership practices and patterns, we found a similarity between *Key players* and *Facilitators*, as both patterns display bottom-up and top-down leadership practices (see the first and fifth row of Table 3.4). For *Key players*, we found top-down practices in which the principals organize and handle everything related to the implementation of the innovation themselves. In contrast, *Facilitators* provide (strict) frameworks and take decisions in a top-down manner but delegate the actual organization of the implementation to teachers. Bottom-up practices exercised by *Key players* were the involving of teachers in decision-making processes, whilst being active themselves as well, whereas for *Facilitators*, they were the shifting of responsibilities to internal school coaches and teachers, whilst being passively involved themselves.

3.4.2.4. Educational sector differences

We also identified small differences between educational sectors in leadership practices. Most primary school principals showed 'our' leadership practices (see Table 3.4). In contrast, most vocational education school principals showed 'their' leadership practices.

3.5. Discussion

This paper explored how school principals enact leadership practices in collaborative innovation within schools. Based on interview data we identified leadership practices and leadership patterns that are discussed in turn.

3.5.1. Repertoire of leadership practices in collaborative innovation

Confirming the expectation of finding a *repertoire* of leadership practices, we identified 11 leadership practices: Bottom-up, Involvement, Facilitation, Top-down, Motivation, Vision focus, Progress, Role Model, Student focus, Transparency, and Connect. The well-known 'bottom-up' and 'top-down' practices are consistent with other studies on leadership practices (Fullan, 2016; Draaisma et al., 2018). Furthermore, in the leadership practices Involvement and Motivation, we recognize the established concept of the relation-oriented practices, and in the practices Vision focus and Progress, we recognize the task-oriented practices (Lee & Carpenter, 2018). Additionally, the four categories of leadership practices stated by Leithwood et al. (2020) can be related to those described in this study: Vision focus is related to 'setting direction', Involvement is related to 'developing people', and Connect partly to 'redesigning the organization'. 'Managing the

instructional program' is less apparent in the leadership practices identified in the current study. A possible explanation for this might be that Leithwood et al. (2020) focused on leadership practices related to student achievement, while the program of this study and the role of the school principal is primarily aimed at collaborative innovation and thus enhancing collaboration and shared responsibility and student achievement is a possible indirect outcome. The leadership practices Facilitation, Role Model, and Connect correspond to subcategories mentioned by Leithwood et al. (2020). Interestingly, our leadership practices Student focus and Transparency, were not distinguished yet in earlier studies. Both practices are relevant in the specific context of collaborative innovation in schools and show different ways in which school principals can relate to teachers, other school staff, and students. All in all, we see that even in a small sample of school principals a wide variety of leadership practices were found.

3.5.2. Leadership patterns in collaborative innovation

In an attempt to explain the variety in leadership practices between school principals, we described three leadership patterns. The *'our'* leadership pattern refers to school principals who participate in the innovation process and was divided into two sub-patterns: *Team player* and *Key player*. Firstly, *Team player* school principals enact leadership practices to promote innovation becoming the joint process of teachers and school principals. This pattern shows similarities with patterns described by Torfing (2019) and Eckert (2019), who also described school principals supporting collaboration and shared responsibility. We choose not to use their label of 'catalytic' leadership for our sub-pattern, as we did not study its effect on innovation outcomes (e.g., whether the school principals accelerate the process), but describe leadership practices in collaborative innovation. Secondly, *Key player* school principals reported leadership practices in which innovation is seen as a collaborative process of teachers and school principals that is directed by school principals. Even though previous literature (e.g., Soini et al., 2016; Torfing, 2019) suggested that school principals should be actively involved in collaborative innovation, these school principals seem too deeply involved (by their own evaluation). These school principals mention they have a strong tendency to take ownership of the process, since they do not believe, or trust that teachers will work on innovation productively without their interference. This finding is in line with a previous study, which also found that school principals still tend to play a major role in complex school processes (Zwart et al., 2018).

The school principals in the *'their'* leadership pattern, were labelled *Facilitators*, which refers to school principals who partake less in the innovation process. They leave the collaborative innovation to the teachers, although they exert control 'from a distance'

(e.g., establishing frameworks). This concept of school principals remaining at a distance is identified in the review of Antonakis and Atwater (2002). They regard leaders' distance as an element of leadership influence and state that leaders may appear to be at distance physically, socially or regarding infrequent contact. The *Facilitators* indeed seem to act at a distance, both by remaining physically remote and by making contact infrequently. According to Klein (2017), mixed results have been reported regarding the effects of leader distance on the innovation process (such as on trust and exchange of knowledge). This study adds an early understanding of school principals' reasons for being distant (e.g., time constraints, different prioritization). Furthermore, based on the fact that half of our sample of school principals enact these distant practices, we emphasize the importance of the effectiveness of this pattern being addressed by future studies.

Overall, the presented patterns of leadership practices describe how school principals view their roles in vertical collaborative innovation. School principals who enact *Key player* and *Team player* leadership practices have frequent interactions with teachers, and a vertical collaborative relationship is consequently present. In contrast, *Facilitators* do not (wish to) build up a collaborative relationship with their teachers, instead remaining at a distance. School principals described by either of the three (sub)patterns seem to consciously reflect on who is responsible for collaborative innovation in schools, but to act in different manners regarding for instance the sharing of responsibilities with teachers and their own involvement.

Lastly, we found that most primary school principals enact 'our' leadership practices, whilst most vocational education school principals enact 'their' leadership practices. The size of the schools they lead might present a tentative explanation. In the Netherlands, primary schools often have (far) fewer students and thus fewer organizational layers and fewer subject teachers than in vocational education. It might be the case that the smaller a school the more involved a school principal can be regarding collaborative innovation.

3.5.3. Future research and limitations

We studied how 22 school principals enact their leadership in collaborative innovation and identified a set of leadership practices and patterns. Obviously, future studies will need to address whether these leadership practices and patterns are also found in larger samples of school principals, and whether these findings apply in schools using other collaborative innovation-based interventions than the specific program researched here. Moreover, it would be interesting to follow the grounded theory approach even further and actively search for counterexamples of these leadership practices, a research strategy which is advised by Corbin and Strauss (2008). Nonetheless, we consider this study

an important step towards insights into leadership practices and patterns, which helps understanding how school principals lead in the context of collaborative innovation.

Additionally, future research could further explore the influence of school context variables on leadership practices in collaborative innovation or could link the leadership practices to outcome measures. Now that we have identified leadership practices and patterns in collaborative innovation, we will study the relation between leadership practices and outcome measures such as distributed leadership, teachers' teaching skills, and student achievement in follow up studies. Furthermore, this current paper provides insights into the potential relevance of the context variables educational sector and school size. Future research could include school culture, since leading collaborative innovation in schools does involve school cultural change (Díaz-Gibson et al., 2014). Another relevant context variable may be the motives for collaborative innovation in schools, as schools can have different motives for implementing programs focusing on collaborative innovation: While some schools in our study started the program to improve their education in general, others started because they are under supervision of the Inspectorate of Education and consider this program as their last means of achieving sufficient educational quality.

Furthermore, to understand why school principals enact certain leadership practices in a certain way, future research could study their rationales further. Our findings of leadership practices and patterns raise several questions that still remain to be answered, such as: Why do some school principals feel more connected or involved to the innovation processes, and/or why do they prioritise these processes in different ways?

In addition, as this study focused on leadership practices in vertical processes, it would be valuable for future studies to focus on the horizontal processes, i.e., between teachers. Including teachers' perspectives could also contribute to our understanding of the enactment of leadership practices of school principals, as the way teachers interact could be considered a relevant context variable.

Lastly, a significant point to bear in mind is that the principals in our sample were all in the implementation phase of innovation. We noticed that some of the school principals talked about their leadership practices normatively. *Key players* and *Facilitators* both mentioned their respective excess or lack of involvedness. We consider this to be a reflection on a leadership struggle (as mentioned by Drago-Severson, 2012; Wildy & Louden, 2000). We would expect that leadership struggles change during the continuous improvement phase of innovations (Van de Ven et al., 1999) and the school principals did not yet seem fully satisfied with their enactment of leadership practices. We would encourage scholars to longitudinally study leadership practices to study the sustainability of leadership practices (Sørensen & Torfing, 2016; Van de Ven et al., 1999).

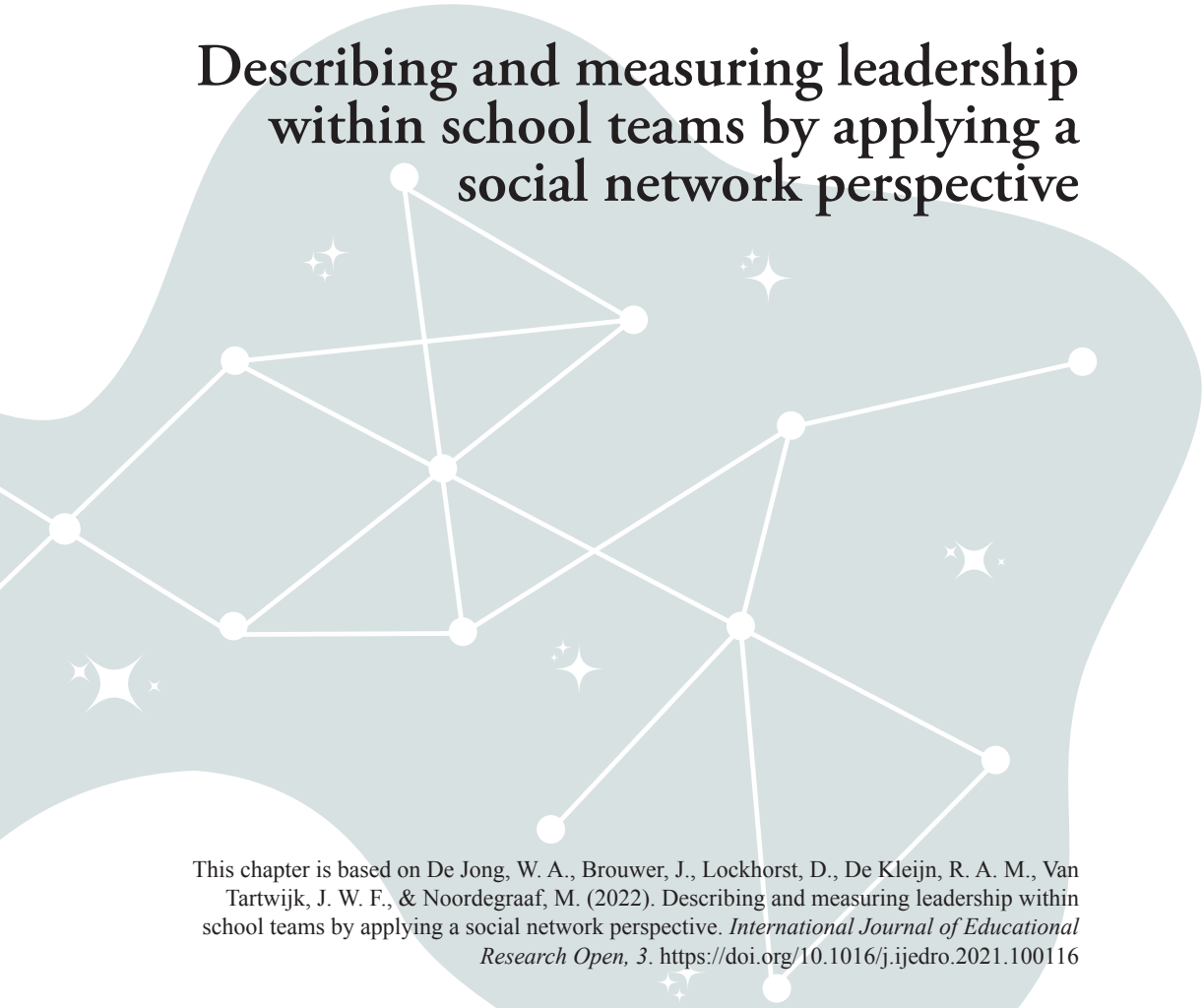
3.6. Conclusion

All in all, the finding that both 'top-down' and 'bottom-up' leadership practices are necessary (Meirink et al., 2010; Hill et al., 2014; Soini et al., 2016) needs more nuance in an educational context in which collaborative innovation is implemented (Torfing, 2019): Distributed leadership (Thien & Chan, 2020), teacher agency (Pantić, 2015), and participative decision making (Thoonen et al., 2011) all play an important role.

Based on our qualitative results, we confirmed several well-known leadership practices reported in educational leadership literature (Fullan, 2016; Draaisma et al., 2018; Leithwood et al., 2020) and contribute two relevant leadership practices, Student focus and Transparency, as being at work in this context. Additionally, we contribute to the call of Leithwood et al. (2020) to explore in greater depth how school principals enact leadership practices since our leadership sub-patterns of *Team players, Key players*, and *Facilitators* describe in detail how school principals enact their practices in leading collaborative innovation. Furthermore, our integrative view on leadership practices helps further understanding of school principals' struggles in leading collaborative innovation. These struggles in leading indicate that school principals' leadership practices and patterns can be shaped in various ways, despite the fact that they chose to implement the same program, aimed at collaborative innovation. The overview of leadership practices and patterns in collaborative innovation that we present in the current study enables school principals to reflect on their own leadership and to consider whether they exert a leadership role that is suitable for their school.

4

Describing and measuring leadership within school teams by applying a social network perspective



This chapter is based on De Jong, W. A., Brouwer, J., Lockhorst, D., De Kleijn, R. A. M., Van Tartwijk, J. W. F., & Noordegraaf, M. (2022). Describing and measuring leadership within school teams by applying a social network perspective. *International Journal of Educational Research Open, 3*. https://doi.org/10.1016/j.ijedro.2021.100116

Author contributions: WAdJ, DL, RdK, MN, JvT designed the study. WAdJ collected the data. WAdJ analyzed the data. JB advised on social network analyses. WAdJ wrote the paper. JB, DL, RdK, MN, JvT critically reviewed the paper.

Abstract

Despite the growing number of studies that acknowledge a crucial role of distributed leadership within schools, limited knowledge exists on how to describe and measure this multi-faceted concept. In a social network study with 130 respondents from 14 Dutch school teams carrying out *collaborative innovation*, we theoretically describe three core aspects of the social interaction process of distributed leadership: *Collective*, *dynamic*, and *relational*. Furthermore, we empirically explore how to measure all these three aspects of distributed leadership from a social network perspective, whereas most research focuses on either collective or dynamic. Our findings indicate that three network measures (density, reciprocity, indegree centralization) form a coherent combination to measure distributed leadership in school teams in terms of collective, relational, and dynamic respectively. Furthermore, based on the combination of measures we found differences in distributed leadership between school teams. Thus, adding the relational aspect in addition to the collective and dynamic aspects seems to be informative to measure distributed leadership. Our study motivates to take a social network perspective, instead of the mostly used aggregation approaches, to measure distributed leadership in school teams.

4.1. Introduction

The studying of solely the role of formal leaders in innovation, which has long been the focus (Hansen & Pihl-Thingvad, 2019; Liu & Werblow, 2019; Molines et al., 2020; Ospina, 2017; Sun & Xia, 2018), is an approach losing currency (Angelle, 2010; Ospina, 2017). In most theoretical frameworks, leadership has commonly been defined as individuals exerting influence over others to structure activities and relationships, knowledge, and skills (Daniëls et al., 2019; Yukl, 2002). Distributed leadership theory postulates that multiple team members can be considered leaders, thus both school principals and teachers, as they are able to influence the motivation, knowledge, or practices of other team members (Daniëls et al., 2019; Harris & Spillane, 2008; Spillane, 2005).

A growing body of literature acknowledges a crucial role of distributed leadership for successful innovations in schools (Brown et al., 2020; Daniëls et al., 2019; Fullan, 2016; Hulpia et al., 2009; Jambo & Hongde, 2020; Law et al., 2010; Meijer, 2014; Ricard et al., 2017; Sullivan et al., 2012; Tian et al., 2016; Tummers & Knies, 2013; Vogel & Masal, 2015). This is in line with the international call for a more social, collaborative, and networked approach to school innovations (Liou et al., 2020). Sinnema et al. (2020) state that sharing responsibilities brings teachers the opportunity to benefit from the capacities of multiple members. Furthermore, teachers can develop a fuller appreciation of the interdependence between and support structures among each other (Azorín et al., 2020) and as a result, this can have powerful impact on arriving at more innovative and democratic solutions (Sinnema et al., 2020; Snoek et al., 2019). However, despite the growing number of effect studies, limited knowledge exists on how to describe and how to measure the multi-faceted concept of distributed leadership (D'Innocenzo et al., 2016; Daniëls et al., 2019; Harris, 2013; Liu & Werblow, 2019; Tian et al., 2016).

The aim of our study is to theoretically describe and empirically explore how to measure distributed leadership within school teams from a social network perspective. Previous studies that proposed to measure distributed leadership with such a perspective were explorative and based on small samples but argue the relevance of applying the social network perspective well (e.g., Brown et al., 2020; Liou et al., 2014). Distributed leadership is a social networked process of distributing leadership practices and responsibilities (Sinnema et al., 2020), and the strength of the social network perspective is that it includes all these social relations in a network of team members (Cullen-Lester & Yammarino, 2016; D'Innocenzo et al., 2016; Sinnema et al., 2020). By combining distributed leadership theory with a social network perspective, we follow a growing number of scholars that call for contributing to "the lack of research into bringing to the forefront both emergent paradigms" (Naumov et al., 2020, p. 9). To this purpose, we study Dutch school teams that

all implemented the same program during the study period, which was aimed at enhancing collaborative innovation of teachers and school principals. We therefore address the following research question: *How can distributed leadership in school teams be described and measured by applying a social network perspective?*

4.2. Theoretical framework

4.2.1. Distributed leadership as a social interaction process

Distributed leadership theory is well-known in both the academic world and school practice (Gronn, 2002; Spillane, 2005). However, limited studies exist that theoretically describe and afterwards empirically measure distributed leadership (D'Innocenzo et al., 2016; Daniëls et al., 2019; Harris, 2013; Tian et al., 2016). Within this study, we attempt to more comprehensively describe and measure distributed leadership. To be able to measure distributed leadership, we first need to describe the concept. We therefore conducted a search on how distributed leadership is described until now in educational and organizational literature (e.g., Azorín et al., 2020; García Torres, 2019; Gronn, 2002; Harris & DeFlaminis, 2016; Spillane, 2005). By studying the descriptions of the concept, we dissected three core aspects of distributed leadership that are often part of these descriptions, namely, *collective, dynamic*, and *relational*, and we describe these below.

Firstly, many researchers, among others Gronn (2002), Harris and DeFlaminis (2016), Liljenberg (2015), and Spillane (2005), interpret distributed leadership as a fluid co-performance process executed by multiple members of a team. This means that not only the formal leader is leading but also teachers or other staff members, for instance co-determination and decision making of teachers in policies. We consider this to be the *collective* aspect of distributed leadership. Spillane and Sherer (2004) found that both school principals, as formal leaders, and teachers, as informal leaders, performed leadership practices. They found that multiple members were interacting and motivating and influencing each other to come up with new ideas and knowledge, and by doing so, they collectively performed leadership practices.

Secondly, the before mentioned researchers and among others, Gronn (2002), state that leadership can be claimed by those with the required expertise for the task or challenge at hand. Distributed leadership does not mean that everyone leads (Harris, 2008). Rather, whoever takes responsibility for a particular task and thus a leadership role depends on the specific situation (Spillane, 2005). We consider this to be the *dynamic* aspect of distributed leadership. Spillane and Sherer (2004) found that teachers perform leadership roles by offering their expertise in the form of relevant examples from their own practice, advising other teachers in similar situations.

Thirdly, among others Gronn (2002), Harris and DeFlaminis (2016), and Pitts and Spillane (2009), conclude that distributed leadership revolves less around individuals and personal leadership acts, and more around relations, interactions, and dialogues between team members in complex school organizational and professional environments. It is concerned with reciprocal interdependencies between members through which tasks are accomplished, since "one leader's practice becomes the basis for another leader's practice and vice versa" (Spillane, 2003, p. 344). We consider this to be the *relational* aspect of distributed leadership. Spillane and Sherer (2004) noted that knowledge is generated through the interactions of teachers and school principals. For instance, a literacy coordinator within a certain school depended on examples given by teachers in order to move forward with ideas for literacy lessons.

In conclusion, based on literature we define distributed leadership as a contextually embedded social interaction process between all team members, which is *collective, dynamic*, and *relational*. We continue by proposing a social network approach to measure these three core aspects of distributed leadership from literature.

4.2.2. Social network perspective on distributed leadership

Distributed leadership develops in social interaction and involves relations between persons in a network, such as a school team. Social network theory is concerned with relations between persons or groups and interactions of organizational and relational processes (e.g., Freeman, 2004; Wasserman & Faust, 1994). This social network perspective is argued to be a fitting point of view to study interactions (e.g., Keim, 2011), and is promising for studying distributed leadership practices (e.g., Azorín et al., 2020; Liou & Daly, 2020). The relations between persons and resources of each person, such as information, knowledge, and support (Coleman, 1988) shape a social network structure. Within this structure, persons have access to and can mobilize resources (Lin, 1999), which is interpreted as social capital and mobilization of social capital (Brouwer et al., 2020; Coleman, 1988; Lin, 1999, 2001; Liou & Daly, 2018, 2020). Coleman (1988) explains that these valuable resources, social capital, can help persons to attain individual goals that they could not reach without these resources. Social capital is often studied in network research by using relational questions, which can target various types of interaction (e.g., advice, (information) exchange) (Brouwer et al., 2020; Liou & Daly, 2018). Pitts and Spillane (2009) state that an advice question "allows us to move beyond an exclusive focus on the formal organization to attend to the informal organization such as informal interactions that are intended or understood by school staff to influence their practice" (Pitts & Spillane, 2009, p. 187). Persons reach out for advice, such as information, knowledge or support (Brouwer et al., 2020; Coleman, 1988), to others who they may perceive as someone who can lead their professional development and have

relevant expertise (Liu, 2021; Spillane, 2006; Tam, 2019). This means that the person who is asked for advice may perform a leadership role (Sinnema et al., 2020; Yukl, 2002), when he/she exerts influence on someone's knowledge and skills (Moolenaar et al., 2011).

