



FOSTERING SUSTAINED TEACHER LEARNING

CO-CREATING PURPOSEFUL AND EMPOWERING WORKPLACES

ARNOUD OUDE GROOTE BEVERBORG

Fostering sustained teacher learning

Co-creating purposeful and empowering workplaces

Arnoud Oude Groote Beverborg

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Arnoud Oude Groote Beverborg

born on 4 February 1981

in Oldenzaal, the Netherlands

First promotor: Prof Dr. P.J.C. Slegers
Second promotor: Prof. Dr. K. van Veen

This dissertation has been approved by the first promotor and the second promotor.

Promotion committee:

Prof. Dr. T.A.J. Toonen (chairperson/secretary)

Prof. Dr. P.J.C. Sleegers (promotor)

University of Twente

Prof. Dr. K. van Veen (promotor)

University of Groningen

Prof. Dr. J.W.M. Kessels

University of Twente

Prof. Dr. C.A.W. Glas

University of Twente

Prof. Dr. F.P. Geijssel

University of Amsterdam

Prof. Dr. G. Devos

Ghent University

Dr. E.J.P.G. Denessen

Radboud University Nijmegen

Dr. N.M. Moolenaar

Utrecht University

“Wissen kann man mitteilen, Weisheit aber nicht. Man kann sie finden, man kann sie leben, man kann von ihr getragen werden, man kann mit ihr Wunder tun, aber sagen und lehren kann man sie nicht.“
(Hesse, 1922)

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“Um. What’s the name of the word for things not being the same always. You know, I’m sure there is one. Isn’t there? There must be a word for it... the thing that lets you know time is happening. Is there a word?” Delirium asked her older brother Dream.

“Change.”

(Gaiman, 1992/2011)

Chapter 1

Introduction

The special task of the social scientist in each generation is to pin down the contemporary facts. Beyond that, he shares with the humanistic scholar and the artist in the effort to gain insight into contemporary relationships, and to realign the culture's view of man with present realities. (Cronbach 1975, p. 126)

The present reality this dissertation is concerned with is teacher learning in the context of continuous change, and the contemporary notion that collaborating in teams facilitates learning and, consequently, effective adaptation to change. Changes in demographics of students, the emergence of new instructional methods, technological innovations in the work field, ongoing reorganizations of work processes, as well as accountability reforms, all continuously place new demands on the educational quality that is needed to prepare students for societal and occupational participation (Kwakman, 1999). Collaboration in teams and lifelong engagement in, both individual and social, professional learning in the workplace are deemed necessary to adapt to these, and all future changes (Klarner, Probst & Soparnot, 2008; Stoll, Bolam, McMahon, Wallace, & Thomas; 2006; Stoll, 2009). The following concrete example sketches how collaboration and learning can manifest in newly formed multidisciplinary teams in secondary Vocational Education and Training (VET) colleges in the Netherlands, where teachers sought to adapt to the latest educational innovations.

During the three years I collected data, I collaborated particularly close with one VET college. At this time a nationwide reform policy was being implemented in VET colleges, aimed at changing teaching practices toward more collaboration by organizing teachers in multidisciplinary teams. Additionally, this VET college had just initiated a policy to promote teacher learning. The policy, communicated to teachers by their leaders, entailed that each team of teachers was required to formulate a shared goal. How a team would manage to attain its goal was left to their own devices, as long as teachers collaborated. For the automotive team the goal was clear. Only 55% of the students had successfully passed their exams previously. More students had to pass their exams in the future. Student results for knowledge of separate technical aspects had not been bad, so individual teachers' competences were not the problem. The teachers set out to make the problem as precise as possible, and it turned out that the students failed in making a correct and specified diagnosis. More specifically, the students did not ask enough questions to come to such a diagnosis. The students thus failed because their conversations techniques were not good enough, as well as their integration of knowledge about automobile techniques and diagnostics. It was clear for the team

that a solution would mean closer collaboration between the language teachers and the automobile technique teachers, as well as between the automobile technique teachers amongst each other. The curriculum of the automotive education was drastically redesigned. Teachers learned to firmly anchor language in the techniques lessons, and to integrate automotive jargon and examples in the language lessons. Also, additional attention was given to the technique of asking questions. Through this self-chosen direction and intensified collaboration between teachers with different specializations next year's pass rate went up to 81% (van der Meer, 2012).

This example illustrates that professional learning in the workplace can be beneficial in changing teacher instructional practices and, consequently, can elevate student results. It implies that teachers reflected on how to improve their instructions, and, needing each other's expertise to do so, they shared information. They also assessed their individual competences, and realized that the key to achievement of the desired result lay in working more interdependently. This realization happened in the context of a policy that was voiced by the team's leader and was supportive of this course of action. These teachers not only learned how to improve student results, they also learned to learn to adapt to a policy of working in an multidisciplinary team by making use of the knowledge and skills their new found team members had to offer.

The benefits of engagement in learning activities are not confined to this single example. Engagement in learning activities has been found to facilitate changes in instruction in a representative sample of elementary school teachers (Slegers, Thoonen, Oort, & Peetsma, 2014; Thoonen, Slegers, Oort, & Peetsma, 2012). In those studies, engagement in learning activities seems to be facilitated by the interplay between organizational and psychological factors. However, systematic knowledge about how teacher learning can be fostered in a VET context is largely lacking. Moreover, sustaining levels of engagement in learning activities over time seems difficult (Giles & Hargreaves, 2006; Horn & Little, 2010; Little, 1990; Schippers, den Hartog, Koopman, & Wienk, 2003; Timperley & Alton-Lee, 2008). Understanding how educational institutions can provide supportive environments that sustain or even elevate learning over time is therefore needed.

Aims of the dissertation

To come to understand the mechanisms at work in fostering teacher professional learning for sustained improvement, scholars have called attention to the interplay between organizational and psychological factors in teacher learning (Richardson & Placier, 2001; Kwakman, 2003; Slegers, 1999; Smylie, Lazarus, & Brownlee-Conyers, 1996; van Veen, Zwart, & Meirink, 2012). Studies into these antecedents and their consequences for professional learning have shown that the impact of leadership and workplace conditions on professional learning appears to be mediated by psychological factors, such as self-efficacy beliefs (Geijssel, Slegers, Stoel, & Kruger, 2009; Kwakman, 2003; Smylie et al., 1996; Thoonen, Slegers, Oort, Peetsma, & Geijssel, 2011). However, most of the relevant studies have been conducted in elementary schools. To validate previous findings additional research in a different context is needed. We therefore will examine in VET colleges the impact of previously identified antecedents on learning. More specifically, based on a model of teacher learning as developed in research on the interplay between organizational

conditions and teachers' psychological factors for teacher learning in elementary schools (Geijssel et al., 2009; Thoonen et al., 2011), this inquiry addresses how engagement in learning activities is fostered through the interrelated influences of transformational leadership practices, perceptions of interdependence, and self-efficacy beliefs in a VET context.

Additionally, this dissertation answers the call for more research that assesses levels of engagement in learning longitudinally, as there is still little systematic evidence for how organizational and psychological factors shape teacher learning in the context of the school over time (Feldhoff, Radisch, & Klieme, 2014; Hallinger & Heck, 2011; Heck & Hallinger, 2014; Thoonen, et al., 2012; Slegers et al., 2014). Where cross-sectional studies are limited in making valid and reliable claims about the direction of influence of the relations between variables, longitudinal studies can make stronger claims about causality. Modelling the influences of leadership, teamwork conditions, and psychological factors on teacher learning over time can validate previous findings from cross-sectional studies, and can assess how teacher learning progresses. Additionally, longitudinal research allows investigating possible reciprocal relations undetected by cross-sectional models, and can therefore make an important contribution to a complete understanding the dynamics of school improvement and the role of teacher learning to foster sustained school improvement. This dissertation is therefore aimed at understanding more about the mechanisms that drive teachers' engagement in professional learning activities over time, by studying them in the Dutch VET context.