However, until now data gathering and analyses in studies on distributed leadership are largely dominated by aggregation approaches using self-perception questionnaires (D'Innocenzo et al., 2016; Hulpia et al., 2009; Joo, 2020; Liu & Werblow, 2019; Sun & Xia, 2018). These methods do not regard each individual relation but focuses on distributed leadership on team level, since the questionnaires ask team members for perceptions of their team (D'Innocenzo et al., 2016). As previously introduced, there are various reasons for combining distributed leadership theory with a social network perspective, such as that the perspective includes the informal processes, studies each team member's perception and all relations between teachers and school principals within a school team. Therefore, in this study, we follow the growing number of scholars that call for combining the social network perspective with distributed leadership theory (Cullen-Lester & Yammarino, 2016; D'Innocenzo et al., 2016; Naumov et al., 2020; Rodway & Farley-Ripple, 2020, Sinnema et al., 2020). We empirically explore how to apply the perspective to study the *collective, dynamic*, and *relational* aspects, and in this way develop a more comprehensive picture of distributed leadership.

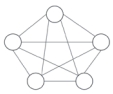
The question arises how to measure all three core aspects of the multi-faceted concept of distributed leadership (collective, dynamic, and relational). The social network perspective includes several measures that might represent various aspects of interaction and thus leadership (see for an overview Borgatti et al., 2013; Gest & Kindermann, 2012). Previous social network studies on distributed leadership mostly included one or two social network measures (e.g., Liou et al., 2014; Mehra et al., 2006) and have been largely based on quite small samples (e.g., De Lima, 2008). In more detail, previous studies on distributed leadership mostly studied graphical sociograms, without including network measures (Mehra et al., 2006; Pitts & Spillane, 2009; Sinnema et al., 2020), or utilized merely one measure to capture one aspect of distributed leadership, mostly density (Carson et al., 2007). Prior studies that utilized two measures, mostly density and centralization (Liou et al., 2014), studied a hypothetical dataset (Mayo et al., 2003), or solely included informal leaders (De Lima, 2008) or utilized it for role identification (Apkarian & Rasmussen, 2020; Smith et al., 2018) and in smaller samples of two schools (De Lima, 2008; Liou et al., 2014; Warfield, 2009) or five schools (Apkarian & Rasmussen, 2020; Brown et al., 2020). Concepts close to distributed leadership are more often studied by a combination of network measures, such as studies on collaboration of teachers (Moolenaar et al., 2012; Sinnema et al., 2020; Smit et al., 2021), research-based practices in networks (Farley-Ripple & Yun, 2021), and leadership of formal leaders or leadership teams (Hooge et al., 2019; Liou & Daly, 2018a, 2020, 2020a;

Spillane & Sun, 2020; Tuytens et al., 2019). These earlier studies indicate the promise of utilizing a social network perspective to depict relations and interactions. However, until now distributed leadership is studied less with such a social network perspective and thus D'Innocenzo et al. (2016) recommend, based on their meta-analysis on distributed leadership and team performance, to further explore the utility of other network measures in addition to the most often studied density and centralization to reveal different aspects of distributed leadership.

In the current study, each of the three core aspects of distributed leadership that we dissected will be measured with their own social network measure, based on an advice seeking network of teachers and their school principal. Insights from previous studies indicate the potential relevance of the social network measures density and centralization (e.g., Carson et al., 2007; Liou et al., 2014). We recognize these measures to fit the collective and dynamic aspect respectively, and we will study these two measures in our bigger sample of school teams. Furthermore, our second goal is to include the third core aspect, namely relational, and to measure this with the social network measure reciprocity. In this way, we study the relevance of adding another social network measure and the coherence of the three measures. Below we briefly explain how the *collective, dynamic*, and *relational* core aspects are captured within the chosen social network measures (for an overview, see Table 4.1).

Table 4.1

Overview of our Proposal How to Describe and Measure Distributed Leadership From a Social Network Perspective

Aspect of distributed leadership	Network Level	Network measurement	
		Name	Figure
Collective	Network	Density	
Dynamic	Network and individual	Centrality	
Relational	Dyadic	Reciprocity	

Firstly, *collective* describes the extent to which the team members are actively consulting each other, for instance for advice, which represents the cohesiveness of a network. The more team members consult each other, the more advice relationships evolve, which results in a more dense (i.e., cohesive) network (Borgatti et al., 2013). The social network measure density helps to study the collective aspect. It indicates how many ties

are present within the whole network, and is hence a measure of how connected the team is (Civís et al., 2019; Harris, 2003; Liou et al., 2020; Sergiovanni, 2001).

Secondly, *dynamic* is reflected by the degree of centeredness of the network around a few central members. It presents how and whether the dynamics of advice seeking in a network proceeds via multiple persons or a small amount of (or one) central member(s) (Borgatti et al., 2013). A network becomes more centralized around those who are asked for resources (for instance advice) by more others (Borgatti et al., 2013). The social network measure indegree centrality helps to study the dynamic aspect since it describes the distribution of ties by identifying to what extent those ties are organized around one or a few central members (D'Innocenzo et al., 2016; Huang et al., 2020). A high indegree centralization signals that a network is highly dependent on a small number of members and thus not that dynamic. If this is the case, this means that the power of individual members varies substantially, with leadership being rather unequally distributed across team members (Hanneman & Riddle, 2005). A low indegree centralization signals that multiple team members are central and thus advice seeking, and for instance a flow of information, is dynamically spread among team members.

Thirdly, to measure the third core aspect of distributed leadership, namely *relational,* we add a third social network measure to the combination of measures. As described before the relational aspect is about reciprocal interactions. The social network measure reciprocity helps to study the relational aspect since it provides insights into the hierarchy within a team and whether there is an interaction (Liou et al., 2020). Reciprocity presents the number of reciprocated ties on a dyadic level. A team with more reciprocated ties among its members is likely less hierarchical and thus more characterized by a distributed leadership structure.

Table 4.1 provides an overview of how we aim to describe and measure distributed leadership by a social network perspective. The three social network measures are expected to add to each other since they all capture another aspect of interaction and relation. Where density simply indicates the connectedness of a school team, centrality indicates whether there are central members on which a school team is dependent on, and reciprocity captures whether the relations are reciprocal and thus the hierarchy of the network of a school team. In sum, we aim to study how all three core aspects of the multi-faceted concept of distributed leadership can be measured by applying three social network measures.

4.3. Methods

4.3.1. Context of the study: Program aimed at collaborative innovation

The research described in this paper is part of a larger research project investigating the effects of a Dutch program aimed at enhancing collaborations for innovation

in schools, by stimulating the establishment of a learning culture and the sharing of responsibilities between teachers and school principals. Such an approach to innovation has been described as *collaborative innovation* in recent public service organizational literature (Bekkers & Noordegraaf, 2016; Torfing, 2019). The program was initiated by an independent foundation, after an international study by the OECD (2016) highlighted that the educational quality of Dutch schools is more than sufficient but could be further improved by enhancement of collaboration by educational staff within schools. At present, approximately a thousand Dutch primary, secondary, and vocational education schools have implemented the methodology of this program (see Appendix 4.1 for a short explanation of the Dutch educational sectors).

We studied distributed leadership within schools participating in this program, as teams in these schools are activated to collaborate and to distribute leadership. The program uses a methodology that is partly based on 'Agile' principles, meaning a team-based approach to improving processes step by step (see Rigby et al., 2016). The methodology motivates schools to have weekly stand-up meetings where teachers and school principals meet each other and where goals are jointly set, and tasks agreed upon. These meetings are followed by codesigning lessons and classroom observations by colleagues.

The program identifies three roles within schools, for which there are specific expectations: School principals, coach-teachers, and teachers. School principals are encouraged to set directions, be a role model in working with collaborative innovation (e.g., being present at weekly meetings, perform classroom observations and ask for feedback), and to facilitate their teachers improving themselves and the school's quality. Coach-teachers are teachers who received a training from an external advisor and perform the supervisor role of the implementation phase within the school, training the other teachers to work with the pro- gram. In this way they have a more formal responsibility than the other teachers (Bryant et al., 2020). Teachers are expected to collaborate with their colleagues on a weekly basis, work with the program, and gradually become co-owners of the school improvement process.

Notably, the program consists of two phases, with the roles' associated responsibilities changing over time. The first phase entails an intensive implementation period, during one school year, in which external advisors help schools to learn the methodology. The expected outcomes of this phase are enhancement of collaboration and increasingly shared responsibility amongst teachers and school principals. The second phase is focused on sustaining the collaborative innovation processes by aligning the program with the schools' culture and structure.

4.3.2. Participants

Fourteen school teams that started working with the program in September 2018 participated in the current study (three school teams were part of one large vocational education institution). The participating schools cover an age range of children from 4 to 16 years and older. The schools were well-spread across the Netherlands, were in rural as well as urban areas, and were all in the first year (the implementation phase). In total, the teams included 148 teachers and school principals, of which we received 130 responses, a response rate of 88% that can be considered excellent (Borgatti et al., 2006).

In social network analyses, instead of the number of participants, relationships are the unit of analysis and, therefore, an indication for the number of observations. The smallest school team had 30 relations (school team N; 6*5), the largest school team had 156 relations to study (school team A). On average the teams had 80 relations. This sample size is comparable with other social network studies in education (see the sample sizes of e.g., Brouwer et al., 2020; Brown et al., 2020; De Lima, 2008; Sinnema et al., 2020). Table 4.2, in which the school teams are ordered based on team size, presents sample information. Within all school teams, women are in the majority. The average age of each team is between 35 and 51 years.

Table 4.2

Sample Information

School teams	*n* Total network	*n* School principals	*n* Teachers (coaches)	Response rate	Missing respondents
A (voc)	16	1	12 (2)	81,3%	3 (18,7%)
B (voc)	14	1	11 (1)	85,7%	2 (14,3%)
C (voc)	12	1	9 (1)	83,3%	2 (16,7%)
D (voc)	12	1	10 (2)	91,7%	1 (8,3%)
E (sec)	12	1	10 (1)	91,7%	1 (8,3%)
F (prim)	12	1	10 (2)	91,7%	1 (8,3%)
G (prim)	11	1	8 (1)	81,8%	2 (18,2%)
H (prim)	10	1	9 (2)	100%	-
I (prim)	9	1	8 (1)	100%	-
J (voc)	8	0	7 (1)	87,5%	1 (12,5%)
K (voc)	8	0	7 (1)	87,5%	1 (12,5%)
L (voc)	8	1	6 (1)	87,5%	1 (12,5%)
M (prim)	8	1	4 (1)	62,5%	3 (37,5%)
N (prim)	6	1	5 (1)	100%	-
Total:	148	12	118 (18)	88%	12%

Note. Voc = vocational education teacher teams, sec = secondary education, prim = primary education.

4.3.3. Design and procedure

4.3.3.1. Measurement of distributed leadership: Asking for advice

In order to measure distributed leadership in school teams, fitting to the definition of leadership as exerting influence, we adopted an advice instrumental network question based on previous social network studies in education (Bryant et al., 2020; Liou et al., 2014; Moolenaar, 2012; Pitts & Spillane, 2009): 'Who do you turn to for advice on working with the educational program?'

Participants were asked to answer this advice question for each team member from a list of their school team members. This results in a matrix form of data on who turns to whom. Team members were represented with random initials (such as AA, AB, AC etc.) in order to anonymize datasets for analyses (see Appendix 4.2 for the matrix form of the advice question).

4.3.3.2. Procedure

We piloted the advice question and the listing procedure within two school teams that were not part of the sample of this study, but work with the same educational program. The participants indicated they experienced no constraints when completing the questionnaire. The research was approved by the ethical review committee for social and behavioral sciences of our university (number 20-056).

After the pilot, we started the main phase of our data collection. The participants received a short explanation about the investment required for and the benefits of participating in the study before completing the social network advice question, and all participants agreed. Furthermore, we chose to set the complete network boundary (Knoke & Yang, 2008) to one teacher team per school, as all schools divided their teachers into sub teams to work on this collaborative program. Each school chose one teacher team to participate in this study.

4.3.4. Analysis plan

First, we calculated the descriptive network measures (density, centrality, and reciprocity). The advice network question is part of a questionnaire from the larger research project, in which we used a five-point Likert scale. We dichotomized the network measure scores to distinguish between ties being absent (score 0) or present (score 1), by recoding 1 as 0 (absent) and 2 till 5 as 1 (present). Based on matrixes of advice network data, we calculated the social network measures per school team (whole network level) by using Ucinet (Borgatti et al., 2013):

1 *Density* (network level): Represents the proportion of directed relationships to the number of possible directed relationships (Wasserman & Faust, 1994). A density of 1 means that everyone asks advice from everyone else (Borgatti et al., 2013).
2 *Centrality* (consists of two measures: Network and individual level):

a Network indegree centralization represents the proportion of the sum of differences in centrality between the most central member in a network and all other members. This indicates whether there is a center (very central members) and a periphery (members with very low centrality scores) regarding the asking for advice (Borgatti et al., 2013).
b Individual indegree centrality is an index that represents the number of ties any specific member has (D'Innocenzo et al., 2016). The members with the largest number within their team perform the most central roles (Sinnema et al., 2020; Smith et al., 2018; Tsai, 2001).

3 *Reciprocity* (dyadic level): Indicates the proportion of observed directed relationships that are reciprocated in a network relative to the number of possible directed relationships (arc-based; Borgatti et al., 2013). When two members turn to each other for advice, this is a reciprocated relationship.

By combining these social network measures, we expect it to represent distributed leadership as follows: Relatively high density, high reciprocity, low indegree centralization, and multiple central members (more than one team member). We compared the association between these measures and team members' roles (school principal, coach-teacher, teacher) in order to explore which role most commonly takes up the central position.

Next, we calculated the correlations between density, reciprocity, and centrality within Ucinet. For each network measure, we attributed the individual data to matrices per school team, for reciprocity and centrality we used 'difference' scores between all team members of a team and for density we used the raw scores of ties being absent (score 0) or present (score 1). In this way, we tested the correlation of the three social network measures and especially the added value of the reciprocity measure. Afterward, we compared all school teams' advice networks with a cross-case analysis, to enhance generalizability and to deepen our understanding of how to describe and measure distributed leadership (Miles & Huberman, 1994). By doing so, we ordered the school teams based on low to high scores of density, reciprocity, and centralization, and examined whether we could exploratively differentiate between school teams, based on face validity and discussions with all authors. Lastly, to visualize and further describe the results, we created sociograms within NetDraw and placed the central members in the center, based on in-degree centrality. We considered the approach used in this

study successful if the correlations between density and reciprocity were positive and the correlations between density and centrality were negative, and if the approach distinguished possible differences between school teams.

4.4. Results

4.4.1. Distributed leadership descriptives in school teams

In order to measure distributed leadership, we calculated social network descriptives for all school teams on team level (see Table 4.3). The scores indicated moderately to highly dense networks (41% to 86%), which means that moderately to many of the possible ties were present between members in the advice network, though this varied considerably between school teams. The same holds for reciprocity (42% to 86%), which means that moderately to many pairs of team members sought advice from each other. Regarding network indegree centralization, all school teams scored low to medium (10% to 30%). This means that some school teams had central members who were more often asked for advice and a periphery with members who were rarely asked. Other school teams did not show such a difference between central members and members in the periphery, indicating less of a hierarchy exists in asking for advice.

Regarding individual indegree centrality, we studied how many central members were present in each school team and which function they had within their team. Most school teams had more than one central member. In 12 out of 14 teams, teachers performed a central member role. In 4 school teams they were the only central member, in the other teams they shared their central member role with the coach-teacher (in 5 teams) and school principal (in 3 teams). Coach-teachers played a central member role often as well, with a score of 11 out of 14 teams. In 2 school teams, they were the only central member. School principals played a central member role in only 3 out of 14 teams (all three being primary schools), and never performed this central member role alone; in all three cases, they shared the central member role with both a coach-teacher and teacher.

Table 4.3

Minimum and Maximum Percentages of Network Descriptives over all School Teams

	Advice-seeking (%)
Density	41 – 86
Reciprocity	42 – 86
Network indegree centralization	10 – 30
Individual indegree centrality (central members)	6 – 62

4.4.2. Correlation of social network measures within teams

Table 4.4 indicates the correlations between the different network measures, per school team. These correlations are analyzed on matrices, see the Methods for the explanation. As expected, the correlations between density and reciprocity indicated a general positive trend, with some correlations being significant, though with small strength. Furthermore, as expected, the correlations between density and indegree centralization indicated a general negative trend and were mostly significant, with small to moderate strength. Thus, the small to moderate correlations suggest that the three social network measures study and represent distinct aspects of distributed leadership and thus add to each other and using all three can help to comprehensively study distributed leadership.

Table 4.4

Correlations per School Team on Advice-seeking

Team *(n)*	Density x reciprocity	Density x indegree centralization
A *(13)*	**0.011**	**-0.209***
C *(10)*	-0.065	**-0.333***
E *(11)*	**0.349***	**-0.293***
J *(7)*	-0.113	**-0.317**
M *(5)*	**0.128**	0.128
D *(11)*	**0.100**	**-0.030**
F *(11)*	**0.169**	**-0.349***
B *(12)*	**0.140**	**-0.322***
G *(9)*	**0.190**	0.027
K *(7)*	**0.317**	**-0.585***
I *(9)*	**0.349***	0.069
N *(6)*	**0.293**	**-0.579***
H (10)	**0.374***	0.1
L *(7)*	-0.412*	**-0.490***

Note. Bold printed correlations fit measurement of distributed leadership. * Sig. < .05.

4.4.3. Distinguishing differences in distributed leadership between school teams

To distinguish differences regarding distributed leadership between teams, we ordered the school teams based on low to high scores of density, reciprocity, and centralization. Table 4.5 indicates that school teams that scored high on density also scored high on reciprocity, low on indegree centralization, and had a relatively higher percentage of central members (see the bold printed scores of school teams K to L in Table 4.5). The

reverse is the case as well (see the scores in italics of school teams A to J in Table 4.5). The bold and italics represent a division of the scores in three parts (the highest score minus the lowest score, divided by three, added to the lowest and highest part, which indicates the boundaries). By utilizing and interpreting this combination of social network measures, we were able to exploratively differentiate between school teams with respect to their level of distributed leadership (see the three different parts in Table 4.5; school teams with italic scores indicate a relatively low level, the middle group without italics or bold scores a moderate level, and bold printed a high level of distributed leadership).

Table 4.5

Descriptive Network Statistics per School Team on Advice-seeking

Team size	Density	Reciprocity	Indeg. Centr.	Central members per team			
				% (number of central members)	School principal	Teacher	Coach-teacher
A *(13)*	*0.405*	*0.456*	*0.289*	*6 (1)*		*1*	
C *(10)*	*0.464*	*0.588*	*0.273*	*16 (2)*		*1*	*1*
E *(11)*	*0.521*	*0.444*	*0.273*	*8 (1)*		*1*	
J *(7)*	*0.551*	0.593	*0.265*	*12,5 (1)*			*1*
M *(5)*	0.686	*0.417*	0.163	*12,5 (1)*		*1*	
D *(11)*	0.636	0.659	0.207	25 (3)		1	2
F *(11)*	0.678	0.659	0.214	*16 (2)*		*1*	*1*
B *(12)*	0.718	0.589	0.166	28 (4)		2	2
G *(9)*	0.611	0.618	**0.110**	27 (3)	1	1	1
K *(7)*	**0.857**	**0.762**	**0.122**	25 (2)		1	1
I *(9)*	**0.764**	**0.800**	**0.125**	*11 (1)*			*1*
N *(6)*	**0.833**	**0.800**	0.200	**50 (3)**	**1**	**1**	**1**
H (10)	**0.800**	**0.861**	**0.099**	**40 (4)**	**1**	**1**	**2**
L *(7)*	**0.857**	**0.810**	**0.122**	**62 (5)**		**5**	

Note. Indeg. Centr. means Indegree centralization. Coach-teachers are teachers who perform the supervisor role of the implementation. Central members are persons who are asked for advice by more others.

4.4.4. Visualizing differences between school teams with sociograms

Within social network studies, sociograms are commonly used to visualize results and provide an overview of the network structure. We present sociograms of two school teams that are indicative for two 'extremes' regarding distributed leadership in our sample, school team C and school H (see Table 4.5 for their scores). Figure 4.1 (team C) and 4.2 (team H) present the sociograms of these two school teams. School team C is of

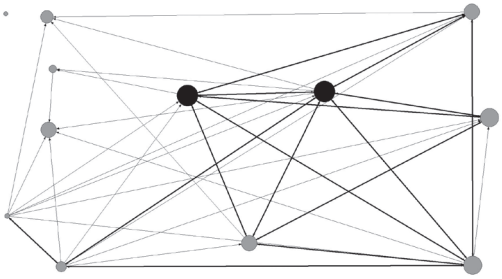
a larger size than school team H, with two members more. The circle sizes are based on the indegree and represent by how many members this specific team member is asked for advice. Moreover, black circles represent central members, calculated as the members with the relative largest indegree of their school team, grey circles represent all other team members with lower indegree scores. Furthermore, the thick lines represent reciprocal relationships, whereas the thin lines represent nonreciprocal (one-way) relationships.

We compared the two sociograms of Figure 4.1 and 4.2 on the collective, dynamic, and relational aspects of distributed leadership. First of all, school team H was more collective than school team C, since team H had relatively more connections and no team members were excluded. However, solely studying this collective aspect does not lead to a reliable conclusion about differences between school teams regarding distributed leadership, since the two sociograms do not indicate large differences. The dynamic aspect strengthens the collective aspect by indicating that school team H was more dynamic than school team C: School team H (see Figure 4.2) had three different sizes of circles, all team members were being asked for advice by more than one team member (see Figure 4.2 in which no small circles were present), and more central members were present (see four black circles in Figure 4.2), compared to school team C (see Figure 4.1), in which eight different sizes of circles, meaning by how many others members are asked for advice, are present. Regarding the roles of central members, within school team C, the two central members were a teacher and coach-teacher; within school team H, the central members were two coach-teachers, one teacher, and the school principal. To draw even more reliable conclusions about the distributed leadership structure within teams, the relational aspect helps to show the hierarchy within a network and indicates another difference between school team H and C. The thick lines in the sociograms indicate reciprocal ties and school team H has distinctly more reciprocal ties than school team C.

In summary, these sociograms visualize distributed leadership, help to indicate that all three aspects contribute to describing distributed leadership within school teams, and suggest that school team H had a less hierarchical network structure, which indicates more distributed leadership than school team C.

Figure 4.1

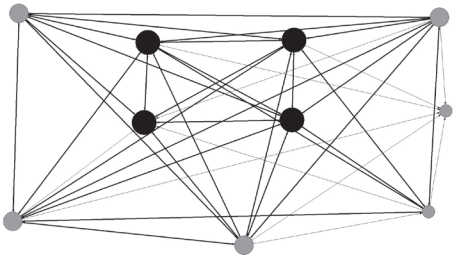
Sociogram of school team C (n = 12)



Note. Black circles represent central members, those having the largest number of incoming ties. The person on the upper left has no connections with the other team members. Thick lines represent reciprocal relations, the 'regular' (or dashed due to the design program) lines are non-reciprocal relationships.

Figure 4.2

Sociogram of school team H (n = 10)



Note. Black circles represent central members, those having the largest number of incoming ties.

4.5. Discussion

The present study contributes to the growing body of empirical research on describing and measuring distributed leadership. Previous research utilized solely aggregated data or studied one or two of the core aspects of distributed leadership. We firstly theoretically dissected distributed leadership and afterwards measured all three core aspects of distributed leadership that we dissected with a combination of social network measures: Density for the *collective* aspect, centrality for the *dynamic* aspect, and reciprocity for the *relational* aspect. This combination of social network measures has an innovative potential for the search of how to measure distributed leadership. The three measures helped to us identify differences in distributed leadership between school teams. Based on the observed correlations between the different network measures, the explored differences between school teams, and the sociograms, we propose that the measures each can help to describe a different aspect of distributed leadership. Studying their combination can help to more comprehensively capture and describe the multi-faceted concept of distributed leadership. Specifically, the correlations between the network measures indicated a relation, which is important for forming a combination of measures, but also showed no strong correlations, indicating each aspect's separate contribution to the informativeness of the combination of measures. Furthermore, the sociograms show the added value of the relational aspect in addition to the collective and dynamic aspect and the strength of interpreting the combination of these three measures to describe and measure distributed leadership in school teams.

The presence of central members, as one key element of the combination of measures, deserves further attention. Identifying central members and whether those are formal or informal leaders is particularly interesting, since it shows how leadership is structured within school teams and helps to reflect whether the leadership is distributed in the way teachers and school principals would like to see it. The latter meaning that teachers and their school principal can talk together about how leadership is structured within their specific team and school and whether they want to change that structure. Furthermore, distributed leadership implies that there is a powerful relationship between vertical and horizontal leadership processes, and that formal leaders have to create cultural conditions and structural opportunities that enable informal leaders to lead and make changes (Harris, 2008). Harris (2008) stated that informal leadership practices are not yet reaching their full potential within schools. Our findings indicated that teachers are most often central members, and that school principals never performed this role on their own. Not only does this indicate a certain level of distributed leadership in schools that were part of this research, but also sounds promising for teachers' professional development (Civís et al., 2019; Sinnema et al., 2020), job satisfaction (e.g., García Torres, 2019), and organizational commitment (e.g., Hulpia et al., 2009). Within the context of collaborative innovation, compared to the school principals, teachers seem to be more often considered by their own team members to ask for advice. Furthermore, we found that coach-teachers and teachers, as informal leaders, are often the central members together, including the school teams with less distributed leadership. Our findings underline the potential of using a social network perspective to study distributed leadership.

4.5.1. Future research

The focus of the present study was to build upon previous studies on how to describe and measure distributed leadership. Follow-up research is needed to determine whether the within team interactions that we studied are indeed representative of distributed leadership as discussed in literature. Besides, additional research can further conceptually dissect the concept of distributed leadership. Furthermore, our study does not offer an explanation for the differences in distributed leadership between school teams nor identifies the possible impact of these differences on relevant outcome measures. Therefore, further research is needed to explore whether the differences between school teams can be explained by variables such as school culture, leadership patterns of school principals (De Jong et al., 2020), gender, and teaching experience. To further deepen

our understanding of distributed leadership, future qualitative research could expand our initial findings. Specifically, it could help to understand the quality or content of the advice, why members (do not) ask a certain team member for advice and whether this depends on how the team member is perceived, and how the team members are interacting. Additionally, future research could study the sustainability of distributed leadership, as we would expect that distributed leadership increases within teams when they continue working with a collaborative innovation approach for an extended period of time.

Additionally, further research needs to examine the generalizability of our approach to other contexts and countries. The results of the present study have limited generalizability, since we studied the rather specific context of Dutch school teams that all have implemented a specific program aimed at collaborative innovation. However, the strength of our study is that it builds upon previous studies by adding valuable insights into the potential of measuring distributed leadership in schools with three social network measures and we had a robust (in response rate) sample of 14 school teams. We suggest that future research include more than one school team per school. This would provide possibilities for testing team differences within schools in levels of distributed leadership.

4.5.2. Practical suggestion

A practical application of our study is to interpret distributed leadership measures of schools together with the teachers and school principals of that particular school. In this way, schools will be encouraged to reflect on (the level of distributed) leadership within their teams and as a result improve their collaborative approach to innovation. This forms a response to the recent international call for a more social, collaborative, and networked approach to school innovations (Liou et al., 2020).

4.6. Conclusion

Despite the growing number of studies on the effects of distributed leadership, limited knowledge exists on how to describe and how to measure the multi-faceted concept of distributed leadership. Thus far, studies on distributed leadership are largely dominated by aggregation approaches, such as studies that used self-perception questionnaires that ask about distributed leadership on team level, rather than a social network perspective, in which distributed leadership is measured by each individual relation in a network. When a social network perspective is used in studies to investigate distributed leadership,

which are mostly explorative studies, either the collective or the dynamic aspect is investigated and the relational aspect is missing. We described distributed leadership by three theoretical aspects and selected appropriate network measures for each of these aspects to measure distributed leadership in school teams. The correlations between the three network measures (density, reciprocity, indegree centralization), the sociograms, and the differences between school teams in their level of distributed leadership, suggest that the three network measures form a coherent combination and simultaneously each of the measures refer to one of the aspects of distributed leadership. Thus, adding the relational aspect in addition to the collective and dynamic seems to be informative to study distributed leadership in school teams. Studying this combination of measures can help to more comprehensively describe distributed leadership and enables us to deepen understanding of leadership processes in school teams.

Appendix 4.1 Dutch educational sectors

The Dutch educational system consists of four educational sectors: Primary (students aged 4 to 12), secondary (students aged 12 to 18), and vocational and higher education (students aged 16 and older) schools. Secondary schools are divided into streams, and primary schools recommend a specific stream to each final-year student. Students can choose any secondary school that offers their recommended stream.

Appendix 4.2 Example of the advice question, matrix form (names fictitious)

Who do you turn to for advice on working with the educational program?

Note: We see asking advice as approaching a colleague of whom you think he/she can help you with the educational program. By working with the educational program we mean all activities that you perform regarding the educational program, such as stand up meetings, activities that result from the stand up meetings, designing lessons together, collaboration with colleagues such as observing each other's lessons.

AA = Sophie Miller
AB = Gerry Smith
AC = Mary Brown
Etc. ...

	Never	Seldom	Sometimes	Often	Very often
AA	○	○	○	○	○
AB	○	○	○	○	○
AC	○	○	○	○	○
Etc.	○	○	○	○	○

5

Collaborative spirit: Understanding distributed leadership practices in and around teacher teams

This chapter is based on De Jong, W. A., De Kleijn, R. A. M., Lockhorst, D., Brouwer, J., Noordegraaf, M., & Van Tartwijk, J. W. F. (resubmitted). Collaborative Spirit: Understanding Distributed Leadership Practices in and Around Teacher Teams

Author contributions: WAdJ, DL, RdK, MN, JvT designed the study. WAdJ collected the data. WAdJ analyzed the data. JB advised on presenting social network results. WAdJ wrote the paper. DL, RdK, JB, MN, JvT critically reviewed the paper.

Abstract

While the effects of distributed leadership are widely studied, how to understand this practice in sociocultural contexts is relatively unknown. Mostly only one contextual level – such as the school level – is studied. We included individual, team, and school levels, and investigated differences in distributed leadership among 14 teacher teams (130–168 teachers and their principals). These teams all work with a Dutch program aimed at *collaborative innovation.* Using a mixed-methods design, we found that distributed leadership is associated with teachers and school principals generating a collaborative spirit to improve education, and experiencing no threshold when it comes to asking advice, as well as with teachers who look beyond their classrooms.

5.1. Introduction

International research indicates that teachers increasingly have roles in educational innovation and leadership (Brown et al., 2020; Daniëls et al., 2019; Fullan, 2016; Tian et al., 2016). Various leadership models include teachers and their expertise, such as distributed, shared, team, and teacher leadership (Daniëls et al., 2019; Liu, 2020; Schott et al., 2020; Tian et al., 2016). Within schools, in particular interest in *distributed leadership* has grown significantly over the last decade, because it can be regarded as a model for collaboration and shared responsibility with an active role of teachers (Daniëls et al., 2019; García Torres, 2019; Harris & DeFlaminis, 2016). The effects of distributed leadership are oriented towards organizational commitment (e.g., Hulpia et al., 2009; Hulsbos et al., 2016; Snoek et al., 2019) and the job satisfaction of teachers (e.g., García Torres, 2019). In addition, research indicates that schools benefit from the capacities of multiple members when leadership is distributed (e.g., Azorín et al., 2020). Because distributing leadership practices means that responsibilities are shared and experiences used, which can lead to more innovative solutions to school challenges (e.g., Snoek et al., 2019). While effects of distributed leadership are widely studied, several researchers suggest that further knowledge is needed on how distributed leadership practices are embedded within wider organizational, social, and cultural contexts; in short, within wider *sociocultural contexts* (Liu, 2020; Liu et al., 2018; Or & Berkovich, 2021). This study aims to identify those aspects of the sociocultural context on individual, team, and school level that are critical in constituting distributed leadership practices in teacher teams.

5.2. Theoretical framework

5.2.1. Distributed leadership practices

Distributed leadership theory interprets leadership as a fluid ‘co-performance process’ (Bennett et al., 2003; Gronn, 2002; Leithwood & Mascall, 2008; Spillane, 2005a). Distributed leadership practices result from interactions between leaders and followers, and the situation in which these interactions are embedded (Jackson & Temperley, 2007; Murphy, 2005; Spillane, 2005). A situation includes material artefacts, tools, and organizational structures and cultures at a specific moment (Spillane & Sherer, 2004). Leaders are defined as persons exerting influence over others, to structure motivation, knowledge, or practices of others (Daniëls et al., 2019; Yukl, 2002). When persons have the required expertise that is necessary within a specific situation, they can lead others,

who are called followers (they can be teachers, school principals, and staff members) (Daniëls et al., 2019; Harris & Spillane, 2008; Spillane, 2005). The focus on practices means that leadership revolves *less* around individuals and personal leadership acts, and *more* around practices that are the outcome of relations and interactions (Gronn, 2002; Harris & DeFlaminis, 2016; Spillane et al., 2004).

5.2.2. Distributed leadership practices in sociocultural contexts

Distributed leadership practices have been argued to be embedded in, and defined by, a wider sociocultural context (Rogoff, 1990; Spillane & Sherer, 2004; Tian et al., 2016). The recognition of the importance of sociocultural contexts is theoretically anchored in sociocultural activity theory. This theory examines the link between activities of individuals, such as leadership practices, and the social contexts in which these activities occur (Pea, 1993). Teachers and school principals act in school organizations and interact with each other. Their interactions are mediated by aspects of the wider sociocultural context (Pea, 1993; Rogoff, 1990). This means that leadership practices have to be understood in the contexts in which they are embedded (Powell & DiMaggio, 1991). Furthermore, various levels of the wider sociocultural context are linked to each other. There are no clear boundaries between context levels, such as individual, interpersonal, and institutional levels of analysis (Giddens, 1984; Orton & Weick, 1990; Rogoff, 1990; Spillane & Sherer, 2004). Within schools, three interrelated levels can be distinguished: The individual level or the level of *teachers* within schools; teachers working in teacher teams, thus forming a *team* level; and the *institutional* or school level, including school principals, support staff, structures, and resources.

While these theoretical underpinnings suggest that the sociocultural context needs to be considered in studying leadership practices, only a few researchers have studied this (e.g., Liu et al., 2018). Therefore, several have highlighted the importance of identifying those characteristics of the sociocultural context that are critical in constituting distributed leadership practices (Daniëls et al., 2019; Harris, 2013; Liu, 2020; Liu et al., 2018; Or & Berkovich, 2021; Spillane & Sherer, 2004).

5.2.3. The link between sociocultural context levels and distributed leadership

When researchers study distributed leadership practices in sociocultural contexts, they mainly focus on one contextual level, and thus cannot address relatedness between context levels. The studies either focus on individual (e.g., Liou & Daly, 2014; Tam,

2019), team (e.g., Mehra et al., 2006), school level (e.g., Liu, 2021; Liu et al., 2018), or national contexts (e.g., Liu, 2020). Below, we summarize the literature on individual (e.g., teacher), team, and school sociocultural characteristics linked with distributed leadership practices.

5.2.3.1. Individual context level linked to distributed leadership practices

Only a few studies have focused on the link between characteristics of individuals, mostly background characteristics, and distributed leadership practices in schools. Liu et al. (2018) indicated that teachers' gender is a predictor of distributed leadership practices. They found that female teachers perceived more distributed leadership practices within a team. Additionally, homophily – which means that people approach others whom they perceive to be like themselves – seems to be important in asking advice (Coburn et al., 2012; McPherson et al., 2001). In line with the definition of leaders, someone who is asked for advice can exert influence, and thus is a leader (Daniëls et al., 2019; Yukl, 2002). Previous studies indicate that teachers will ask others when they perceive that these others have relevant expertise (Liu, 2021; Spillane, 2006; Tam, 2019). Liou and Daly (2014) studied distributed leadership practices in the context of data-driven instructional improvement. They also found that more experienced teachers are more often asked for advice. A last characteristic is friendship (Brouwer et al., 2020). Various studies indicate the positive influence of friendship on asking someone for advice, which can result in the assignation of a leadership role to the other person (Brouwer et al., 2018; Nebus, 2006), as friends are very accessible and there is a high probability of response from them (Nebus, 2006).

5.2.3.2. Team context level linked to distributed leadership practices

Team characteristics rarely seem to be included within studies on distributed leadership practices. Karriker et al. (2017) and Mehra et al. (2006) studied team size and team gender composition, but they did not find a link with the degree of distributed leadership. However, both studies call for a further exploration of the possible link. Pitts and Spillane (2005, 2009) studied the link between themes of interaction and distributed leadership practices, and they found that teachers approached several others for subject knowledge, planning, teaching strategies, and assessment (Pitts & Spillane, 2009; Spillane, 2005). However, these authors did not study how themes of interaction positively or negatively link to the degree of distributed leadership.

5.2.3.3. School context level linked to distributed leadership practices

School level characteristics seem to be divided in terms of the school as an organization, the background characteristics of school principals, and the leadership role of school principals. With regard to the school as an organization, school culture was found to represent whether members are open to distributing leadership practices (März et al., 2018). School culture can be a stimulus for distributed leadership practices to become embedded if it includes all school members, and builds upon collaboration (Harris, 2014; Liu et al., 2018; Muijs & Harris, 2006; Tam, 2019). Liu et al. (2018) found that mutual respect, as an aspect of school culture, results in more distributed leadership practices. In addition, the reasons for schools to engage in innovation and collaboration processes might be linked to distributed leadership practices. One such reason might be the pressure to innovate in terms of educational practices (Makoelle, 2014; Scheerens & Demeuse, 2005).

Lastly, several review studies indicate that the leadership role of school principals and their background characteristics are key to creating conditions for distributed leadership practices (Drewes et al., 2019; Jambo & Hongde, 2020; Liu et al., 2018; März et al., 2018; Tian et al., 2016). However, the ways in which school principals' leadership foster distributed leadership practices is relatively understudied (Drewes et al., 2019; Mentink et al., 2021).

5.2.4. The current study: Multiple teams, multiple levels

We investigated teacher teams in the Netherlands. In the Dutch educational system, strong school autonomy is combined with the monitoring of quality standards by the national government (Nusche et al., 2014; OECD, 2018). Our study is part of a larger research project in which a program was evaluated that is aimed at collaborative innovation; this means that teachers and school principals collaboratively approach innovation processes (Bekkers & Noordegraaf, 2016; Torfing, 2019). In an earlier study on how to measure distributed leadership practices in such collaborative innovation-oriented teacher teams,[13] differences were found in distributed leadership practices between teams (De Jong et al., 2022). Within the current study, we use these differences between teacher teams to study the role of wider sociocultural contexts. We go beyond previous research, by using a *combination* of three contextual levels, namely, individual, team, and school contexts. This leads to the following main research question: *How can differences in distributed*

[13] We continue to refer to these collaborative innovation-oriented teacher teams in this chapter as teacher teams.

leadership between collaborative innovation-oriented teacher teams be understood from multiple sociocultural context levels? We aim to provide insights to teachers, school principals, and teacher educators into how distributed leadership practices within teacher teams are embedded in sociocultural contexts.

5.3. Methods

5.3.1. Context of the study

In 2016, the OECD highlighted that the educational quality of Dutch schools could be further improved by strengthening collaboration within schools. An independent foundation developed a program with this aim. The program distinguishes from other programs by its large scale. So far, more than a thousand Dutch primary, secondary, and vocational education schools have implemented it voluntarily. Because it is implemented by a large number of schools, the impact of the program is evaluated. Our study is part of the larger research project in which this program aimed at collaborative innovation was evaluated.

The program uses 'Agile' principles, meaning a team-based approach, including the teachers and school principal(s), to improve processes step by step (see Rigby et al., 2016). The method is based on cycles of eight weeks and at the core of it, there are four tools: (1) Stand-up sessions of fifteen minutes, where teachers and school principals meet each other and where ideas are translated into jointly goals and action plans. (2) Within-school lesson visits to observe colleagues. (3) Codesigning lessons. (4) Students' voice, a structured approach to get the students' view as a source of inspiration.

In terms of the time allocation, firstly, a start team is trained by a coach from the external program, who remains involved for two years. This team includes 2-3 coach-teachers (teachers with a coach role) and their school principal. Afterward, smaller groups of teachers are formed (8-10 persons) within school and within each team a coach-teacher is present, who helps the other teachers to collaboratively work on education with the four tools in, preferably, a weekly routine. The school principal is expected to be quite actively involved in the teams and practicing of the tools but not steering.

5.3.2. Design and procedure

With our study we aim to contribute to understanding of how distributed leadership practices within teacher teams are embedded in a sociocultural context. To answer our research question, we collected both quantitative and qualitative data. With regard to

analyses, we, firstly, used quadratic assignment procedures (QAP) to analyze our questionnaire data and we performed qualitative analyses on interview data. Secondly, we merged the results of the QAP's and the interviews to study links between sociocultural context and degree of distributed leadership. Because of this, the design of our study is a convergent parallel design, which enhances the validity and reliability of our study (Burke Johnson & Onwuegbuzie, 2004).

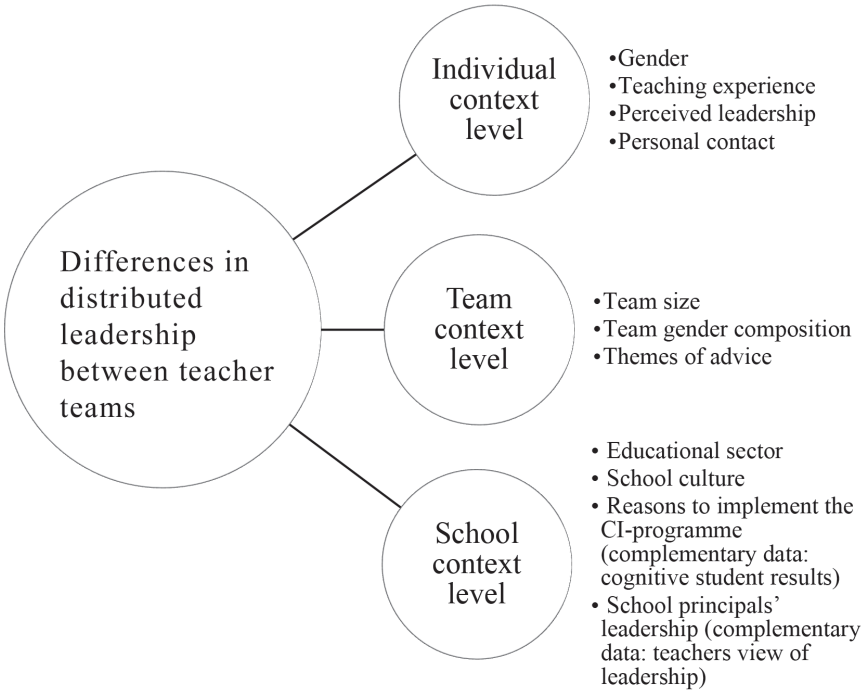
We randomly selected 12 schools from the larger research project database based on school identification numbers. In the Netherlands, schools from primary (students aged 4 to 12), secondary (students aged 12 to 18), and vocational education (students aged 16 and older) work with the program. Therefore, a selection criterion was including primary, secondary, and vocational schools. Previous studies on distributed leadership practices were mostly conducted within primary or secondary education (Bryk & Schneider, 2002; Daly, 2012; Jambo & Hongde, 2020; Liou & Daly, 2014; McLaughlin & Talbert, 2001). We invited the schools to randomly select one of their teacher teams to complete a social network questionnaire, which formed the starting point of our study. A response rate of 88% was reached which Borgatti et al. (2006) refer to as 'excellent'. Next, we included the data of sociocultural characteristics on three levels; see Figure 5.1.

The data for the individual and team level were collected via the social network questionnaire, in Spring 2019, by 130 teachers and 12 school principals. For the school level various data gathering instruments were used, namely, the school website for tracing the educational sector, a questionnaire on aspects of school culture (called the horizontal and vertical working relations questionnaire), a questionnaire on reasons to implement the program, cognitive student results, and interviews with school principals about their leadership. For the questionnaire on school culture specifically, no teacher identification number was included in the dataset of the program. While this is no problem for the school level analyses since culture is a school context level variable, we cannot present an exact number of teachers who completed both the social network questionnaire and the horizontal and vertical relations questionnaire that measured aspects of school culture.[14]

[14] This questionnaire was completed by 168 teachers in total.