The changing Dutch secondary Vocational Education and Training context

Schools in general, but VET colleges in particular, have been confronted with ongoing reforms, including restructuring movements, educational reform efforts, and rigid accountability policies, as strategies to improve the quality of education. For VET colleges this resulted in many mergers with the formation of massive educational institutions as a consequence. Contrary to elementary schools, where the lines between all people working in one building are much shorter, and where relatively long and intense connections between the teachers with the schools and also between the teachers and students within the schools exist, VET colleges are more loosely coupled organizations with multiple levels or subsystems, and involve a higher level of education (Orton & Weick, 1990; Weick, 1976).

These institutions also are involved in educational reforms aimed at the development of learning environments designed to stimulate self-regulated, reflective, independent, and social-interactive learning (De Kock, Slegers, & Voeten, 2004). From the idea that a craft is not learned at school but in practice, student learning in authentic workplaces has become more central in VET colleges (e.g., König & Mulder, 2014; Messmann, Mulder, & Gruber, 2010). These learning environments are designed to prepare students for life-long learning so that they may function in a continuously changing labor market (Poortman, 2007). The learning environments provide students with opportunities to gain job experiences through the performance of occupational tasks, thereby facilitating the transfer of their instructions to future occupations (Bolhuis, 2003; Poell, van Dam, & van den Berg, 2004). To further bridge the gap between educational and occupational settings, VET colleges have attracted experienced professionals from the actual field to teach their students, resulting in a wide variety of experiences and expectations amongst teachers.

To successfully implement these changes, VET teachers have been organized into multidisciplinary teams, in which teachers from different disciplines and different subjects are called to collaborate for imparting the competences students need to become skilled in the professions they are being educated for. However, working in teams does not always accumulate in desired effects (Mueller, Procter & Buchana, 2000; Richter, Dawson, & West, 2011; Slavin, 1990). Working in multidisciplinary teams is often foreign to teachers due to the traditionally individualistic nature of the profession. Teachers had been given much autonomy, and they consequently developed a personal responsibility for their classrooms (Somech & Boehler 2002). Formation of teams in an educational setting is therefore not an easy task and altering the practices of teachers is even more difficult (e.g. Crow & Pounder, 2000; Fullan, 2002; Scribner, Sawyer, Watson, & Myers, 2007; Somech & Drach-Zahavy, 2007). The challenge facing these VET teachers is therefore to come to understand how to work effectively in teams that are directed at strengthening their professional expertise and practice, with the ultimate goal of improving student performance (e.g., Meirink, Meijer, Verloop & Bergen, 2009; Meirink, Imants, Meijer & Verloop, 2010; Truijen, 2012). To do so, ongoing collaboration and sustained engagement in professional learning in the workplace are assumed to be key (Stoll et al., 2006).

Engagement in professional learning activities

Knowledge gained in professional development workshops and training courses hardly transfers to the workplace to improve the teaching practices of teachers or help them adapt to changing teaching circumstances (Clarke & Hollingsworth, 2002; Richardson & Placier, 2001; van Woerkom, 2003). Rather, the most important sources of learning are the challenges of work itself and interactions with other people in the workplace (Eraut, Alderton, Cole, & Senker, 1998). Ongoing learning in the workplace enables teachers to find solutions that are tailored to their specific circumstances and allows them to maintain high levels of craftsmanship in a changing environment where solutions that were once found expire (Korthagen & Vasalos, 2005; van Woerkom, 2003). This has provided an impetus for many researchers to adopt the “change as professional learning” perspective to professional development. Teacher learning in the workplace is seen as an active and constructive process that is problem oriented, situated in daily teaching practice and in interaction with peers, and takes place throughout adults’ lives (Jarvis, 1987; Marsick & Watkins, 1990; Putnam & Borko, 2000; Smylie, 1995; Geijssel et al., 2009). In line with this view, researchers have emphasized the notion of ongoing and lifelong teacher learning embedded in schools as a natural and thus expected component of professional activities of teachers (Clarke & Hollingsworth, 2002; Cochran-Smith & Lytle, 1999; Desimone, 2009; Jarvis, 1987; Putnam & Borko, 2000; Slegers, Bolhuis & Geijssel, 2005; Smylie, 1995). This perspective on learning implies that teachers take responsibility for their own actions and generate the necessary knowledge and skills to take charge of change themselves.