Figure 5.1

Overview of Variables to Study the Sociocultural Context of Distributed Leadership



5.3.3. Participants

Since one large vocational education organization was included in our sample, which tend to be rather large compared to primary and secondary schools in the Netherlands, we included three teacher teams from this organization. These three teams had the same school principal. Our sample thus consisted of 14 teams of 12 schools, including 130 teachers and 12 school principals. The teams were well-distributed across the Netherlands and all were in their first year of working with the program.

See Table 5.1 for information on the teacher teams, such as their sample sizes in relationships,[15] which is the common unit of analysis in social network research, and in individuals.

[15] Formula for number of observations per team network: n * (n – 1) (Borgatti et al., 2013).

Table 5.1

Sample Information of the Teacher Teams Ordered by Team Size

Teacher teams	Team size: Relationships	Team size: Individuals	Age (year) M (SD)	Gender distribution (% of women)	Teaching experience (year) M
A (voc.)	240	16	46.1 (13.1)	92	10
B (voc.)	182	14	39.5 (12.9)	50	5
C (voc.)	132	12	39.4 (13.7)	10	10
D (voc.)	132	12	48.6 (10.6)	27	5
E (sec.)	132	12	40.5 (13.4)	55	5
F (prim.)	132	12	41.8 (11.8)	72	10
G (prim.)	110	11	39.7 (11.8)	89	10
H (prim.)	90	10	35.8 (11.8)	90	5
I (prim.)	72	9	43.1 (13.5)	78	10
J (voc.)	56	8	38.4 (9.9)	86	1
K (voc.)	56	8	48.4 (10.3)	86	5
L (voc.)	56	8	51.3 (8.6)	86	5
M (prim.)	56	8	36.2 (9.4)	80	10
N (prim.)	30	6	35.8 (4.9)	83	10

Note. Voc. = vocational education, sec. = secondary education, prim. = primary education.

5.3.4. Measurements

5.3.4.1. Distributed leadership practices within teacher teams

To answer our research question on the link between distributed leadership practices within teacher teams and their sociocultural context, we first need to indicate the degree of distributed leadership within teams. In a previous study, we measured distributed leadership practices in the same teacher teams that are included in the current paper (De Jong et al., 2022). Within this previous study, we followed earlier studies (e.g., Moolenaar et al., 2011; Pitts & Spillane, 2009) in using an 'advice network'-question, namely: To whom do you turn for advice on working with the program?, in order to measure distributed leadership practices. Respondents, namely teachers and their school principal, answered this question for all team members. This resulted in a data matrix describing who turns to whom. These data were analyzed by a coherent combination of three social network measures: Density, reciprocity, and indegree centrality. These measures together were used to determine the degree of distributed leadership of each teacher team and resulted in a relative order of the included teacher teams, from higher to lower distributed leadership practices. Teacher teams with relatively high scores on

density and reciprocity and low on indegree centrality were interpreted as teams with a higher degree of distributed leadership. Teacher teams that scored relatively low on density and reciprocity and high on indegree centrality were interpreted as teams with a lower degree of distributed leadership. See Appendix 5.4 for the specific scores on these social network measures and the relative order of teams. The relative order of teacher teams on distributed leadership practices is used for the current study, see Table 5.4 in the results for the order.

5.3.4.2. Sociocultural context characteristics: Individual, team, and school level

To answer our research question, we included sociocultural characteristics on individual, team, and school level that seem relevant for distributed leadership practices, based on previous literature as presented in the theoretical framework. In Table 5.2 we present the included variables per level and how we measured them. We examined the individual level mostly with respect to background characteristics. In the analysis section, we present how open answers of Themes of advice and Reasons to implement the program were coded and analyzed in the first analysis step. The school variable School principals' leadership requires a bit more explanation than will fit in the table. The three leadership patterns, namely, mean the following. First, the *Team player* leadership pattern included school principals who enacted leadership practices intended to promote innovation becoming a joint process of teachers and school principals. Second, the *Key player* leadership pattern included school principals who enacted leadership practices to direct the innovation process, but also stated that it was a collaborative process. Third, the *Facilitator* leadership pattern included school principals who enacted leadership practices such as 'controlling from a distance', and left the collaborative innovation to the teachers.

Table 5.2

Overview of How Sociocultural Context Characteristics on Individual, Team, and School Level were Measured

Level	Variables	How we measured the variable
Individual	*Gender, Teaching Experience,*	Gathered along with the social network questionnaire. Gender was indicated with: 1 = man, 2 = woman, 3 = other
	Perceived leader,	All team members were asked: Who act(s) as (a) leaders in this teacher team?
	Personal contact	All team members were asked: Out of your team members, with whom do you have personal conversations?
Team	*Team size,*	Along with the social network questionnaire, the school principal was asked about team size
	Team gender composition,	The percentage of women was calculated per team based on Gender
	Themes of advice	Following on from the question about advice, an additional open question was posed to all team members: on what themes do you seek advice when approaching this specific team member? The respondents were able to provide multiple answers.
School	*Educational sector,*	Schools were from primary, secondary, and vocational education
	School culture: Working on lesson practices-scale,	One scale on working on lesson practices, designed by the management of the program. We conducted a confirmatory factor analysis and analyzed scale reliability based on the data of the larger research project and discovered good internal consistency (α = .73, 7 items, see Appendix 2.2 of Chapter 2).
	Reasons to implement the program,	Three sources of data: Interviews with school principals, a questionnaire for external advisors, cognitive student results. School principals were asked: What is the reason that your school started to implement the program? Interviews were audiotaped, transcripts were made, and member checks were conducted (see De Jong et al., 2020). In the Analysis section, we present how the other two data sources were used complementary.
	School principals' leadership	Leadership patterns of school principals in the context of collaborative innovation, identified in an earlier study (De Jong et al., 2020): *Team player*, *Key player*, *Facilitator*. We triangulated these patterns by including teachers' perspectives on their school principal's leadership with a scale called School principals' leadership from the horizontal and vertical working relations questionnaire (α = .92; see appendix 5.2 for the confirmatory results and items).

5.3.5. Analysis

The analyses for answering our research question consisted of two steps. Firstly, we conducted quadratic assignment procedures (QAP) within teams to study which individual level variables predict advice-seeking, the latter is the measure of distributed leadership practices. We included the significant individual variables to team level. In this way, we were able to include these in the second and main analysis step, namely, to study our unit of analysis: Teacher teams and how their context influences their degree of distributed leadership. Secondly, we analyzed links by comparing teams with higher and lower degrees of distributed leadership and their team and school level sociocultural characteristics.

5.3.5.1. First step: Individual level: Quadratic assignment procedures (QAP)

Firstly, we conducted quadratic assignment procedures (QAP), multiple regression analysis, in Ucinet for each teacher team to test the link between individual characteristics and advice seeking relationships, which is our measure of distributed leadership practices. We conducted the QAP's per teacher team since the teacher team is the unit of analysis and the boundary of the network (which means that persons could not select team members from other teams than their own team). The QAP is suited for social network data, since it can analyze observations that are interdependent, and social network data is interdependent. More conventional statistical tools are not appropriate, because network data violate the assumption of independent observations (Borgatti et al., 2013). All characteristics showed weak (.3) to moderate (.4–.6) correlation. The individual characteristics that were significant were aggregated to the team level and included in the next analysis step, in which our main unit of analysis, the team level, i.e., teacher teams, are studied.

5.3.5.2. Second step: Team and school level: Analyzing links between distributed leadership and sociocultural characteristics

To answer our research question on the link between distributed leadership practices within teacher teams and their sociocultural context, we qualitatively analyzed the links between distributed leadership of each teacher team and its sociocultural characteristics on team and school level. As stated, significant predictors of the individual level were included in the analysis on team level.

Preparing two qualitative variables to be included in the analysis.

For Themes of advice on team level and Reasons to implement the program on school level we first had to code the data into categories to be able to include these in the main analysis of how sociocultural characteristics link with distributed leadership practices. For

Themes of advice, two authors categorized half the dataset of teachers' answers. After achieving sufficient agreement, the first author continued categorizing, and had several peer debriefings. This resulted in the following themes of advice: Collaboration, designing lessons, lessons, organizing improvement of education, policy and vision, role as coach-teacher, stand-up meetings, students and classes, and visiting lessons. See Appendix 5.1 for descriptions and number of mentions of the themes that were used for categorization. The most mentioned theme of each teacher team was included in the analysis.

Regarding Reasons to implement the program, the first and third author had multiple peer debriefing sessions, and after achieving a sufficient agreement of 83%, the first author continued to categorize all data. See Appendix 5.3 for indicators that helped with the categorizing and number of mentions. This resulted in the following reasons: Improving learning culture, improving the quality of education, improving data-informed ways of working, a new school start, working more efficiently, and low educational quality. We triangulated these reasons with external advisors' given reason for each specific school, see Appendix 5.3. More specifically, for the reason low educational quality, we added cognitive student results.[16] Both the external advisor and the students' results confirmed the reason mentioned by school principals.

The qualitative analysis on team and school level.

We ordered the teacher teams as cases from higher to lower distributed leadership practices in a meta-matrix in Excel. The team and school sociocultural characteristics were included in the columns (Miles & Huberman, 2014). We investigated whether there was a link between the range of distributed leadership practices and each sociocultural characteristic. To do so, we compared teacher teams with lower distributed leadership practices to teacher teams with higher distributed leadership practices with regard to the sociocultural characteristics. If the teams with higher distributed leadership practices indicated a reverse link with a specific sociocultural characteristic than the teams with lower distributed leadership practices, we interpreted this as a link. All authors discussed the found links and the variables that we did not find a link for, to reach consensus on the findings.

This study was approved by the Ethical Review Committee for social and behavioral sciences of our university (number 20-056).

[16] We chose data from the school year 2016–2017, the year before the schools implemented the program. For the primary schools this meant including the mean of the final exam that primary school students make in the Netherlands, for the vocational schools this meant percentage of passed students. Both are relative to the national norms, which are provided by the Dutch National Inspectorate of Education.

5.4. Results

Within this results section, we firstly present how individual characteristics (based on the social network questionnaire) link to advice-seeking. Advice-seeking is how we measured distributed leadership practices. After that, the significant findings of the analysis on individual level will be included in the analysis of team characteristics. In one large table, we ordered the teacher teams on their degree of distributed leadership. We present which team characteristics link to distributed leadership practices and which school characteristics link to distributed leadership practices. This is a combination of qualitative and quantitative data. Lastly, we summarize the results of the three levels in a table.

5.4.1. Characteristics of individuals linked to advice-seeking (measure of distributed leadership practices)

Table 5.3 presents the regression results on background characteristics of individuals and advice-seeking. A significant contribution was found for the Perceived leader within 8 out of 14 teams. This meant that within these teams, when someone perceived another person as a leader, it was more likely that this other person would be asked for advice. Next, Personal contact was found to be significant within five teams. This meant that within these teams, when someone had personal contact with another person, it was more likely that this person would be asked for advice. Furthermore, the Teaching experience of teachers was only significant within one team, and thus did not add additional explained variance overall to the Perceived leader and Personal contact for asking someone for advice. Finally, Gender was not significant in any team, and thus did not add additional explained variance. This means that being of the same gender (or not) did not matter when it came to asking someone for advice.

These regression results indicated that in most teams, perceiving someone as a leader (Perceived leader) mattered most when it came to asking someone for advice. When the Perceived leader was not significant within a team, it was Personal contact that related to who is asked for advice.

Table 5.3

QAP, Multiple Regression, per Teacher Team on Advice-Seeking

Teacher team	Personal contact β	Perceived leader β	Gender[a] β	Teaching experience β	Model fit R^2
A	0.13	0.31 *	0.01	0.01	13
B	0.06	0.19	0.03	-0.22	2
C	0.28 *	0.16	-0.20	-0.05	18
D	0.40 *	0.31 *	0.11	0.06	40
E	0.07	0.25 *	0.06	-0.06	9
F	-0.01	0.26 *	0.11	0.11	10
G	0.37 *	0.05	-0.13	0.43 *	29
H	0.62 *	0.08	-0.01	-0.04	40
I	0.27	-0.21 *	0.15	0.25	18
J	0.10	0.28 *	0.34	-0.07	24
K	0.10	-0.25	-0.07	-0.29	11
L	-0.16	-0.08	0.04	0.18	6
M	-0.01	0.89 *	-0.18	0.28	68
N	0.39 *	0.51 *	-0.23	0.13	43

Note. *$p < .05$ one-tailed. [a] Gender matrix via exact matches (same gender = 1). Other characteristics via differences.

5.4.2. Characteristics of teams and schools linked to distributed leadership practices

5.4.2.1. Characteristics of teams

The significant individual characteristics Perceived leader and Personal contact were aggregated to team level to analyze the link between sociocultural characteristics and distributed leadership practices. Within Table 5.4, these characteristics are presented, next to the other team characteristics.

In Table 5.4, teacher teams with higher distributed leadership practices are shown at the top, and those with lower distributed leadership practices are shown at the bottom. Teams with higher distributed leadership practices include teachers who have many relationships with their colleagues, and who seek advice from each other. They have an even distribution of advice. Teachers from teams with lower distributed leadership practices have fewer relationships with their colleagues and there are some teachers with a central role and thus an uneven distribution, who are more often asked for advice and thus perform a leadership role.

Regarding links between characteristics of teams and their distributed leadership, we see that the teams with higher distributed leadership practices sought advice on the theme Organizing improvement of education most often, whereas the seven teams with the lowest distributed leadership, except one, sought advice on the themes of Students and classes and Lessons. How often this most mentioned theme was mentioned in a teacher team is indicated by the percentage of mentions in Table 5.4.

Next, within teams with higher distributed leadership practices it did not seem to matter whether you perceived someone as a leader (Perceived Leader) as to whether you turned to that team member for advice. On the other hand, within the seven teams with the lowest distributed leadership, except one, perceiving someone as a leader did matter in terms of asking them for advice.

We did not find a link between distributed leadership practices and the following team characteristics: Personal contact, team size, and team composition.

Table 5.4

Distributed Leadership Practices of Teacher Teams and Team and School Characteristics

	Team					School			
Distributed leadership: Teams ranging from high to low[a]	Most mentioned theme asked for advice (% of mentions compared to total)	Personal contact sig. β	Perceived leader sig. β	Team size	Team gender composition (% women)	School principals' leadership[b]	Culture: Working on lesson practices	Reason to implement program: Low educational quality	Educational sector[c]
L	Organizing improvement (26%)			8	86	F	2.77		Voc.
H	Organizing improvement (44%)	0.62		*10*	90	T	3.76		Prim.
N	Organizing improvement (46%)	0.39	0.51	6	83	T	2.66		Prim.
I	Lessons (30%)		-0.21	9	78	T	2.70		Prim.
K	Organizing improvement (34%)			8	86	F	2.77		Voc.
G	Organizing improvement (29%)	0.37		*11*	89	T	*2.98*		Prim.
B	Organizing improvement (57%)			*14*	*50*	F	2.67	x	Voc.
F	Stand-up meetings (19%)		0.26	*12*	72	K	2.58		Prim.
D	Lessons (39%)	0.40	0.31	*12*	27	F	2.67	x	Voc.
M	Lessons (42%)		0.89	8	80	F	*3.04*	x	Prim.
J	Lessons (54%)		0.28	8	86	F	2.77		Voc.
E	Students, Classes (33%)		0.25	*12*	*55*	F	2.89		Sec.
C	Organizing improvement (33%)	0.28		*12*	10	F	2.84	x	Voc.
A	Lessons (30%)		0.31	16	92	K	*3.08*	x	Voc.

Note. The highest one-third scores are indicated in bold; the middle one-third scores are italicised. [a] Based on De Jong et al. (2022). [b] T = *Team player*, K = *Key player*, F = *Facilitator*, based on De Jong et al. (2020). [c] Prim. = primary education, Sec. = secondary education, Voc. = vocational education.

5.4.2.2. Characteristics of schools

Regarding the third and last level, namely characteristics of schools and their distributed leadership practices, we see that most of the teams with higher distributed leadership practices have school principals who described themselves as a *Team player*, one who participates within the educational improvement processes. The teams with lower distributed leadership practices all have school principals who described themselves as *Facilitators* who steer from a distance, and two teams had a *Key player* who direct the process. As discussed in the Methods section, we found that teachers' perceptions underline the school principals' leadership patterns. This means that teachers perceive school principals' leadership as more involved within teams with higher distributed leadership practices.

In addition, with regard to a Reason to implement the program, low educational quality indicates a link. Only teams with the lowest distributed leadership, and teams within the middle of the range, started to implement the program because they perceived their educational quality to be too low. We found that both the external advisor and the cognitive students' results confirmed the remark of the school principal who mentioned that low educational quality was a reason to implement the program.

We did not find a link between distributed leadership practices and the following school characteristics: Working on lesson practices, Educational sector, and several Reasons to implement the program. These Reasons are not included in Table 5.4 to improve legibility but are shown in Appendix 5.3.

Lastly, we summarized the results in Table 5.5, by presenting the four sociocultural context characteristics that we found to be linked to distributed leadership practices.

Table 5.5

Our Results on Links Between Sociocultural Context and Distributed Leadership (DL)

Variables (level)	Higher DL	Lower DL
Perceived leader (individual and team)		Negative link
Theme asked for advice (team)	Organizing improvement	Students, classes, Lessons
School principals' leadership (school)	Team player	Facilitator
Reason to implement (school)		Low educational quality

Note. An empty cell means that there was no link.

5.5. Discussion

This study responded to prior calls to direct more attention to the study of the sociocultural context of distributed leadership practices (Liu, 2020; Liu et al., 2018; Or & Berkovich, 2021). Using a mixed-methods design, we studied characteristics of three contextual levels, in order to answer the research question: *How can differences in distributed leadership between collaborative innovation-oriented teacher teams be understood from multiple sociocultural context levels?* We reached a better understanding of the sociocultural contexts of distributed leadership by finding links with four characteristics, which we will summarize from the perspective of teams with higher distributed leadership practices.

Firstly, teachers in teacher teams with higher distributed leadership practices clearly asked each other for advice on schoolwide organizing improvement processes, instead of mainly or only focusing on their own classrooms. Secondly, team members of these teams approach each other for advice irrespective of perceiving someone as a leader. Thirdly, the school principals of these teams participate more in the innovation processes. Fourthly, these teams started the program for reasons other than low educational quality. These four characteristics indicate a *collaborative spirit* to improve education together. This collaborative spirit manifests itself in teachers talking about improving educational standards at their school, and thus (daring to) look beyond their own classroom. These teams have an intrinsic motivation to improve their education collaboratively. This is in contrast with teams with lower distributed leadership practices and a lack or lower degree of collaborative spirit, which have an extrinsic motivation, namely the improvement of the quality of their education, but it seems that they do not collaborate as much to solve it.

We thus conclude that teacher teams with higher distributed leadership practices have a stronger *collaborative spirit* to improve education together. As stated in our theoretical framework, previous research mainly studied one contextual level in relation to distributed leadership and thus cannot address relatedness between context levels. We studied a combination of three contextual levels, namely, individual, team, and school contexts, and continue by interpreting these – together – in the remainder of this discussion paragraph.

A collaborative spirit in teacher teams with higher distributed leadership practices is linked to the wider debate about ‘professionalism in transition’, which is visible in organizational literature (e.g., Andersen et al., 2018; Noordegraaf, 2007, 2011, 2015; Wu et al., 2017). We especially recognize how Hoyle (1975) and Windmuller (2012) distinguish ‘extended’ from ‘restricted’ professionals. They describe ‘extended’ professionals as teachers who are involved in professional activities outside the classroom, and collaboratively improve education and their own professional development by

collaboration, evaluating (their own) education, and asking for advice. They see 'restricted' professionals as teachers who act autonomously and are especially concerned with effectiveness of their own class, subject content, and didactics. The differences that we found between the teacher teams and their degree of distributed leadership seem to link to these two 'types' of professionals. This can also be related to the distinction made by Evans (2008), focusing on educational professionals, between 'demanded, prescribed, and enacted' professionalism. This highlights extrinsic versus intrinsic 'reconfigurations' of professionalism as well (Noordegraaf, 2015): Teachers who are committed to go beyond routinized ways of working show 'enacted professionalism'. All in all, teachers from teams with higher distributed leadership practices in our study can be recognized by the term 'extended professionals' who are able to 'enact' new forms of professional action.

Furthermore, in our study we found that school principals in teams with higher distributed leadership participate in the innovation process, as *Team players*. The *Team player* is one of the leadership patterns identified by De Jong et al. (2020). They did not yet study the relatedness of these leadership patterns to other concepts. As stated by among others Drewes et al. (2019) and Mentink et al. (2021), the ways in which school principals' leadership foster distributed leadership practices is relatively understudied. Our study adds to the study of De Jong et al. (2020) and other previous research by providing new insights into the link between school principals' leadership and distributed leadership, with an emphasis on team relations.

Teachers from teams with lower distributed leadership in our study, act more like 'restricted' team professionals in terms of Hoyle's professionals (1975). They are first and foremost concerned with the effectiveness of their own class, subject content, and didactics. This professional attitude is also recognized in other research, stating that some teachers are strongly focused on everyday professional practice in their classroom (Giesbers & Bergen, 1991; Van Gennip & Sleegers, 1994). Within teams with lower distributed leadership, perceiving someone as a leader seems to still plays a role in asking someone for advice. This finding relates to previous research that indicated that teachers ask others for advice when they perceive these others as having relevant expertise or experience, or when they see others as some sort of 'leader' (Liu, 2021; Spillane, 2006; Tam, 2019). Our study adds to this current body of knowledge by indicating that perceiving someone as a leader might relate to having relevant teaching experiences, or other kinds of experiences or features. We, namely, did not find teaching experience to play a role in asking for advice, but perceiving someone as 'leader' does. A possible reason for this more self-focused characteristic of the teachers and the experienced threshold of asking others who are experienced as leaders, in the teams with lower distributed leadership,

might be the low educational quality. This provides an extrinsic motivation to improve education rather than an intrinsic motivation. Furthermore, the school principal in these teacher teams with lower distributed leadership may have felt the urge – because of the lower educational quality – to tighten the reins in terms of leadership.