Moreover, in schools in general, but in VET colleges in particular, individual learning seems not sufficient to face continuous changes (Stoll, et al., 2006; Stoll, 2009). Learning activities individual teachers can engage in, such as keeping up to date, experimenting, and self-reflection, generate knowledge that is beneficial for improvement, but they make this knowledge only potentially available for others. Scholars have therefore suggested that teachers also exchange knowledge and skills, reflect critically on their own and their

colleagues' practices, make their perceptions, ideas, and practices, explicit, and discuss the adequacy of those with each other to enhance effective adaptation (Fullan, 2001; Stoll et al., 2006; Toole & Louis, 2002; Vescio, Ross, & Adams, 2008; van Woerkom, 2003). Through engagement in social learning activities, such as information sharing and asking for feedback, new knowledge becomes available for, and can spread in, the whole team (van Woerkom, 2004). Through generating and exchanging knowledge all teachers can improve their instructional qualities, and thereby strengthen educational organizations' capacities for change (Cochran-Smith & Lytle, 1999; Stoll, 2009). The focus of teacher learning at the workplace should thus be on teachers' engagement in a variety of professional learning activities within the educational context, and becoming part of a community of learners (ten Dam & Blom, 2006; Sfard, 1998; Stoll et al., 2006; Wenger, 1998; van Woerkom, 2003).

It seems likely that ongoing and increased levels of engagement in professional learning makes a significant contribution to improving educational practice and, in turn increasing student performance (Desimone, 2009; Thoonen et al., 2011; Vescio et al., 2008). The importance of teacher learning for adaptation to change and sustained improvement therefore leads to the question how to facilitate teacher learning, and how to sustain sufficient levels of learning over time.

Fostering sustained engagement in professional learning

Findings from research on teacher learning has suggested that levels of engagement in individual learning activities seem to be relatively stable over time (e.g., Thoonen et al., 2012). Levels of engagement in social learning, however, seem to be prone to declination over time, even when teachers recognize the affordances of the resources their colleagues can provide for their own learning, and are motivated to pool their expertise to determine a course of action aimed at improving education (Gabelica, Van den Bossche, De Maeyer, Segers, & Gijssels, 2014; Horn & Little, 2010; Little, 1990; Schippers, den Hartog, Koopman, & Wienk, 2003).

To understand how teacher learning can be facilitated, studies into professional learning communities and school wide change capacity have been conducted (e.g., Stoll, 2009; Stoll et al., 2006). These studies point towards such organizational conditions as transformational leadership and perceptions of interdependence, as well as psychological factors such as self-efficacy beliefs, in enhancing individual and social teacher learning. Moreover, these variables interact to create a supportive environment for learning: the impact of transformational leadership practices on teacher learning activities seems to be mediated by both perceptions of the workplace and psychological factors (Geijsel, et al., 2009; Kwakman, 2003; Leithwood, Jantzi, & Mascal, 2002; Runhaar, 2008; Smylie et al., 1996; Stoll et al., 2006; Thoonen et al., 2011).

The psychological factor self-efficacy refers to the level of competence a person expects to display in a given situation. Teachers with higher efficacy beliefs will persist in the face of difficulties, feel empowered, are less constraint by doubt, and will thus arrive quicker at a satisfying solution (e.g., Bandura, 1993; Caprara, Fida, Vecchione, Del Bove, Vecchio, Barbaranelli, & Bandura, 2008; Goddard, Hoy, & Woolfolk Hoy, 2004). When they believe to be efficacious, teachers can more easily summon the will to continuously evaluate their practices, learn, and adapt (Geijsel et al., 2009; Meirink, 2007; Runhaar, 2008; Thoonen et al., 2011; Yost, 2006).

The first organizational condition, perceived interdependence, refers to the degree of interaction between team members required to complete tasks (task interdependence), or to mutually pursue and reach a team's common goal (goal interdependence) (Deutsch, 1980; Runhaar, 2008; Tjosvold, Tang, & West, 2004; Tjosvold, Yu, & Hui; van der Vegt & van de Vliert, 2002). When working interdependently on tasks and common goals, teachers provide each other structure and support. This specifies a course of action that may reduce teachers' feelings of uncertainty and strengthen their beliefs in their ability to foster both individual and social learning (e.g., Staples & Webster, 2008). Moreover, interacting with team members enables teachers to observe others' skills, voice new insights, or share information. Collaborating in multidisciplinary teams therefore provides many new opportunities for learning, if teachers recognize how to use them (Witziers, Sleegers, & Imants, 1999).

The second organizational condition for the optimization of an environment for teacher learning is transformational leadership. A transformational leader motivates teachers to do more than they originally expected and often even more than they thought possible, resulting in extra effort and changed practices (Leithwood, Jantzi, & Steinbach, 1999; Ross & Gray, 2006). Three complementary sets of practices have been found critical for enhancement engagement in learning. Firstly, by providing direction through the initiation and identification of a vision, a transformational leader inspires teachers to formulate shared goals, connect to these, commit to them and try to attain them. Secondly, individualized consideration and attention to individual needs and feelings, as well as, acting as a role model, coaching, delegating challenging tasks, and providing feedback, help followers elevate their personal potential, through which teachers may feel empowered to seek out team members to interact, and exchange information with. Thirdly, by challenging and supporting teachers sufficiently to continuously calibrate the adequacy of their knowledge and instructional practices, transformational leaders intellectually stimulate teachers to formulate shared goals (Dionne, Yammarino, Atwater, & Spangler, 2004; Geijsel, Sleegers, & van den Berg, 1999).

Thus, previous research shows that engagement in professional learning activities are facilitated by the interplay between self-efficacy, task and goal interdependence, and transformational leadership. However, because systematic knowledge about how VET teacher learning can be fostered is largely lacking, the effects of these psychological and organizational factors on teacher learning need validation in a VET context.

Moreover, there is still little systematic evidence for how organizational and psychological factors sustain levels of engagement in learning activities over time. Additionally, the interplay between organizational conditions, psychological factors, and learning activities has as yet been operationalized with unidirectional relations (c.f., Desimone, 2009; Sleegers et al., 2014; Thoonen, 2011). This results in a lack of understanding about their interplay; that is, whether reciprocal relations exist between them, and whether they co-develop over time. Teacher learning, for instance, is thought to play a mutual, or even pivotal, role in strengthening educational organization's capacities for change (e.g., Stoll et al., 2006). Teachers may need to learn how to interact with colleagues and to discover how they can benefit from the resources their team members may provide to support them, and to provide an environment rich in new information to be learned from. "They may need to lose time in order to gain time" (Mulford, 2010). This means, for instance, that teachers may need some time for reflection before they feel efficacious. Self-efficacy develops when satisfying solutions in various problematic or uncertain situations have been perceived, and also when people have perceived their team members to resolve

problems (Bandura, 1997). Efficacy beliefs thus develop because teachers learn how to deal effectively with demands they face given the circumstances they are in. Developing these situation specific beliefs is therefore a responsibility of teachers themselves, although supportive environment can offer opportunities to do so. Teachers also need time to discover how an environment is supportive for them (e.g., Aritzeta & Balluerka, 2006; Ortiz, Johnson, & Johnson, 1996), and to learn to recognize the affordances of the resources their colleagues can provide for their own learning (Horn & Little, 2010; Little, 1990; Nonaka, 1994; Spillane, Reiser, & Reimer, 2002; Weick, Sutcliffe, & Obstfeld, 2005). Perceptions of interdependence could therefore be influenced by engagement learning activities, just as engagement in learning activities is influenced by perceptions of interdependence. Also, where a vision building leader may inspire teachers to formulate and attain common goals, teachers' continued interaction and pursuit of those goals may also inspire their leader to remain inspirational. However, systematic knowledge about the reciprocity between organizational conditions, psychological factors, and learning activities is lacking, and it is therefore important to investigate their reciprocity to understand the interactions that drive teacher learning.