In addition, Kessels (2018) mentions a paradoxical leadership dynamic that might also help to interpret these results in the teams with lower distributed leadership. He reviewed four studies on school principals' leadership and found that school principals respond to teachers' attitude. He argues that if teachers mainly focus on their own classroom, are reluctant in taking initiatives, and avoid collaboration, teacher teams seem like an organizational administrative unit. This impedes a shared values orientation and professional social exchange and provokes more directive leadership of school principals. Subsequently, this might result in a restriction of teachers' professional spaces and this then influences how teachers behave.

One might wonder about the causality; namely, whether the collaborative spirit within teacher teams results in higher distributed leadership, or vice versa. However, following the distributed leadership perspective, we interpret the link between distributed leadership practices and its sociocultural context as a reciprocal process; leadership and context influence each other. The notion of 'mutual influence' is introduced by the interpersonal theory, acknowledging that persons mutually influence each other's behavior (Horowitz & Strack, 2010; Veldman et al., 2017). Furthermore, many cultural researchers stress this mutual influence, by showing how sociocultural contexts affect leadership practices (e.g., Pea, 1993; Rogoff, 1990), and how these contexts are also transformed through leadership practices, at the same time (Spillane & Sherer, 2004). An example is the role of culture: This constitutes leadership practices and is created and potentially transformed by leadership practices (Giddens, 1979). The more specific Kessels' (2018) paradoxical leadership dynamic implies that school principals' leadership is provoked by teachers' attitude and vice versa, as mentioned. Or and Berkovich (2021) found the mutual influence between school principals' leadership and contextual characteristics such as school culture as well. They argue that school principals should reflect on how their practices fit cultural characteristics. We contribute by stating that school principals and also teachers should be aware of their attitude, how they influence others, and that they are influenced by others, and that they are able to proactively create new practices by changing their own attitude.

We did not find evidence that teaching experience, personal contact, team size and team gender composition, working on lesson practices, educational sector, and several reasons to implement the program were linked to distributed leadership practices. The

lack of a link with teaching experience and personal contact seems to indicate that these individual characteristics matter less for distributed leadership than their collaborative spirit. The same holds for team size and team gender composition (Karriker et al., 2017; Mehra et al., 2006) and educational sector. With regard to working on lesson practices, all teacher teams seem to collaborate little. The lack of a link might be caused by the collaboration being focused on lessons, while the characteristics that did indicate a link seem to be more about collaboration beyond lessons, such as improving education and having a spirit of 'we do it together'.

5.5.1. Future research and limitations

We advocate the inclusion of multiple sociocultural contexts in future research, as our findings confirm the relatedness of the different levels (Rogoff, 1990). Future research could further study how several contextual levels relate to each other and how their combination link to distributed leadership practices. Diving deeper into the relationship between a collaborative spirit and distributed leadership practices could help schools in achieving more of such collaborative and distributed practices. We were only able to gather data in one country, and we were not able to include the international level. However, according to Liu (2020), this level also plays a role in distributed leadership in schools since countries differ in cultures. In addition, we would recommend that future research should preferably include multiple teams from one school, but we acknowledge this is labour-intensive for respondents to complete the questionnaires and for researchers to perform the social network analyses per teacher team. A limitation is that we worked with an existing dataset, and thus could examine the individual level background characteristics only. We could not include characteristics of individuals such as intrinsic motivations (Hirschler, 2013; Windmuller, 2012) and the engagement of teachers with their schools (Schaufeli, 2013). Based on our findings, we would expect these to be linked to distributed leadership practices, and therefore recommend that future studies include these. Another limitation is that because of a limited dataset in various distributions of men and women and educational sector (especially secondary education), we held back from drawing conclusions. Still, our study reveals interesting insights into the links between sociocultural context characteristics and distributed leadership practices. Lastly, since three teacher teams of the same vocational education organization were included, the scores on school level, thus school principals' leadership and the school culture variable, weigh more. However, the links we found between the contextual characteristics and distributed leadership practices remain the same if we would ignore the three teams. An option would have been not to include two of the three teams but then we would have had less variation in our sample on the team and individual level.

5.5.2. Implications for educational practice

Our study aimed to identify aspects of the sociocultural context on individual, team, and school level that are critical in constituting distributed leadership practices in teacher teams. Based on our findings, we see several implications for educational practice. First, the results of our study encourage teachers to collaborate (more), talk about improving education, dare to ask preferably all other team members for advice, and believe in the strength of team members' expertise. Second, higher distributed leadership is found in teacher teams where school principals enact leadership practices to promote improving education becoming a joint process. This insight into which role to take is relevant for school principals who want to distribute leadership and build a collaborative spirit within their teacher teams. Being aware of the influence you have on others and processes such as mutual influence with teams, helps in breaking down attitudes and practices that are not suitable for distributing leadership. Finally, teacher educators have a key role in teaching teachers to exert a productive role regarding distributing leadership practices within their team. Teacher educators need to train teachers to be able to collaborate and ask advice from and provide advice to others, to believe in their own expertise and the expertise of others, and to have a collaborative spirit. They need to stimulate 'enacted' professionalism by way of which educational professionals try to reshape their work on the basis of an intrinsic motivation to do so. The educational context – schools and teams – should facilitate this.

5.6. Conclusion

Among the available empirical research, most studies treat distributed leadership as an independent variable when investigating its effect on individuals and schools (García Torres, 2019; Harris, 2008; Hulsbos et al., 2016; Tian et al., 2016). We studied how distributed leadership practices are embedded in sociocultural contexts, based on a rich dataset with a mixed-methods design. Our study further develops the argument that studying the sociocultural context of distributed leadership practices with multiple related context levels helps to generate knowledge for the (practical) understanding of distributed leadership practices. In sum, our findings provide insights for academia and practice that show that distributed leadership works well with team members sharing a collaborative spirit to improve education, backed by intrinsic motivations to do so. That's the (collaborative) spirit.

Appendix 5.1 Table with descriptions of themes of advice

Description of Themes of Advice, Ordered Most to Least Mentioned

Themes of Advice	Description and answers	Number of mentions of teams (% of total number of mentions (90))
Organizing improvement of education	On organizing improvement of education. Answers such as: Organizing education, process of improvement, systems of collaborative innovation, how and where to go, collective	14 (15%)
Lessons	On lessons in the classroom. Answers such as: Lessons, teaching, lesson ideas, lesson situations, lesson topics	12 (13%)
Collaboration	On the collaboration of teachers. Answers such as: Team issues, team meetings, communication, atmosphere, colleagues	12 (13%)
Visiting lessons	On visiting lessons of other teachers, which is part of the program. Answers such as: Visiting lessons, providing feedback, asking for feedback on lessons, class visit, observing lessons	11 (12%)
Stand-up meetings	On stand-up meetings, which is part of the program. Answers such as: Goals, set goals, design of the white board, actions following goals	11 (12%)
Students and classes	On student and classes, and questions that teachers have about this. Answers such as: Student affairs, student participation, supervising students and classes	11 (12%)
Designing lessons	On designing lessons, which is part of the program. Answers such as: Lesson designs, plans, application of lesson methods	9 (10%)
Role as coach-teacher	On the role that some teachers have (the internal coach-teacher). Answers such as: Development, questions about the role	6 (7%)
Policy and vision	On policy issues and school vision. Answers such as: School developments, policy development, specific policies such as reading, vision	4 (4%)

Note. All teacher teams mentioned four or more themes.

Appendix 5.2 Table on school principals' (SP) and teachers' perspective on SP's leadership

The table below is ordered on Teacher perspective scores on school principals' leadership. The results indicate that the perceptions of teachers were in line with the leadership patterns, which are based on the perceptions of school principals. All teams with lower scores on Teacher perspective had a *Facilitator* or *Key player* school principal and teams with higher scores on Teacher perspective mostly had a *Team player* school principal.

Teachers' and School Principals' Perspective on SP's Leadership

Teacher perspective	School principal perspective	Team
2.52	Facilitator	M
2.56	Facilitator	E
2.67	Key player	A
2.80	Facilitator	D
2.80	Facilitator	B
2.89	Key player	F
3.09	Facilitator	J
3.09	Facilitator	K
3.09	Facilitator	L
3.26	Team player	N
3.33	Facilitator	C
3.40	Team player	I
3.46	Team player	G
4.28	Team player	H

Appendix 5.3 Table on reasons to implement the program

Indicators that Describe the Reasons to Implement the Program, Ordered From Most to Least Mentioned

Reasons	Indicators that describe the reasons	Number of mentions of schools (% of total number of mentions (33))
Improving learning culture	Wanting to become a professional organization, learning culture, stimulating collaboration, talks about education instead of issues that are not important	12 (36%)
Improving the quality of education	Wanting to improve education, to renew, a high quality of education for students	10 (30%)
Low educational quality	Wanting, and in need of, tools to improve and achieve basis level, an urgent situation that needs to change, excessively low judgement of educational inspection	5 (15%)
Working more efficiently	Wanting to optimise the work processes of teachers, less lengthy meetings, no waste of time	3 (9%)
New school start	Wanting to have a smooth merger of two schools, and a tool for starting a new school	2 (6%)
Improving data-informed ways of working	Wanting to gather more data, working in a data-informed way, recognizing the usefulness of using data	1 (3%)

Note. Schools were allowed to mention more than one reason.

Questionnaire completed via email by external advisors about reasons of schools to implement the program

Please let us know why each school that you train started to implement the program.

School name	Reason to implement 1. Improving the learning culture 2. Improving the quality of education 3. Improving data-informed ways of working 4. New school start 5. Working more efficiently 6. Low educational quality 7. Other ... (explain)

The Reasons did not indicate a link with distributed leadership practices, as they are either described by all teams or solely by one to three teams across the range of distributed leadership.

Reasons to Implement the Program Linked to Distributed Leadership Practices

Distributed leadership: Teams ranging from high to low	Working more efficiently	Improving the learning culture	Improving the quality of education	Improving data-informed ways of working	New school start
L		x			
H	x	x		x	
N		x			
I		x			
K		x			
G		x			
B		x	x		
F		x			x
D		x	x		
M	x	x	x		x
J		x			
E		x			
C	x	x	x		
A		x	x		

Appendix 5.4 Descriptives of advice-seeking

The networks of Advice-seeking were moderately to highly dense (41 to 86%), see the table below. Regarding reciprocity, the teacher teams scored moderately to high (42 to 86%). Regarding network indegree centralisation, the teacher teams scored low to medium.

Descriptive Network Statistics per Teacher team on Advice-seeking, ordered From High to Low Distributed Leadership

Team	Advice-Seeking		
	Density	Reci.	Centr.
L	0.857	0.810	0.122
H	0.800	0.861	0.099
N	0.833	0.800	0.200
I	0.764	0.800	0.125
K	0.857	0.762	0.122
G	0.611	0.618	0.110
B	0.718	0.589	0.166
F	0.678	0.659	0.214
D	0.636	0.659	0.207
M	0.686	0.417	0.163
J	0.551	0.593	0.265
E	0.521	0.444	0.273
C	0.464	0.588	0.273
A	0.405	0.456	0.289

Note. Reci is reciprocity, Centr. is indegree centrality. The standard deviations of density were between .2 and .4 in all teams. The scores on density, reciprocity, and indegree centrality for advice-seeking were used to determine the degree of distributed leadership of each teacher team. Teacher teams are relatively ordered, compared to each other, from higher to lower degrees of distributed leadership.

6

Conclusion, Contributions, and Suggestions

6.1. Conclusion

6.1.1. Introduction to the conclusion

Innovations in schools often do not turn out as intended. One important reason is that the vast majority of teachers and school principals are not involved, or do not feel to be involved, when decisions are made on the content and implementation of (nation-wide) innovations. The number of collaborative forms of jointly led innovation, however, is increasing. These forms of innovation require changes in teachers' and school principals' professionalism. The schools that we studied chose to use the leerKRACHT program to work on education in more collaborative ways. This program is aimed at stimulating so-called 'collaborative innovation'. Collaborative innovation is characterized by a multi-actor approach to innovation, with both vertical and horizontal working relations. In this dissertation, horizontal relations refer to working relations between teachers. Vertical relations pertain to working relations between teachers and school principals. These relations need to be led. Based on theoretical studies, leading collaborative innovation is considered to be distributed. Distributed leadership means that multiple team members can be considered leading. However, it is yet unclear how leading collaborative innovation actually happens in schools, and what this means for leadership practices of both teachers and school principals in day-to-day working contexts. The aim of this dissertation is to understand better how collaborative innovation is actually led by school principals and teachers.

We used key concepts that helped us study how collaborative innovation is led, derived from different bodies of knowledge: changing professionalism, collaborative innovation, leadership, networks, and sociocultural contexts. By bringing these bodies of knowledge together, we have tried to develop a more overarching perspective on leading collaborative innovation in schools. Here multiple levels of analysis (individuals, teams, schools) and multiple factors (organizational, cultural, educational) are interwoven. We studied the following main research question:

How do school principals and teachers lead collaborative innovation in schools?

In order to answer this research question, we conducted four related studies, each with a specific sub-question:

1. *How do horizontal and vertical working relations in school affect collaborative innovation practices?*
2. *How do school principals enact leadership practices in leading collaborative innovation?*

3. *How can distributed leadership in school teams be described and measured by applying a social network perspective?*
4. *How can differences in distributed leadership between collaborative innovation-oriented teacher teams be understood from multiple sociocultural context levels?*

We continue this conclusion section with an overview of these four studies. Each of these empirical studies contributes to answer the main research question. In the next section, we discuss the contributions of this dissertation to (distributed) leadership theory and the notion of collaborative innovation in schools. Methodological considerations of the studies are brought forward. In the final section, suggestions for future research and practice are presented. We close this chapter with a final remark on the merits of this dissertation.

6.1.2. Overview of the empirical studies

6.1.2.1. Leadership by school principals and teachers in collaborative innovation

Chapter 2 presents our investigation of both horizontal and vertical working relations in relation to collaborative innovation. We addressed the research question: *How do horizontal and vertical working relations in school affect collaborative innovation practices?* Using a mixed-methods design, multilevel analyses were applied to questionnaire data gathered among teachers of 157 schools and qualitative analyses of interview data from interviews with teachers of 20 schools. With regard to horizontal working relations, teachers indicated the importance of wanting to work together (Collaborative mindset) and learn from each other (Learning attitude) in a safe environment (Safety) for collaborative innovation. Furthermore, regarding vertical working relations, teachers mentioned the important role of coach-teachers (Stimulator) and school principals (Leader) and that school principals need to share responsibilities with teachers (Sharing responsibilities). Based on a multilevel analysis of what affects collaborative innovation, we found that school principals who stimulated teachers to improve education collaboratively and were involved in the collaborative process themselves enhanced collaborative innovation practices. Lastly, we found that teachers experience that both school principals and coach-teachers need to be actively involved to enhance collaborative innovation practices. At the same time, we indicated that teachers and school principals involved in horizontal and vertical working relations do not necessarily nor simply result in collaborative innovation. We studied school principals' leadership in collaborative innovation in Chapters 3 and 5 and (coach-) teachers in Chapter 4.

6.1.2.2. School principals' leadership in collaborative innovation

Chapter 3 describes our study on how school principals lead collaborative innovation. We addressed the research question: *How do school principals enact leadership practices in leading collaborative innovation?* Twenty-two school principals were interviewed twice. Transcripts were coded for leadership practices. The results indicated 11 leadership practices: Bottom-up, Involvement, Facilitation, Top-down, Motivation, Vision focus, Progress, Role model, Student focus, Transparency, and Connect. The school principals enacted these 11 practices in different ways, wherein we identified three leadership patterns: *Team player, Key player, Facilitator*. *Team player* school principals promote innovation for the joint process of teachers and school principals (often mentioning leadership practices such as Transparency and Involvement). *Key player* school principals see innovation as a collaborative process that is directed by school principals (Involvement and Top down). *Facilitator* school principals leave the collaborative innovation process to the teachers and exert control from a distance (Top down and Progress). We studied how these leadership patterns link to distributed leadership in Chapter 5.

6.1.2.3. Describing and measuring distributed leadership

Chapter 4 addressed the research question: *How can distributed leadership in school teams be described and measured by applying a social network perspective?* We used a social network perspective since this perspective focuses on interactions between people. This is useful to study distributed leadership, as leadership practices are the result of interactions (Azorín et al., 2020; Freeman, 2004; Liou & Daly, 2020; Wasserman & Faust, 1994). A social network questionnaire was completed by 14 school teams. Based on a literature search, we described distributed leadership with three core aspects: *Collective*, *Dynamic*, and *Relational*. *Collective* means that leadership is a fluid co-performance process executed by multiple team members. *Dynamic* means that leadership can be claimed by those with the required expertise for the challenge at hand. *Relational* means that leadership revolves less around personal leadership acts and more around interactions. We found a coherent combination of three social network measures (density, reciprocity, and indegree centralization) that measure the three core aspects. Applying these measures showed differences in higher and lower degrees of distributed leadership between school teams. Teams with higher distributed leadership included teachers who had many relationships with their colleagues, and who sought advice from each other (measure of distributed leadership). Teams with lower distributed leadership included teachers with fewer relationships with their colleagues. In these

teams, there were teachers with a more central role than others and thus their network had an uneven distribution of leadership. Teachers with a more central role were more often asked for advice and thus performed a leadership role. Irrespective of the degree of distributed leadership, teachers were most often central members in the networks, followed by coach-teachers. We studied how degrees of distributed leadership related to school teams' sociocultural context in Chapter 5.

6.1.2.4. Sociocultural contexts of distributed leadership: Collaborative spirit

In Chapter 5 we addressed the research question: *How can differences in distributed leadership between collaborative innovation-oriented teacher teams be understood from multiple sociocultural context levels?* We studied the sociocultural contexts of these teacher teams, with lower and higher degrees of distributed leadership as found in Chapter 4. Questionnaires and interviews were conducted in 14 teacher teams. We found that teams with higher degrees of distributed leadership have school principals with a *Team player* leadership pattern (Chapter 3), experience no threshold when it comes to asking advice of another, have an intrinsic motivation for collaborative innovation, and have conversations about improving education beyond the scope of their own classroom. We described these teams with higher degrees of distributed leadership as having a stronger *collaborative spirit* to improve education compared to school teams with lower degrees of distributed leadership. Lastly, we did not find a link between the degree of distributed leadership and teaching experience, personal contact, team size and team gender composition, intensity of working together on lesson practice, and educational sector.

6.1.3. Answering the main research question

Based on the four empirical studies, we discern three overarching themes. By addressing these themes below, we start answering our main research question: *How do school principals and teachers lead collaborative innovation in schools?*

6.1.3.1. School principals' role in leading collaborative innovation

Firstly, we found that school principals search for a balance in *steering* frameworks and providing professional *space* to teachers. In interviews, they mentioned that starting to work with leerKRACHT created a new situation in which they had to search for their role again (Chapter 3). This search resulted in various patterns of school principals' leadership: how school principals enact leadership practices differs. We identified three

leadership patterns: *Team player*, *Key player*, and *Facilitator* (Chapter 3). We described these three patterns by addressing how school principals position themselves within the horizontal and vertical working relations (Chapters 2 and 3). *Team player* school principals provide professional space to teachers. Teachers can come up with ideas and take a leadership role (horizontal). They are committed to develop the school vision in collaboration with teachers and consider collaborative innovation a shared responsibility (vertical). Both *Facilitator* and *Key player* school principals steer strongly on boundaries (vertical). The *Facilitator* is at a distance from the horizontal process, is not involved nor up to date, and states that the coach-teacher is responsible for the process. The *Key player* is too involved in the horizontal process and leaves less space to teachers (Chapters 2 and 3).

Based on a multilevel analysis of what affects collaborative innovation, we found that school principals who stimulated teachers to improve education collaboratively and were involved themselves enhanced collaborative innovation. We classified these leadership practices as *Team player* practices. Moreover, we found that *Team players* have teacher teams with higher degrees of distributed leadership than *Key players* and *Facilitators* (Chapters 3 and 5). Taken together, we could say that school principals need to ensure that something happens, without doing it all themselves when they lead collaborative innovation.

6.1.3.2. Leading collaborative innovation with distributed leadership practices

Secondly, both teachers and school principals noted aspects of distributed leadership when talking about how to lead collaborative innovation. Teachers mentioned that teachers in horizontal working relations need to have a collaborative mindset and an attitude to lead together. Furthermore, they mentioned that teachers and school principals in vertical working relations need to share responsibilities and leadership in interaction (Chapter 2). With respect to school principals, *Team players* addressed that leading a collaborative innovation is a process involving all team members. These school principals interact with teachers to lead collaborative innovation (Chapter 3). Thus, leading collaborative innovation is experienced as a *process* of distributing leadership practices in interaction between principals and teachers (Chapters 2 and 3).

Based on a literature search, we defined distributed leadership as a *collective*, *dynamic*, and *relational* process (Chapter 4). Not all school teams have the same collective, dynamic, and relational process. Consequently, teams differed in their degree of distributed leadership in collaborative innovation (Chapter 4). However, we also found a similarity: almost all teams had more than one central member (Chapter 4).

Teachers were most often central members in a network. Being a central member meant that they influenced others' knowledge and skills by providing advice to others about collaborative innovation practices. They thus performed a leadership role. In addition to teachers, coach-teachers were often central members. Coach-teachers are teachers that help their colleagues to practice collaborative innovation with the four leerKRACHT tools. Teachers experienced that coach-teachers were needed to prepare and provide structure in collaboration sessions and stimulate teachers to collaborate (in the horizontal working relation). Furthermore, they were needed to address school principals on their role in collaborative innovation and connect teachers and school principals (vertical relation) (Chapter 2).

6.1.3.3. Collaborative spirit in leading collaborative innovation

Thirdly, we found that a *collaborative spirit* supports leading collaborative innovation with distributed leadership. School teams with higher degrees of distributed leadership had a stronger collaborative spirit to improve education together compared to school teams with lower degrees of distributed leadership (Chapter 5).

This collaborative spirit has a few key elements. Firstly, it is a matter of *interactions* between team members unrelated to formal or perceived leadership roles. This element is based on the following findings. On the one hand, school teams with higher degrees of distributed leadership had *Team player* school principals. These school principals interacted with their teachers – for instance, developing the school vision together. Moreover, they provided professional space to teachers so that teachers can interact with each other and take leadership roles. On the other hand, we found that perceiving someone as a leader did not matter when asking someone for advice, and thus interacting, in school teams with higher distributed leadership. These team members ask for advice about collaborative innovation, irrespective of formal leadership roles. Perceiving someone as a leader did matter when asking advice in teams with lower distributed leadership.