To investigate such reciprocity, a longitudinal design is needed. Modelling the influences of organizational conditions and psychological factors on teacher learning over time enables both the validation of previous findings from cross-sectional studies, and investigation of possible reciprocal relations undetected by cross-sectional models (e.g., Heck & Hallinger, 2010; Salanova, Bakker, & Llorens, 2006; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). Additionally, longitudinal designs can assess whether levels of learning are sustained over time or whether they change (Eschleman & LaHuis, 2013; McArdle, 2009). Longitudinal studies can therefore make an important contribution to a complete understanding of the nature and dynamics of school improvement and the role of teacher learning to foster sustained school improvement.

Outline of this dissertation

To understand more about the mechanisms that drive teachers' engagement in professional learning activities, the aims of this dissertation are 1) the validation of the model on the interplay between organizational and psychological factors in fostering engagement in teacher learning that was developed in research in elementary schools, and 2) the assessment of co-development of the variables in the model in terms of reciprocity and change over time. To realize these aims we conducted two cross-sectional and two longitudinal studies, for which we collected data on three occasions with yearly intervals by sending digital questionnaires to about 800 teachers in about 70 teams from 6 VET institutions using an online survey program. The first cross-sectional study is concerned with the validation the previously established model and the structural relations therein by studying it in the Dutch VET context, and by including different variables. The second cross-sectional study extends the findings of the first empirical chapter by introducing more learning activities to the model. The longitudinal studies build on the findings from the cross-sectional studies to assess reciprocity and change. These studies focus less on the interplay between all variables, but instead focus on the interplay over time between variables that were strongly related. The first longitudinal study is concerned with the reciprocity between organizational conditions, psychological factors and knowledge generating learning

activities, as well as with their change over time. The second longitudinal study assesses the drivers of social learning, their reciprocity, and their change over time. Figure 1.1 presents an overview of which variables and relations will be investigated in which chapter.