Secondly, the collaborative spirit relates to *intrinsic motivation*. Members of school teams with higher distributed leadership differed from members of school teams with lower distributed leadership in their motivation to improve education. Teams with higher distributed leadership were highly motivated to improve their education and their school culture further. They were not driven by an extrinsic motivation, such as the urgency to improve a low educational quality. Teams with lower distributed leadership were mainly motivated to achieve sufficient educational quality. These teams had received a negative judgment of their educational quality by the Dutch Inspectorate of Education.

Thirdly, the collaborative spirit implies *conversations on improving education* in school teams. Members of school teams with higher distributed leadership talk together about schoolwide improvements to education, such as improvements in educational standards and collaboration activities such as reflection and feedback. They thus have conversations about improving education that go beyond their own classrooms. Members of school teams with lower distributed leadership talk less about topics that go beyond their own classroom, tending to focus on their own students and classes.

In sum, the collaborative spirit is visible in teams in which 1) team members go beyond formal roles or perceived leaders when they interact; 2) team members are intrinsically motivated; and 3) team members jointly discuss and try schoolwide improvements to education. These elements of the collaborative spirit of a school team respectively refer to *how* innovation happens, *why*, and *what* innovations could or should happen.

6.1.3.4. To conclude

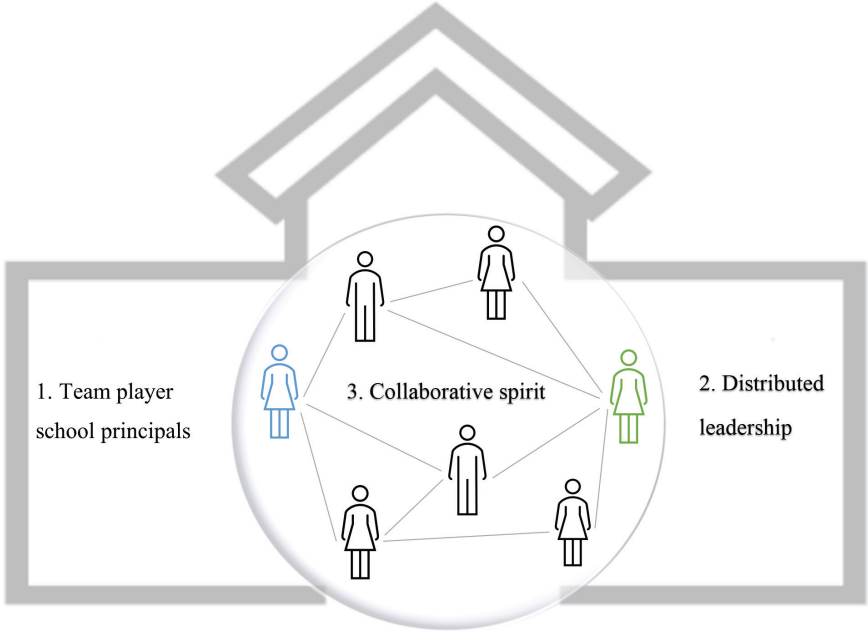
Our main research question was: *How do school principals and teachers lead collaborative innovation in schools?* This dissertation shows that leading collaborative innovation processes in schools occurs in a variety of ways, with varying degrees of involvement of school principals and teachers. We call the dimension underlying these differences *collaborative spirit*. Teams with high levels of collaborative spirit, interact with each other unrelated to formal roles or perceived leaders, are intrinsically motivated, and jointly discuss and try schoolwide improvements to education. Such a collaborative spirit supports teachers' and school principals' *distributed leadership practices* in leading collaborative innovation. Leading collaborative innovation is thus distributed and balanced in steering and securing space. This means that collaborative innovation should not be led only by school principals nor only by teachers. Both are needed in jointly led collaborative innovation, which goes beyond a culture of individualism.

For school principals, this means that as *Team Players,* they balance steering on frameworks *and* providing professional space to teachers. They position themselves as part of the team in order to innovate education collaboratively. Within the teams, teachers can enact leadership practices in collaborative innovation by providing advice to others. Coach-teachers can enact leadership practices by structuring collaboration sessions and stimulating both teachers and school principals to collaborate on education.

In Figure 6.1, we return to Figure 1.3 (Chapter 1) and summarize our findings on how school principals and teachers lead collaborative innovation.

Figure 6.1

Summary of the Three Overarching Themes of This Dissertation



Note. Blue person is a school principal, green is a coach-teacher.

6.2. Contributions to scholarly literature

In this section, we discuss the contributions to the scientific literature of the three overarching themes. In addition, methodological considerations are highlighted.

6.2.1. School principals' roles in leading collaborative innovation

School principals search for a balance between steering on frameworks *and* providing professional space to teachers. Ros and Van Rossum (2019) found the same among school principals in the context of distributed leadership. The authors compared ten portraits of school principals, concluding that school principals constantly consider when they can trust leadership to professionals and when they themselves need to steer. Trust thus seems an important aspect affecting how school principals balance steering and providing professional space. Even though trust was not an explicit element among *Team players* or *Facilitators* in our studies, we did find a lack of trust in the *Key player* pattern. *Key players* do not yet trust that teachers are able to and will practice collaborative innovation

without vertical steering. Our findings confirm that trust can affect how school principals find a balance between steering and providing professional space.

In terms of how school principals find this balance, we described three leadership patterns. We found only two studies in other contexts that described leadership patterns of formal leaders. To the best of our knowledge, Torfing (2016) is the only one who has identified leadership patterns in the specific context of collaborative innovation. His patterns were theoretically derived and based on civil society organizations rather than schools. He presented three patterns: *Conveners* who spur interaction, *Facilitators* who promote collaboration, and *Catalysts* who prompt actors to think out of the box. While we both use the label Facilitator, our descriptions differ. Whereas Torfing described Facilitators as leaders who constructively manage differences between actors and are involved in processes of mutual learning, *Facilitators* in our studies were not involved in the collaborative innovation processes and only facilitated the innovation from the side – for instance, in providing time to collaborate. Interestingly, in our interpretation, all three of Torfing's patterns would be part of our *Team player* pattern. Torfing's patterns can thus be seen as a further specification of our *Team Players*. He addresses all patterns as being beneficial for collaborative innovation but does not explain whether leaders can enact all three patterns or only one. We see our other two patterns, *Key players* and *Facilitators*, as extending the range of Torfing's patterns. We found that some principals relate too much to the collaborative innovation process and to teachers. These *Key player*s do not yet trust their teachers to lead collaborative innovation. They do not dare to provide the teachers with professional space and choose to steer strongly. Other school principals relate too little to the collaborative innovation process and to teachers too less. These *Facilitator*s minimize their involvement in collaborative innovation and with teachers. They mainly delegate their participation to coach-teachers. The fact that we found an extension of Torfing's patterns might be a result of our research design. Instead of describing what is desirable to enhance collaborative innovation, we studied and described leadership in daily practice.

The second study of leadership patterns was found in the context of collaborative teacher learning (Van Schaik et al., 2020). Van Schaik et al. identified that school principals enacted one of the following four leadership patterns: *Integrators*, *Facilitators*, *Managers of teacher learning*, or *Managers of daily school practice*. We and Van Schaik et al. both use the label *Facilitator*. They described *Facilitators*, and the patterns of *Managers of learning* and *Managers of daily school practice* as school principals who mainly direct initiatives by formally recognized leaders, and their participation and involvement with teachers is limited. Our *Facilitator* pattern confirms these three patterns, since we also found school principals who delegate their participation to coach-teachers and minimize

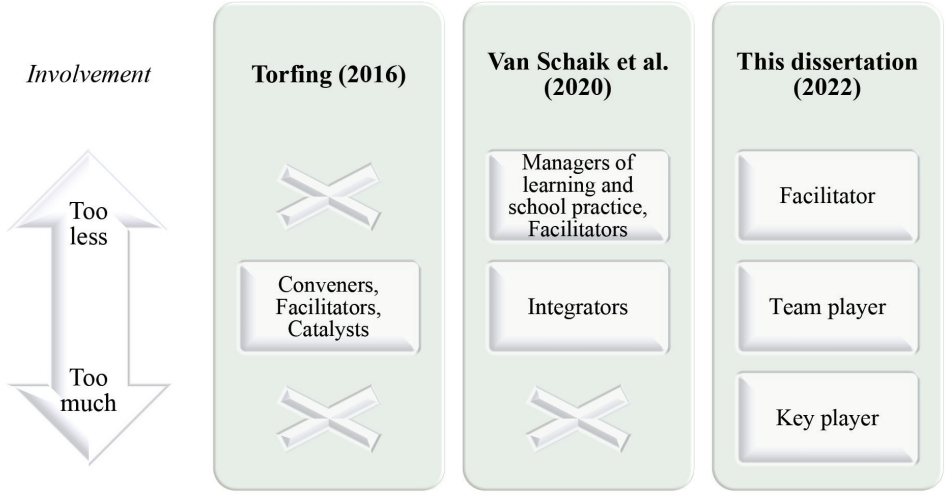
their involvement. Moreover, Van Schaik et al. describe their *Integrators* as we describe our *Team player*s: School principals who are involved in school processes and with teachers. Whereas Van Schaik et al.'s study was descriptive, we show that the *Team player* leadership pattern is preferable over our other two leadership patterns (*Key player* and *Facilitator*) for collaborative innovation. Since Van Schaik et al.'s *Integrators* seem comparable, we would also expect the *Integrators* to have a positive impact and the other patterns not to.

Another contribution of our leadership patterns is that we expand the range of Van Schaik et al. with the *Key player* pattern. School principals can choose to be too involved in collaborative innovation and leave less professional space to teachers. The fact that we found school principals who are too involved might be a result of the starting point of the school-wide leerKRACHT program. It gives rise to a new situation in which school principals search for a leadership balance.

In Figure 6.2, we summarize how our leadership patterns broaden the range of how school principals choose to lead innovation processes. We feel that insights into how school principals can be too involved in collaborative innovation processes enrich current literature (*Key player*). Furthermore, our conclusion that *Team players* enhance collaborative innovation and have teams with higher degrees of distributed leadership deepens our understanding of leadership and its impact. Our findings therefore contribute to Leithwood et al.'s (2020) call for more in-depth analysis of *how* school principals enact leadership practices to deepen our understanding of leadership and its impact.

Figure 6.2

Comparison of Leadership Patterns of School Principals or other Formal Leaders



6.2.2. Leading collaborative innovation with distributed leadership practices

Both teachers and school principals experience that they lead collaborative innovation together, although this differs from school to school – we found different degrees of distributed leadership in schools. Studying leadership in networks helped us to gain insights into the roles of teachers and school principals in leading collaborative innovation. The role of school principals was discussed in the previous section. Consequently, we discuss here the role of teachers in leading collaborative innovation.

Both regular teachers and coach-teachers – teachers with a formal leadership role in the program aimed at collaborative innovation – can play a central role in leading collaborative innovation. Teachers experienced that coach-teachers are needed to prepare and provide structure in collaboration sessions and to connect teachers and school principals in collaborative innovation. These coach-teachers are close to teacher leaders (e.g., Schott et al., 2020; Struyve et al., 2018). Teacher leaders have become a topic of interest in international educational research and policy. They can be either formal or informal leaders and situated at the school-level or grade-level (Struyve et al., 2018). They help translate "principles of school improvement into the practices of individual classrooms" (Day & Harris, 2003, p. 973). The leadership practices of coach-teachers that we found can be related to the findings of a large interview study on teacher-led school improvement (Nguyen & Hunter, 2018) that also found that teacher leaders prepared sessions and played a connecting role between teachers and school principals. Furthermore, Nguyen and Hunter (2018) found that tensions arose between teachers and teacher leaders when teachers transitioned into teacher leadership roles. The first source of tension was that teacher leaders felt they had to avoid conflict and maintain trust and good social ties with their colleagues for teacher acceptance. The second tension concerned the perception that teacher leaders were losing part of their identity as teachers and becoming somewhat like administrators. Although we did not systematically study this, in our interviews some coach-teachers told they also experience tensions. These coach-teachers mentioned, for instance, that they find it difficult to guide and direct their colleagues. They do not want to confront colleagues but they sometimes had to. For instance when teachers were not attending meetings. This tension indicates that leading collaborative innovation together is *not* a matter simply of combining horizontal and vertical working relations. We would suggest further study on how the tensions between teachers and coach-teachers and between coach-teachers and school principals can be reduced.

6.2.3. Collaborative spirit in leading collaborative innovation

A collaborative spirit supports team members to distribute leadership in collaborative innovation. We see a collaborative spirit in teams that show three specific elements: Team

members who *interact* with other members unrelated to formal roles or perceived leaders with an *intrinsic motivation* to discuss and try *schoolwide improvements to education jointly*. To understand this spirit better, we discuss how these three elements are related to the literature.

The first element is *interaction* between team members, unrelated to formal leadership roles or perceived leaders. The element of interaction can be related to what Stoll (2020) referred to as co-creation. Based on previous research on capacities for learning, Stoll proposed an agenda for change in which she addressed policy makers, practitioners, and researchers. In this agenda, she highlighted the necessity for a collaborative process of learning and leading in schools, proposing that "creating capacity for learning won't be 'your responsibility' or 'my responsibility' but will be located at all levels of the system and community, involving people in genuine collaboration" (Stoll, 2020, p. 426). Based on her focus on the school as a system and its community, we highlight the relevance of interactions within and between horizontal and vertical working relations.

The second element is an *intrinsic motivation* rather than an extrinsic motivation to improve education. This is in line with the self-determination theory (SDT), which argues that intrinsic motivation leads to more positive outcomes than extrinsic motivation (e.g., Deci & Ryan, 2012; Ryan & Deci, 2000). We endorse the findings of previous research that identified a positive impact of teachers' intrinsic motivation on their innovative behavior at work (Klaeijssen et al., 2018; Pyhältö et al., 2012; Thurlings et al., 2015). These previous studies describe innovative behavior as the extent to which teachers develop and implement new ideas. We studied a specific type of innovative behavior since we focused on the collaborative innovative behavior of teams. We found a positive association between intrinsic motivation and distributed leadership practices.

More specifically, SDT posits that the fulfilment of three basic psychological needs is conditional for intrinsic motivation – i.e., the need for *competence*, *autonomy*, and *relatedness* (e.g., Deci & Ryan, 2012; Klaeijssen et al., 2018). This dissertation has found that within schools with a collaborative spirit and a higher degree of distributed leadership, these three needs are met. Regarding the need for *competence*, teachers within these schools are stimulated to take on a leadership role based on their expertise and competence. The teachers also grant leadership to others who have relevant expertise for the task at hand. Regarding the need for *autonomy*, teachers seem to experience professional space. They look beyond their own classroom, talk about improving education with their colleagues, and have a school principal who provides this space and involves them in developing the school's vision. Regarding the need for *relatedness*, teachers and school principals interact with each other and are connected by asking and providing advice. Relating the element of motivation of teams to SDT helps to (theoretically) position the collaborative spirit better. The three needs, originally intended to describe *individual* motivation, thus also help to

examine *team* motivation. Fullan (2008, 2016) highlights the relevance of teams in terms such as collective, joint, or shared processes – for instance, in shared ownership, shared responsibility, and teacher agency. He states that shared processes have the advantage of remaining even if one or several persons leave the team or school. Concerning the collaborative spirit, if multiple persons share the intrinsic motivation to improve education together, the spirit is independent of one or two persons leaving.

The third element points to the *joint conversations* of teachers and school principals *about schoolwide improvements*. Teachers who contribute to a collaborative spirit go beyond a focus on their own classroom and enter into conversations about how to organize schoolwide improvements. Our finding of such teachers' behavior confirms the importance of what Hoyle (1975) and Windmuller (2012) called *extended professionals*, i.e., teachers who are involved in professional activities outside the classroom, and who collaboratively improve education, evaluate (their own) education, and ask for advice. We also found teachers who focus more on their own classroom. These are the *restricted professionals* identified by Hoyle (1975) and Windmuller (2012), i.e., teachers who act autonomously and are especially concerned with the effectiveness of their own class, subject content, and didactics. This focus on professionals and how professionalism changes is also discussed in organizational literature, including many public and non-profit domains (e.g., Martin, 2021; Noordegraaf, 2020; Stone & Travis, 2011). The authors emphasize the strength of extended professionals as they argue that professionals can no longer isolate themselves but need to become *connected* with colleagues (Noordegraaf, 2007, 2011, 2015, 2020; Wu et al., 2017). This dissertation provides examples of how professionalism in public/societal services, such as schools, changes. Teachers and school principals can become more connected by starting conversations on schoolwide improvements. We confirm the strength of more connectedness between colleagues. Teachers who were more connected also distributed leadership more in collaborative innovation.

6.2.4. Methodological considerations

There are a number of methodological considerations of this dissertation that should be noted.

6.2.4.1. Limitations and strengths of a large evaluation study

This dissertation uses data gathered in a research project that was funded by the Netherlands Initiative for Education Research (NRO). A precondition was to use existing Foundation leerKRACHT questionnaires. We used two of these in this dissertation. Although we optimized the validity and reliability of the two questionnaires, we were not able to study data on every relevant level, such as individual, team, and school. Identification numbers

were not included in the Foundation leerKRACHT datasets. Furthermore, not every concept that would have been relevant to study leadership in collaborative innovation, such as asking teachers more specifically about their leadership practices, was included in the questionnaires. To compensate for possible biases, we used additional data gathering instruments such as semi-structured interviews with school principals and teachers and a social network questionnaire, which provided the opportunity for new topics to emerge.

A strength of using data from a larger research project is that schools were not additionally burdened with data gathering. Another strength is that all schools worked with the same program, making it easier to compare schools. On the other hand, it might be that particular kinds of school decided to work with the program and that we have a slight sample bias. However, we found that the schools were representative of Dutch schools in terms of urbanity, denomination, and school size (De Jong et al., 2021). A question that arises for follow-up research is whether our findings apply in schools using collaborative innovation-oriented programs other than the specific program studied here.

6.2.4.2. Self-reports

In most of the studies, only self-reported data were used, which may be sensitive to response tendencies and social desirability: these included a questionnaire on horizontal and vertical working relations (Chapters 2 and 5), a questionnaire on collaborative innovation (Chapter 2), interviews with teachers (Chapter 2), and interviews with school principals (Chapter 3). However, we used a mixed-methods design in Chapters 2 and 5 in which we combined questionnaire and interview data, enhancing the reliability of the results. In Chapter 4, we used social network data, being data about other team members, in Chapter 5, we triangulated school principals' self-reports with data from teachers: this confirmed the self-reports.

6.2.4.3. Sample sizes of individual studies

The sample sizes used in our studies differ. Chapter 2 has a large sample size with regard to the questionnaires. However, we also selected a smaller number of extreme case studies to study further the links between working relations and collaborative innovation. The strength of selecting case studies is that it increases the reliability of the analyses (Seawright, 2016). Chapter 4 has a sufficient sample size, since the unit of analysis in social network research is relationships rather than the number of participants. Chapters 3 and 5 are based on smaller samples sizes of 22 schools (Chapter 3) and 14 school teams (Chapter 5). However, our aim was to understand leadership processes within schools and to compare schools and relate them to several contextual characteristics. With a smaller sample size but rich datasets, we were able to study these relationships thoroughly.

6.3. Suggestions

Based on the findings of this dissertation, various suggestions can be made for future research and for schools.

6.3.1. Suggestions for future research

Firstly, we suggest future research on collaborative innovation in schools to broaden the scope of horizontal and vertical working relations. This might help to understand even better how to enhance collaborative innovation. Regarding horizontal relations, we suggest studying how school principals from various schools can innovate their educational and leadership practices collaboratively. Horizontal relations between school principals are rarely studied, as mentioned by Honig and Rainey (2020), while there is an opportunity for them to learn from each other.

Regarding broadening analyses of vertical working relations, we suggest including school board members (district leaders in US research). While they are part of the education system, their roles in relation to school principals are rarely studied (e.g., Honig & Rainey, 2020; Hooge & Honingh, 2014; Hooge et al., 2019). Honig and Rainey (2020) argue that school board members' roles are changing in managing operational matters to helping school principals become more effective leaders. In the Netherlands, we see this changing role in the latest development of the new Inspectorate of Education examination framework. The inspectorate encourages school board members to be more involved in their schools' quality (de Graaff, 2022; Inspectie van het onderwijs, 2022). Future research could delve into how school board members can support school principals and their professional development.

Secondly, our studies were quite explorative and provided insights into the leadership practices of school principals and teachers and the relevance of a collaborative spirit. The collaborative spirit seems especially promising for leading collaborative innovation in schools with distributed leadership. However, future research is needed to examine further how a collaborative spirit arises or is created in school teams and how it develops over time. We interpreted a collaborative spirit within teams based on several sources of data. We suggest that future research interviews teachers and school principals about the team spirit and how they would describe it. Furthermore, future research could study schools that do not work with leerKRACHT or other public/societal organizations to examine which elements of the collaborative spirit are found and how these elements relate to each other.

Thirdly, we found that coach-teachers lead collaborative innovation by, for instance, structuring meetings and motivating teachers to collaborate. Future research could study the concrete ways in which these roles are performed and how they might change over time. We expect that roles are subject to change when leerKRACHT becomes more programmed in schools' culture. Furthermore, the tensions that seem to arise between

coach-teachers and teachers and between coach-teachers and school principals deserves attention. Since the coach-teacher role seems comparable with teacher leaders, these insights are relevant for teacher leadership literature. In addition, the role of school principals in collaborative innovation deserves further attention. For instance, we found that safety within school teams increases the influence of school principals' leadership in collaborative innovation, but how this works exactly is not yet clear from our studies.

6.3.2. Practical suggestions for schools

6.3.2.1. School principals and their professional development programs

Firstly, school principals must be aware of their important roles in stimulating both collaborative innovation and distributed leadership. They have to search for the right balance in their degree of steering and providing professional space, matching the phases of development of their school team. When school principals read the descriptions of the three leadership patterns that we found, they can reflect on them and talk about them with their teachers or colleague school principals. Questions to ask themselves (or other school principals and teachers) might be: *Do I recognize one of the patterns? Is this how I want to fulfil my leadership role? What do teachers say about my role?*

Secondly, we recommend that school principals enhance the collaborative spirit within schools. They can do so by showing that they view collaborative innovation as a *joint* process and behaving as a *team* member. They can choose to be present at meetings, to show their commitment and the importance of the meetings. Furthermore, they can ask teachers about innovations' progress to be up to date, share their insights and ideas, and develop vision plans with teachers collaboratively. School principals can also talk transparently with teachers about their role and teachers' role in leading collaborative innovation to improve their working relations. During the interviews with teachers and school principals, we noted that these talks rarely take place, while both teachers and school principals mentioned silent expectations. Teachers told us things like: "The school principal never asks anything and doesn't hold anyone accountable". Their school principal said: "It all goes well because if they want something they will come, and they don't come to me". Especially in the context of retention of teachers, it seems important to distribute responsibility, utilize everyone's expertise, and talk transparently about expectations and roles to design an attractive work environment.

Conversations between school board members and school principals about leadership roles and responsibilities might also be relevant. We recommend that school board members reflect on how they relate to their school principals. We advise school board members to start a conversation with their school principals on how they can help each other practice collaborative innovation in their schools.

Thirdly, it is noticeable in our research that school principals are searching for their roles, one suitable for collaborative innovation within their school. They search for a balance between steering and providing professional space to teachers. Professional development programs for school principals can play a role by preparing them to search for their role, talking about situations from their own school practice and how they can enact leadership practices as *Team players*. The three leadership patterns and the eleven leadership practices can also be used for reflection during professional development programs. Practicing collaborative innovation provides a new situation within the school. It challenges school principals to reflect on their leadership role. Paying attention to this is relevant for both new and more experienced school principals.

6.3.2.2. Teachers and their professional development programs

Firstly, teachers have a responsibility for collaborative innovation, with and without a defined role as coach-teacher. When professional space is provided, teachers are asked to assume their responsibility with a collaborative mindset. Our suggestion for doing so would be to start by realizing the potential of each team member and daring to grant them leadership roles. The four tools of leerKRACHT can help teachers and school principals to structure collaboration and to practice distributed leadership. We advise teachers to talk intentionally about education and minimize wandering off topic by addressing each other when it happens. Many teachers, to illustrate, mentioned they easily discuss the color of the school fence instead of educational quality.

Another suggestion is to let teachers reflect on their own roles in the school and their expertise, and to talk about these with colleagues. Researchers could help schools by conducting a social network questionnaire and interpreting the sociograms with teachers and school principals collectively. Interpreting these together could be helpful to start the conversation about who brings which expertise and whether the network has central members. Team members can become more aware of belonging to a network, since social network analysis shows that networks are all about interaction. Since teachers' and school principals' roles and professions are changing, insights into each other's roles and challenges might help to build a collaborative spirit for innovation.

Secondly, teachers' professional development programs can play a role in teaching both teachers that become coach-teachers and regular teachers to take on leadership roles and responsibilities. There are programs for teacher leaders, but our studies highlight that there should be a broader focus on how teacher leaders (coach-teachers) and regular teachers work together. This is all the more important as tensions might arise

between teachers and coach-teachers. To deal with distributing leadership, collaborative innovation, and possible tensions, we suggest professional development programs to help teachers explore their own expertise and that of their colleagues. Furthermore, we advise letting teachers practice building trust in colleagues' decision-making skills. Teachers might learn to let go: they do not need to have a say in everything.

Thirdly, the change to more distributed leadership calls for other roles and behaviors among teachers and school principals. The question arises whether all team members need to be excellent in all aspects or whether rather *team expertise* is called for. Teams can include members with diverse backgrounds and different forms of expertise to be able to enact leadership in varying situations (Bijlsma & Keyser, 2021; Engeström, 2018; Torfing, 2019). Team competencies have received attention for some time in vocational education (Van Vlokhoven & Aalsema, 2021) and recently in primary and secondary education (Ketelaar et al., 2020; Van Tartwijk, 2022). Our findings indicate that it is important to discuss further the relevance of team expertise in schools and policy for leading collaborative innovation.

6.4. Final remarks

History shows that educational innovations, in particular at the national level, are often unsuccessful. One important reason for this is that teachers and school principals are often not asked to be or do not feel to be involved in deciding on the content or implementation of nation-wide innovations. There seems to be little governmental attention to change processes *in* schools, while this dissertation highlights the involvement of teachers and school principals in making innovations happen. We show that teachers and school principals can take joint responsibility in leading collaborative innovation. A collaborative spirit supports this joint process of distributed leadership in collaborative innovation. Such a spirit implies that teachers and school principals go beyond their formal roles or perceptions of leaders when they interact and are intrinsically motivated to discuss and try schoolwide education improvements jointly.

Teachers thus need to be given the professional space to lead beyond their role in the classroom. School principals need to be involved in collaborative innovation processes. They need to provide teachers with professional space *and* steer on the strategy, frameworks, boundaries, and vision. This, in turn, means that policy makers and school board members must realize that educational change takes place *within* schools, within day-to-day contexts, full of interactions and conversations. Thus, balancing between steering on the one hand and providing professional space to school principals and teachers on the other hand is also useful for policy makers and school board members. Leading collaborative innovations *in* schools calls for innovative collaborative leadership practices.

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Samenvatting [Summary in Dutch]

1. Introductie

Innovaties in het onderwijs pakken vaak niet uit zoals ze bedoeld zijn (Boyd, 2021; Den Brok, 2018; Fullan, 2008; Vanlommel, 2021; Verbiest, 2021; Wubbels & Van Tartwijk, 2018). Innovaties kunnen geïnitieerd worden op nationaal niveau en lokaal in scholen en kunnen gaan over inhoudelijke onderwijskundige zaken of meer organisatieprocessen. Het verslag van de parlementaire onderzoekscommissie onder voorzitterschap van Jeroen Dijsselbloem liet zien wat er speelde bij een aantal innovaties op nationaal niveau. Leraren en schoolleiders ervaarden vaak onvoldoende autonomie en voelden zich daardoor minder of niet betrokken bij de innovatie. De commissie stipte overigens ook aan dat scholen soms te weinig autonomie 'pakken' (Tweede Kamer der Staten Generaal, 2008; ook Van Eck & Bollen, 2014). Als professionals, zoals leraren, onvoldoende autonomie ervaren bij het vormgeven en implementeren van een innovatie kunnen zij zich vervreemd voelen van de innovatie en het beleid (Tummers, 2012; Tummers et al., 2013). Bij meer lokale innovaties, in scholen, kan deze dynamiek van het ervaren van onvoldoende autonomie ook spelen bij schoolleiders en leraren. In dit proefschrift analyseren wij of en hoe schoolleiders en leraren vorm en leiding geven aan innovatieprocessen in hun school.

De belangstelling groeit voor leraren en schoolleiders die als professionals een rol spelen in innovaties (Inspectie van het Onderwijs, 2018; Leithwood et al., 2020; Onderwijsraad, 2018). Deze belangstelling voor hun professionaliteit wordt onder andere zichtbaar in de 'Kennisagenda van het Onderwijs', waarin aandacht wordt gevraagd voor de school als professionele organisatie (o.a. Ros, 2022; Van Tartwijk, 2022) en in een nieuw initiatief genaamd 'Ontwikkelkracht' dat onderwijs en onderzoek verbindt, met als doel om het onderwijs te innoveren (Rijksoverheid, 2022). Bovendien worden extra financiële middelen geïnvesteerd in de professionele ontwikkeling van schoolleiders en leraren (Rijksoverheid, 2022; VO-raad, 2022).

Zowel in de onderwijspraktijk als in de onderwijsliteratuur ligt de nadruk nog vooral op samenwerking tussen leraren (Admiraal et al., 2021; Hargreaves & O'Connor, 2017; Schildkamp et al., 2016). Maar in de organisatieliteratuur daarentegen, is eerder een begrip geïntroduceerd dat verder gaat: 'collaborative innovation'. Wij noemen dit in dit proefschrift in het Nederlands *samenwerkend innoveren*. Samenwerkend innoveren wordt gekenmerkt door een gezamenlijke benadering van innovatie in zowel horizontale als verticale werkrelaties (Bekkers & Noordegraaf, 2016; Sørensen & Torfing, 2018). Horizontale relaties verwijzen naar werkrelaties tussen personen en organisaties

op hetzelfde hiërarchische niveau. In dit proefschrift verwijzen wij daarmee naar werkrelaties tussen leraren. Verticale relaties betreffen werkrelaties die verschillende organisatieniveaus, functies en hiërarchieën doorkruisen (Torfing, 2019). In dit proefschrift verwijzen we daarmee naar werkrelaties tussen leraren en schoolleiders. Een onafhankelijk onderwijsprogramma dat ook focust op de rol van leraren en schoolleiders in het verbeteren van het onderwijs is van Stichting leerKRACHT. Dit programma probeert in scholen meer tijd en structuur voor samenwerking in de twee werkrelaties te creëren. In het onderzoek dat wordt beschreven in dit proefschrift bestudeerden wij scholen die allen werken met het programma leerKRACHT.

De horizontale en verticale relaties in scholen moeten worden *geleid* (Angelle, 2010; Bason, 2010; Ospina, 2017). Het is echter nog onduidelijk hoe het leiden van samenwerkend innoveren in scholen gebeurt en welke leiderschapspraktijken nodig zijn van zowel leraren als schoolleiders in de dagelijkse werkcontexten. Om meer specifieke inzichten te krijgen in leiderschap gebruiken wij in dit proefschrift het concept van 'leiderschapspraktijken' (in plaats van bijvoorbeeld leiderschapsstijlen). Leiderschapspraktijken zijn acties van personen die voortkomen uit interacties tussen leiders, volgers en een specifieke situatie (Alqahtani et al., 2020; Noman et al., 2018).

2. Onderzoeksvraag

Het doel van dit proefschrift is om beter te begrijpen hoe samenwerkend innoveren in scholen wordt geleid door schoolleiders *en* leraren. Ons doel is om tot inzichten te komen die helpen om leiderschapspraktijken van schoolleiders en leraren beter te begrijpen en ons wetenschappelijk begrip van samenwerkend innoveren in de onderwijscontext te versterken. Bovendien kunnen inzichten in specifieke leiderschapspraktijken schoolleiders en leraren helpen om te reflecteren op hun rol en hen inspireren om innovatieprocessen samen aan te pakken. Wij beantwoorden daarom de volgende hoofdonderzoeksvraag:

> *Hoe geven schoolleiders en leraren leiding aan samenwerkend innoveren in scholen?*

Om deze onderzoeksvraag te beantwoorden hebben we vier studies met elk een specifieke deelvraag:

1. *Hoe beïnvloeden horizontale en verticale werkrelaties in de school het samenwerkend innoveren?*
2. *Hoe geven schoolleiders leiding aan samenwerkend innoveren?*

3. *Hoe kan gespreid leiderschap in teams beschreven en gemeten worden met een sociaal netwerk perspectief?*
4. *Hoe kunnen verschillen in gespreid leiderschap tussen teams begrepen worden vanuit hun socioculturele context, op individueel, team- en schoolniveau?*

3. Onderzoeksperspectief

Om de hoofdvraag van het onderzoek te beantwoorden, brengen wij verschillende sleutelconcepten met elkaar in verband.

Veranderend professionalisme

De veranderende rollen van schoolleiders en leraren passen in een bredere ontwikkeling van *veranderend professionalisme*. Noordegraaf (2020) stelt dat professionaliteit niet door professionals zelf wordt 'gemaakt', maar afhankelijk is van vele actoren, hun interacties en contextuele factoren. In dit proefschrift richten we ons op schoolleiders en leraren als moderne professionals in samenwerkend innoveren. In plaats van 'voor te schrijven' hoe, waarom en wanneer leraren wat moeten doen, kunnen leraren als professional het professionele werk zelf vormgeven (Van Tartwijk, 2022). Als leraren op deze manier meer autonomie krijgen, moeten ze daarbij wel ondersteund worden door de organisatie (o.a. Knies, 2019).

Samenwerkend innoveren

Innovatie in de publieke sector kan worden gedefinieerd als het ontwikkelen van nieuwe ideeën die de manier transformeren waarop activiteiten gewoonlijk worden uitgevoerd (Torfing, 2019). *Samenwerkend innoveren* betrekt meerdere relevante actoren en dit verrijkt de uitwisseling van kennis, competenties en ideeën en breidt de creatieve ideeën uit voor het omgaan met uitdagingen (Roberts, 2000).

Leidinggeven aan samenwerkend innoveren

Samenwerkend innoveren moet worden ondersteund en *geleid* (Bason, 2010). Leiderschap wordt doorgaans gedefinieerd als individuen die invloed uitoefenen op activiteiten en relaties, kennis en vaardigheden van anderen (Daniëls et al., 2019; Yukl, 2002). In theoretische artikelen wordt gesteld dat leiderschap aan samenwerkend innoveren het beste gespreid, horizontaal en adaptief kan zijn en dat leiders het zelfregulerende karakter van de innovatieprocessen moeten respecteren (Angelle, 2010; Ospina, 2017).

Dit wordt ook erkend in de theorie over gespreid leiderschap, die we in dit proefschrift gebruiken (Spillane, 2005).

Leidinggeven aan samenwerkend innoveren in netwerken

Het bestuderen van leiderschap als een sociaal fenomeen dat zich afspeelt in interactie tussen meerdere personen, past bij een *sociaal netwerkperspectief*. Zo'n perspectief focust op relaties tussen personen of groepen (Freeman, 2004; Raelin, 2016; Wasserman & Faust, 1994).

Socioculturele contexten van leiding geven aan samenwerkend innoveren

Leraren en schoolleiders werken en interacteren in schoolorganisaties. Hun interacties hangen samen met aspecten van de bredere *socioculturele context* van hun school (Pea, 1993; Rogoff, 1990). De socioculturele activiteitentheorie gaat in op het belang van socioculturele contexten voor onder andere leiderschap in scholen (Rogoff, 1990; Spillane & Sherer, 2004; Tian et al., 2016). Hoewel verschillende onderzoekers aangeven dat de socioculturele context in ogenschouw moet worden genomen bij het bestuderen van leiderschapspraktijken, hebben slechts enkele onderwijsonderzoekers de context daadwerkelijk bestudeerd. Degenen die dit deden, hebben zich voornamelijk gericht op één contextueel niveau, zoals individueel of teamniveau (Liou & Daly, 2014; Liu, 2021; Liu et al., 2018; Tam, 2019). Dit betekent dat eerder onderzoek nog niet is ingegaan op relaties *tussen* niveaus van contexten.

4. Context van het onderzoek

In dit proefschrift bestudeerden wij scholen die werken met het programma van Stichting leerKRACHT.[17] In 2022 hebben meer dan duizend Nederlandse scholen in het primair, voortgezet en beroepsonderwijs dit programma geïmplementeerd. Het doel van dit tweejarige programma is het stimuleren van meer samenwerking tussen leraren onderling en tussen leraren en schoolleiders met het oog op het verbeteren van het onderwijs.

Het programma gebruikt een team-aanpak om processen stap voor stap te verbeteren (Rigby et al., 2016). De methode van het programma is gebaseerd op vier instrumenten: (1) Bordsessies: in vijftien minuten worden ideeën vertaald naar gezamenlijke doelen en actieplannen. (2) Lesbezoek; leraren observeren elkaars lessen en geven feedback. (3) Gezamenlijk lesontwerp: leraren ontwerpen samen lessen of onderdelen daarvan. (4)

[17] https://stichting-leerkracht.nl/

Stem van de leerling: een gestructureerde aanpak om de mening van leerlingen over het onderwijs te horen.

Als scholen beginnen met leerKRACHT wordt als eerste een startteam opgesteld. Dit team bestaat uit twee leraren (schoolcoaches genoemd) en de schoolleider en zij worden opgeleid door een expertcoach vanuit Stichting leerKRACHT. Vervolgens worden lerarenteams gevormd en binnen elk team helpt een schoolcoach om in een wekelijkse routine van samenwerken met de vier instrumenten te komen.

5. Overzicht van de bevindingen van de vier empirische studies

In *hoofdstuk 2* (deelvraag 1) onderzochten we welke factoren van horizontale en verticale werkrelaties een rol spelen in samenwerkend innoveren in scholen. Hiervoor gebruikten wij verschillende instrumenten voor het verzamelen van kwantitatieve en kwalitatieve data: een vragenlijst over horizontale en verticale werkrelaties (n = 1200 leraren van 124 scholen), een vragenlijst over innovatiepraktijken (n = 2036 leraren van 157 scholen) en groepsinterviews *(*n = 53 leraren van 20 scholen). Over de horizontale werkrelaties geven de leraren aan dat een samenwerkende houding, van elkaar willen leren en een veilige omgeving belangrijk is voor samenwerkend innoveren. Over de verticale werkrelaties noemen de leraren de belangrijke rol van de schoolcoaches en de schoolleiders en het delen van verantwoordelijkheden met leraren. Uit een multilevel analyse blijkt dat het ervaren leiderschap van de schoolleider een positieve invloed heeft op samenwerkend innoveren. Echter is positief ervaren leiderschap en de rol van schoolcoaches niet voldoende om tot samenwerkend innoveren te komen in alle scholen. Het leiderschap van schoolleiders werd verder bestudeerd in hoofdstuk 3 en 5 en dat van leraren en schoolcoaches in hoofdstuk 4.

In *hoofdstuk 3* (deelvraag 2) onderzochten we de rol van schoolleiders in het leiden van samenwerkend innoveren in scholen. We interviewden daarvoor 22 schoolleiders van po-, vo- en mbo-scholen, elk twee keer en vroegen naar hun leiderschapsrol en naar de rol van de leraren in samenwerkend innoveren. Transcripten van deze interviews werden gecodeerd op leiderschapspraktijken en wij vonden er 11. De schoolleiders voeren deze 11 leiderschapspraktijken op verschillende manieren uit, waarin wij drie patronen van schoolleiderschap onderscheiden: *Teamspeler*, *Sleutelspeler*, *Ondersteuner*. *Teamspelers* zijn schoolleiders die samenwerkend innoveren zien als een gedeeld proces van leraren en schoolleiders en zichzelf als onderdeel van het team positioneren. *Sleutelspelers* zijn schoolleiders die voornamelijk zelf de verantwoordelijkheid pakken voor het succes van samenwerkend innoveren. Zij vertrouwen dit proces nog niet aan de leraren toe.

Ondersteuners zijn schoolleiders die op afstand staan van het samenwerkend innoveren en vooral de schoolcoaches dit proces laten sturen. Zij faciliteren wel in tijd en ruimte voor de leraren om samen te werken. Hoe deze leiderschapspatronen samenhangen met gespreid leiderschap werd bestudeerd in Hoofdstuk 5.

In *hoofdstuk 4* (deelvraag 3) onderzochten wij hoe gespreid leiderschap te beschrijven en meten is met een sociaal netwerkperspectief in teams die samenwerkend innoveren. Een sociaal netwerkperspectief focust op het bestuderen van interacties, zoals leiderschapspraktijken tussen personen. Wij ontwierpen daarom een sociaal netwerk vragenlijst op basis van eerdere literatuur waarin gevraagd werd aan wie teamleden advies vragen over het werken met leerKRACHT. Vragen om advies wordt in de literatuur vaker gebruikt als maat voor het meten van gespreid leiderschap. De vragenlijst werd uitgezet in 14 teams. In totaal hadden wij een reactie van 130 (van de 148) leraren en 12 schoolleiders. Wij beschrijven gespreid leiderschap op basis van eerder onderzoek als een collectief, dynamisch en relationeel proces. Voor het meten van deze drie karakteristieken van gespreid leiderschap voerden wij een sociaal netwerkanalyse uit op de vragenlijstdata met drie netwerkmaten. Elke maat meet respectievelijk één van de drie karakteristieken: dichtheid, wederkerigheid en centralisatie. Onze resultaten tonen dat deze drie maten samen een mate van gespreid leiderschap kunnen weergeven. Daarnaast zien we dat teams verschillen in hun mate van gespreid leiderschap en dat leraren het vaakst een centrale rol in de netwerken spelen.

In *hoofdstuk 5* (deelvraag 4) onderzochten wij hoe verschillen in de mate van gespreid leiderschap in lerarenteams te begrijpen zijn vanuit sociaal-culturele contexten. Wij bestudeerden hiervoor kenmerken van het individu, het team en de school. In de studie werd gebruik gemaakt van methoden voor het verzamelen van zowel kwalitatieve en kwantitatieve data bij 14 teams. We gebruikten een sociaal netwerk vragenlijst over advies vragen, gepercipieerde leiders en vriendschap, een vragenlijst over horizontale en verticale werkrelaties, een vragenlijst onder expertcoaches over de reden waarom scholen werken met leerKRACHT, interviews met de schoolleiders over leiderschap en we verzamelden schoolgemiddelden van leerlingscores. De resultaten tonen dat teams met een hogere mate van gespreid leiderschap schoolleiders hebben die het patroon van *Teamspeler* beschrijven, leden hebben die geen drempel ervaren om advies te vragen aan een ander, een intrinsieke motivatie hebben voor samenwerkend innoveren en gesprekken voeren over het verbeteren van het onderwijs. We interpreteren dat gespreid leiderschap positief samenhangt met een gezamenlijke ‘spirit’. De betekenis van deze ‘spirit’ wordt hieronder toegelicht.

6. Beantwoording van hoofdonderzoeksvraag met drie overkoepelende thema's

Ten slotte wordt in *Hoofdstuk 6* de overkoepelende onderzoeksvraag beantwoord aan de hand van drie thema's die wij onderscheiden op basis van de vier studies.

Het eerste thema gaat over hoe schoolleiders leidinggeven aan samenwerkend innoveren. Schoolleiders die hun leiderschap beschrijven passend bij het leiderschapspatroon *Teamspeler* hebben een positieve invloed op samenwerkend innoveren. Het is echter voor de meeste schoolleiders zoeken naar een balans in sturen via kaders en het bieden van professionele ruimte aan leraren (Hoofdstuk 3).

Het tweede thema gaat over het leiden van samenwerkend innoveren via gespreid leiderschap. Leraren en schoolleiders merken op dat het leiden van samenwerkend innoveren een proces is van het verdelen van leiderschapspraktijken tussen schoolleiders en leraren (Hoofdstuk 2, 3). Er zijn verschillen tussen scholen in hoeverre zij leiderschap ook echt spreiden (Hoofdstuk 4). Wij definiëren gespreid leiderschap als een 'collectief, dynamisch en relationeel' proces, onafhankelijk van formele leiderschapsrollen (Hoofdstuk 4). Voor schoolleiders betekent dit dat zij als *Teamspeler* leidinggeven. Voor leraren betekent dit dat zij leiderschap uitoefenen door anderen van (gevraagd) advies te voorzien. Specifiek voor de schoolcoaches geldt dat zij leiderschap kunnen uitoefenen door samenwerkingssessies voor te bereiden en leraren en schoolleiders met elkaar te verbinden in samenwerkend innoveren.

Het derde thema gaat over een *gezamenlijke spirit* om het onderwijs te verbeteren. Deze spirit ondersteunt leraren en schoolleiders in het gespreid leiden van samenwerkend innoveren. Deze spirit bestaat uit drie onderdelen, verwijzend naar het 'hoe', 'waarom' en 'waarover'. We beschrijven de 'spirit' als teamleden die (1) in interactie met elkaar onafhankelijk van formele leiderschapsrollen (2) en vanuit een intrinsieke motivatie (3) samen streven naar schoolbrede verbetering van het onderwijs (Hoofdstuk 5).

7. Suggesties voor vervolgonderzoek en praktische suggesties voor scholen

In hoofdstuk 6 benoemen wij een aantal suggesties voor vervolgonderzoek en praktische suggesties voor scholen.

We stimuleren toekomstig onderzoek naar samenwerkend innoveren in scholen om horizontale en verticale werkrelaties breder te bestuderen om zo samenwerkend innoveren in en tussen scholen verder te versterken. Bij het verbreden van horizontale

werkrelaties valt te denken aan het bestuderen van relaties tussen schoolleiders van verschillende scholen (Honig & Rainey, 2020). Om de verticale werkrelaties breder te bestuderen raden wij aan ook schoolbestuurders te bestuderen, in relatie tot schoolleiders en leraren (Hooge & Honingh, 2014; Hooge et al., 2019). Daarnaast kan toekomstig onderzoek bestuderen hoe een gezamenlijke 'spirit' in teams tot stand komt en hoe deze zich ontwikkelt over tijd zodat we scholen beter kunnen helpen tot zo'n 'spirit' te komen.

Voor de scholen geldt dat schoolleiders de drie leiderschapspatronen die we identificeerden kunnen gebruiken om te reflecteren op hun eigen handelen. Zij kunnen de beschrijvingen van deze rollen gebruiken in gesprekken met hun collega's (mede leidinggevenden en leraren) over wat gewenste rollen voor hen als schoolleider zijn in innovaties. Daarnaast willen we schoolleidersopleidingen stimuleren om schoolleiders voor te bereiden op de zoektocht naar een balans in sturen en ruimte geven aan hun leraren wanneer nieuwe situaties zich in de school voordoen. Leraren willen wij aanmoedigen om naar hun eigen rol en expertise te kijken en hierover te spreken met collega's (leraren en schoolleiders). Lerarenopleidingen kunnen hierin een rol spelen door leraren meer bewust te laten worden van hun eigen expertise en het belang van verschillende expertises in een team te benadrukken.

8. Tot slot

De geschiedenis leert dat onderwijsvernieuwingen vaak mislukken. Een belangrijke reden lijkt te zijn dat leraren en schoolleiders zich niet genoeg betrokken voelen of worden om te beslissen over de inhoud en implementatie van landelijke onderwijsinnovaties. Dit proefschrift laat zien dat schoolleiders en leraren belangrijk zijn in het samen leiden en uitvoeren van samenwerkend innoveren. Een *gezamenlijke spirit* ondersteunt het proces van het gespreid leiden van samenwerkend innoveren. Leraren hebben professionele ruimte nodig om de leiding te kunnen nemen die verder gaat dan de rol in hun eigen klas. Schoolleiders moeten een balans vinden tussen het bieden van professionele ruimte aan leraren en sturen op strategie, kaders, grenzen en visie. Wij stimuleren beleidsmakers en schoolbestuurders zich te realiseren dat onderwijsverandering in scholen plaatsvindt, binnen dagelijkse contexten, vol interacties en gesprekken. Zij moeten, net als de schoolleiders, ook balanceren tussen sturen op grenzen en visie enerzijds en het bieden van voldoende professionele ruimte aan schoolleiders en leraren anderzijds. Het leiden van samenwerkend innoveren in scholen vraagt dus om innovatieve gespreide leiderschapspraktijken.

Summary

1. Introduction

When innovations are initiated, schools often find that many challenges and innovations do not turn out as intended (Boyd, 2021; Den Brok, 2018; Fullan, 2008; Vanlommel, 2021; Verbiest, 2021; Wubbels & Van Tartwijk, 2018). These innovations can be initiated on a national level, but they can also happen on regional or local levels, as innovations within schools. Innovations can focus on substantive elements of educational practice, such as curriculum change; they can focus on the procedures and standards for realizing good education; or they can focus on improving organizational processes. The parliamentary investigation by the Dijsselbloem committee (2008) reported a number of problems with certain nation-wide innovations. Teachers and school principals often experienced insufficient autonomy and therefore felt little or not at all involved in the innovations (Tweede Kamer der Staten Generaal, 2008; Van Eck & Bollen, 2014). When professionals such as teachers perceive low degrees of influence and autonomy in relation to shaping the content and implementation of national policies in schools, such as certain innovations, they can feel alienated from a policy (Tummers, 2012; Tummers et al., 2013). In the case of more local innovations, in schools, comparable dynamics of experiencing insufficient autonomy take place. In this dissertation, we analyze whether and how school principals and teachers shape and lead local innovation processes in schools.

Interest in teachers and school principals playing a role in innovations as professionals is increasing (Inspectie van het Onderwijs, 2018; Leithwood et al., 2020; Onderwijsraad, 2018). In the Netherlands, this interest in their professionalism is reflected in the 'Knowledge agenda',[18] focusing on the school as a professional organization (e.g., Ros, 2022; Van Tartwijk, 2022) and a new initiative called 'Developmental force'[19] that connects educational practice and research to innovate education (Rijksoverheid, 2022). Recently, additional financial resources have been invested in the professional development of school principals and teachers (Rijksoverheid, 2022; VO-raad, 2022).

In both educational practice and literature, the focus is still mainly on teachers' collaboration (Admiraal et al., 2021; Hargreaves & O'Connor, 2017; Schildkamp et al., 2016). In organizational literature, however, scholars have gone beyond this and introduced the notion of *collaborative innovation*. Collaborative innovation is characterized by a multi-actor approach to innovation. A specific feature of collaborative innovation is

[18] 'Kennisagenda' of the Netherlands Initiative for Education Research (NRO).

[19] 'Ontwikkelkracht' of the Ministry of Education, Culture and Science and Nationaal Groeifonds.

that it involves both horizontal and vertical working relations (Bekkers & Noordegraaf, 2016; Sørensen & Torfing, 2018). Horizontal relations refer to working relations between persons and organizations at the same hierarchical level. In this dissertation, we study relations between teachers. Vertical relations pertain to working relations that cut across different organizational levels, functions, and hierarchies (Torfing, 2019). In this dissertation, we study relations between teachers and school principals. The program of Foundation leerKRACHT is an independent program that also focuses on the role of teachers and school principals in improving education together.[20] This foundation aims to structure collaboration in working relations in schools to improve education.[21] We studied schools that work with the leerKRACHT program.

The horizontal and vertical working relations in schools need to be *led* (Angelle, 2010; Bason, 2010; Ospina, 2017). It is as yet unclear how leading collaborative innovation actually happens, and what it asks of both teachers' and school principals' leadership practices in day-to-day working contexts. That is why we initiated this study. In order to gain more specific insights into leading collaborative innovation, we use the concept of *leadership practices* (Alqahtani et al., 2020; Noman et al., 2018).

2. Research question

The aim of this dissertation is to better understand how collaborative innovation is led in schools by school principals and teachers. Our aim is to provide insights that will help to understand better the roles and leadership practices of teachers and school principals in leading collaborative innovation in schools. Moreover, we aim to strengthen our scientific understanding of collaborative innovation in the educational context further. More practically, insights into specific leadership practices can help school principals and teachers to reflect on how they lead their educational innovations and inspire them to approach innovation processes collaboratively. Therefore, we will answer the following main research question:

How do school principals and teachers lead collaborative innovation in schools?

In order to answer this research question, we set-up four related studies, each with a specific sub-question:

1. *How do horizontal and vertical working relations in school affect collaborative innovation practices?*

[20] leerKRACHT means both Learning force and Teacher in Dutch (usually referring to teachers in primary schools).

[21] https://stichting-leerkracht.nl/

2. *How do school principals enact leadership practices in leading collaborative innovation?*
3. *How can distributed leadership in school teams be described and measured by applying a social network perspective?*
4. *How can differences in distributed leadership between collaborative innovation-oriented teacher teams be understood from their sociocultural context, including at individual, team, and school levels?*

3. Research perspective

To answer the main research question of the study, we relate several key concepts.

Changing professionalism

The changing roles of teachers and school principals fit into a wider development of *changing professionalism*. Noordegraaf (2020) argues that professionalism is not made by professionals themselves, but is dependent upon many actors, their interactions, and contextual factors. In this dissertation, we have focused on teachers and school principals as modern professionals working together in collaborative innovation. Instead of prescribing what teachers should do, how, why, and when, teachers can shape their professional work (Van Tartwijk, 2022). Teachers thus will have more autonomy, but for this they have to be supported by the organization (e.g., Knies, 2019).

Collaborative innovation

Innovation in the public sector can be defined as an effort to develop new ideas that disrupt established practices and transform the way things are usually done (Torfing, 2019). *Collaborative innovation* includes relevant actors, facilitating the exchange of knowledge, competences, and ideas, and stimulates processes of mutual learning that may improve understanding of the challenge at hand and extend the range of creative ideas about how to solve it (Roberts, 2000).

Leading (collaborative) innovation

Collaborative innovation processes need to be supported and *guided* (Bason, 2010). Leadership is commonly defined as individuals exerting influence over others' activities and relationships, knowledge, and skills (Daniëls et al., 2019; Yukl, 2002). It is, mostly theoretically, argued that leadership of collaborative innovation is essentially distributive,

horizontal and adaptive, and that leaders need to respect the self-regulating character of collaborative innovation processes (Angelle, 2010; Ospina, 2017). This is recognized in the distributed leadership theory that we use in this dissertation. This theory postulates that multiple team members can be considered leaders (Spillane, 2005).

Leading (collaborative innovation) in networks

Studying leadership as a social phenomenon that is enacted in interaction between several persons fits with a *social network perspective*, which is concerned with relationships between people or groups (Freeman, 2004; Raelin, 2016; Wasserman & Faust, 1994).

Sociocultural contexts of leading collaborative innovation

Teachers and school principals act in school organizations and interact with each other. Their interactions are mediated by aspects of the wider sociocultural context (Pea, 1993; Rogoff, 1990). Sociocultural activity theory states the importance of sociocultural contexts for leadership and other practices in schools (Rogoff, 1990; Spillane & Sherer, 2004; Tian et al., 2016). This means that leadership practices have to be understood in the contexts in which they are embedded (Powell & DiMaggio, 1991). While these theoretical underpinnings suggest that the sociocultural context needs to be considered when studying leadership practices in collaborative innovation, only a few educational researchers have studied the context. The ones that studied the context have mainly focused on one contextual level (Liou & Daly, 2014; Liu, 2021; Liu et al., 2018; Tam, 2019). This means that previous research has not yet studied the relationships between levels and contexts.

4. Research context

In this dissertation, we studied Dutch schools that work with the educational program leerKRACHT (see https://stichting-leerkracht.nl/). In the 2012-2013 school year, the program was implemented for the first time by 15 schools. Up until 2022, more than a thousand primary, secondary, and vocational education schools had implemented this program.

The aim of the two-year leerKRACHT program is to initiate a transformation to collaborative innovation and a learning school culture to improve the quality of education. To achieve this, the program uses a team-based approach, including the teachers and school principal(s), to improve processes step by step. The program's method is based on four practical tools that are all working methods of collaboration: 1)

Stand-up sessions, where ideas are translated into joint goals. 2) Within-school lesson visits by team members, who provide feedback to one another. 3) Codesigning lessons or parts of lessons with team members. 4) Students' voice, a structured approach to get students' views to improve education.

We consider this program to stimulate collaborative innovation, since both teachers and school principals are expected to collaborate and share resources, knowledge, and ideas; it thus asks for an (other) approach to innovation. The implementation process starts with training of a start team (two teachers as coach-teachers and their school principal) by a coach from the external program; these coach-techers train the rest of the school.

5. Overview of the chapters and their findings

In *Chapter 2* (sub-question 1), we studied how factors of horizontal and vertical working relations in schools affect collaborative innovation practices. We used a mixed-methods design of two questionnaires on horizontal and vertical working relations (n = 1,200 teachers from 124 schools) and on collaborative innovation practices (n = 2,036 teachers from 157 schools) and group interviews (n = 53 teachers from 20 schools). With regard to horizontal working relations, teachers highlighted the importance of wanting to work together and learn from each other in a safe environment. Furthermore, regarding vertical working relations, teachers mentioned the role of coach-teachers and school principals and that they need to share responsibilities with teachers. Based on a multilevel analysis, we find that school principals' perceived leadership positively influences collaborative innovation practices. Lastly, we find that positive experiences of school principals' leadership and coach-teachers are not enough to stimulate collaborative innovation practices in all schools. School principals' leadership in collaborative innovation was further studied in Chapters 3 and 5, and that of coach-teachers in Chapter 4.

In *Chapter 3* (sub-question 2), we investigated school principals' role in leading collaborative innovation in schools. Interviews were conducted twice with 22 school principals. We asked about their leadership role and about the role of teachers in collaborative innovation. Transcripts of these interviews were coded for leadership practices. We found 11 leadership practices, and school principals enacted these practices in different ways. We distinguished three leadership patterns: *Team player*, *Key player*, and *Facilitator*. *Team players* are school principals who see collaborative innovation as a shared process for teachers and school principals and position themselves as part of the team. *Key players* are school principals who mainly take responsibility for the

success of collaborative innovation practices themselves. They do not yet entrust this process entirely to teachers. *Facilitators* are school principals who are at a distance from collaborative innovation and mainly let the coach-teachers lead the process. They facilitate in terms of time for teachers to collaborate. How these leadership patterns are linked to distributed leadership was studied in Chapter 5.

In C*hapter 4* (sub-question 3), we investigated from a social network perspective how distributed leadership can be described and measured in teams working on collaborative innovation. A social network perspective focuses on studying interactions, such as leadership practices, between individuals. We therefore designed a social network questionnaire based on previous literature. The questionnaire sought to ascertain from whom advice was sought on working with leerKRACHT. Asking for advice is often used in the literature as a measure of distributed leadership. We conducted a pilot in a primary and secondary school and adapted some of the questionnaire items. The questionnaire was distributed to 14 teams. In total, we received responses from 130 (out of 148) teachers and 12 school principals.

Firstly, based on previous research, we describe distributed leadership as a collective, dynamic, and relational process. To measure these three characteristics of distributed leadership, we conducted a social network analysis of the questionnaire data with three network measures. Each measure measured one of three characteristics: density, reciprocity, and centralization. Our results showed that these three measures together can ascertain degrees of distributed leadership. In addition, we found differences between school teams in terms of higher and lower degrees of distributed leadership. We found, too, that teachers are most often the central player in advice-seeking networks, followed by coach-teachers. In Chapter 5, we studied how these differences in degrees of distributed leadership link to school teams' sociocultural context.

In *Chapter 5* (sub-question 4), we examined how differences in degrees of distributed leadership in teacher teams can be understood in relation to sociocultural contexts. We studied characteristics of the individual, the team, and the school context in 14 teacher teams. We used a mixed-methods design of a social network questionnaire about advice-seeking, perceived leaders, and friendship; a questionnaire on horizontal and vertical working relations; a questionnaire among external coaches about why schools work with leerKRACHT; interviews with school principals about leadership; and student scores. We found that teams with higher degrees of distributed leadership have *Team player* school principals, experience no threshold when it comes to asking advice of another, have an intrinsic motivation for collaborative innovation, and have conversations about improving education beyond the scope of their own classroom. We infer that a higher degree of

distributed leadership is positively associated with teachers and school principals with a collaborative spirit to improve education together. This spirit is explained below.

6. Answering the main research question with three overarching themes

In *Chapter 6,* we answer the main research question using three overarching themes that we distinguish based on the four studies.

The first theme is about how *school principals* lead collaborative innovation. School principals who describe their leadership as fitting the *Team Player* leadership pattern have a positive influence on collaborative innovation. However, most school principals seek a balance in steering frameworks and providing professional space to teachers (Chapter 3).

The second theme is about leading collaborative innovation with *distributed leadership*. Teachers and school leaders note that leading collaborative innovation is a process of distributing leadership practices between school principals and teachers (Chapters 2 and 3). We find differences between schools in the degree to which they actually distribute their leadership (Chapter 4). We define distributed leadership as a "collective, dynamic, and relational" process, independent of formal leadership roles (Chapter 4). For school principals, this means that they lead as *Team Players*. For teachers, this means they can enact leadership by providing others with advice. Specifically, coach-teachers can enact leadership by preparing collaboration sessions and connecting teachers and school principals in collaborative innovation processes.

The third theme is a *collaborative spirit* to improve education. This spirit supports teachers and school principals in distributing their leadership in collaborative innovation. This spirit has three components, referring to (1) 'how', (2) 'why', and (3) 'what'. We describe the spirit as team members who (1) interact with each other independent of formal leadership roles (2) and with intrinsic motivation (3) jointly aim for school-wide improvements to education (Chapter 5).

7. Suggestions for future research and practical suggestions for schools

In Chapter 6, we mentioned a number of suggestions for future research and practical suggestions for schools. We encourage future research on collaborative innovation in schools to broaden the scope of study of horizontal and vertical working relations. In broadening horizontal relations, one might think of studying school principals from different schools (Honig & Rainey, 2020). To study vertical relations more broadly, we recommend also studying school board members in relation to school principals and

teachers (Hooge & Honingh, 2014; Hooge et al., 2019). In addition, future research can study how a collaborative spirit is established and how it develops so that we can help schools to achieve such a spirit.

We encourage school principals to use the three leadership patterns to reflect on their own role and leadership practices. They can use the descriptions of these patterns in conversations with their colleagues (co-leaders and teachers) about the desired role of school principals in innovations. In addition, we would encourage school principal development programs to prepare school principals to seek a balance in steering and providing professional space to teachers when new situations arise in school. We would encourage teachers to take a look at their own role and expertise and to discuss this with colleagues (teachers and school principals). Teacher development programs can play a role in helping teachers to become more aware of their own expertise and emphasizing the importance of team expertise.

8. Final remarks

History shows that educational innovations are often unsuccessful. One important reason for this is that teachers and school principals are often not asked to be or do not feel involved in deciding on the content or implementation of nation-wide innovations. This dissertation shows that teachers and school principals can take joint responsibility in leading collaborative innovation. A collaborative spirit supports this joint process of distributed leadership in collaborative innovation. Teachers thus need the professional space to be able to lead beyond their role in the classroom. School principals need both to provide professional space to teachers *and* to steer the strategy, frameworks, boundaries, and vision. This, in turn, means that policy makers and school board members must realize that educational change takes place within schools within day-to-day contexts full of interactions and conversations. Thus, balancing steering the boundaries and vision on the one hand and providing enough professional space to school principals and teachers on the other hand might also be useful for policy makers and school board members. Leading collaborative innovations *in* schools calls for innovative collaborative leadership practices.

About the author

Angela Zuijderduijn-de Jong was born on 14 January 1993 in Meerkerk, the Netherlands. She obtained her high school degree (Autheneum) in 2011 from Lyceum Oudehoven in Gorinchem and her BSc in Educational Sciences in 2014 at Utrecht University. During her Bachelor program she went to Universitetet i Oslo (Erasmus Exchange Program) and completed an Honors program. In 2016 she obtained her MSc, a research Master's in Educational Sciences: Learning in Interaction, from Utrecht University. During her Master's, she worked as a research assistant at TIAS (Tilburg University), where her interest in social network analysis began, and was an intern at Oberon (research and consultancy organization).

In 2016, Angela started working at Oberon as a researcher. Together with her future PhD-team she wrote an NRO-application, which succeeded. In June 2017, Angela started as an external PhD candidate at the Department of Education at Utrecht University, alongside her job at Oberon. Her PhD project consisted of a five-year study of the Foundation leerKRACHT program. She wrote both yearly research reports and scientific articles. During her PhD, she gave a dozen oral presentations (guest lecturer, conferences).

One day a week, Angela worked on several other research projects at Oberon, mainly focused on leadership, collaboration within and between schools, professionalization of teachers and school principals, and school culture. She was the course coordinator and one of the teachers of the Learning in Organizations course (GST, Utrecht University). In addition, she supervised interns and students writing their theses, was the internship coordinator, and worked as a Kennismakelaar for the Kennisrotonde of NRO. On 1 September 2022, she will start at the Lectorate Werken in Onderwijs at Hogeschool Utrecht.

Publications and presentations

International peer-reviewed scientific publications

De Jong, W. A., Lockhorst, D., De Kleijn, R. A. M., Noordegraaf, M., & Van Tartwijk, J. W. F. (2020). Leadership practices in collaborative innovation: A study among Dutch school principals. *Educational Management Administration & Leadership*. https://doi.org/10.1177/1741143220962098

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De Jong, W. A., De Kleijn, R. A. M., Lockhorst, D., Van Tartwijk, J. W. F., & Noordegraaf, M. (under review). Collaborative approaches: Studying horizontal and vertical working relations in schools and how they affect collaborative innovation practices.

Presentations:

Colloquium Social Network Analysis (2018), EAPRIL (2022), EARLI and JURE (2019), ECER (2021), Guest lectures BAB (2021) EUR (2019, 2020, 2021) RUG (2020) TIAS (2020) UMC (2022) USBO (2022), ICO national and international spring/fall school (2017 – 2021), Inspiration session for school board members (2021), NRO congress (2017, 2019), NVMO (2022), ORD (2018, 2020, 2021, 2022), Podcast VO-raad (2022), ResearchED (2021, 2022), Sunbelt INSNA (2018), VELON (2019), Webinar Stichting leerKRACHT (2020).

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