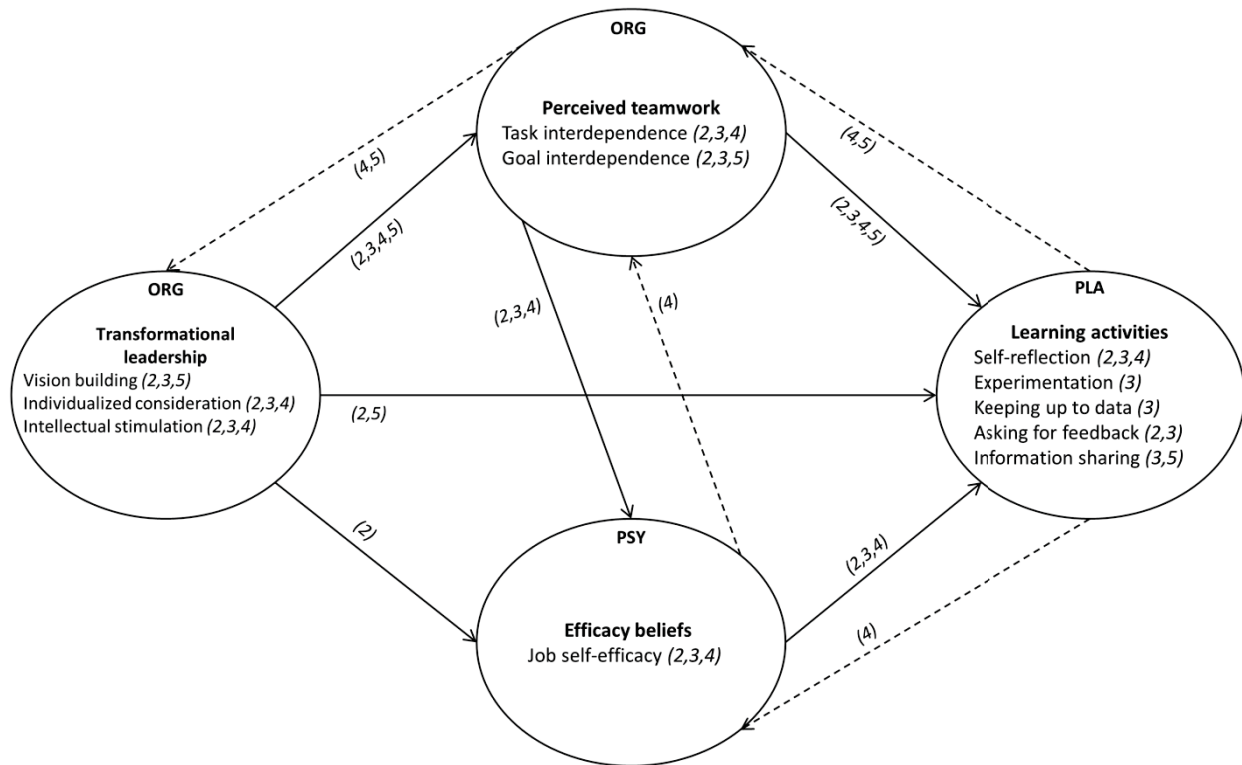


Figure 1.1

Overview of the variables and their relations in this dissertation

ORG represents the organizational conditions, PSY represents the psychological factor, PLA represents the professional learning activities. Solid arrows represent 'straightforward' effects, and dashed arrows represent 'reversed' effects (their combinations make up reciprocal relations). Numbers in parentheses indicate the chapters in which certain variables and relations are investigated.

Cross-sectional studies

Chapter 2 examined how transformational leadership, perceived task and goal interdependence, and self-efficacy, facilitate VET teachers' engagement in the individual learning activity self-reflection and the social learning activity asking for feedback. Task and goal interdependence, and asking for feedback were newly introduced to the model. Questionnaire data were analyzed using Structural Equation Modelling (SEM). As teachers were part of teams, and a nested data structure therefore existed, we applied multilevel techniques to the path modelling techniques to correct for team membership.

In *chapter 3* we added more learning activities to the model found in chapter 2, to extend understanding of the interplay between factors in fostering engagement in a variety of learning activities. We therefore explored the extent to which VET teachers, working in multidisciplinary teams, distinguish between various individual and social learning activities, and whether the interplay between transformational leadership practices, task and goal interdependence, and self-efficacy beliefs, influences all learning activities to the same

degree and in the same manner. The learning activities included in the model were keeping up to date, experimentation, self-reflection, asking for feedback, and information sharing. The same data, as well as the same multilevel SEM strategy to analyze the data, was used as in chapter 2.

The findings from these two chapters showed strong links between the transformational leadership practices individualized consideration and intellectual stimulation, task interdependence, self-efficacy, and, subsequently, all learning activities. This indicates that an empowering environment facilitates engagement in learning activities for both generation and exchange of knowledge. The findings additionally showed strong links between the transformational leadership practice vision building, goal interdependence, and, subsequently, the social learning activities. This indicates that a purposeful environment facilitates engagement in learning activities for specifically knowledge exchange. The reciprocity within these two sets of linked variables, as well as how their interplay sustains or even elevates levels of engagement in learning activities over time, will be examined in chapters 4 and 5.

Longitudinal studies

In *Chapter 4* we assessed the influences of the transformational leadership practices individualized consideration and intellectual stimulation, task interdependence, and self-efficacy beliefs on teachers' engagement in self-reflection is investigated *over time*, as well as the possible reciprocal relations between these variables. Questionnaire data gathered on three measurement occasions were analyzed using a multivariate Latent Difference Score (LDS) model. LDS modelling is a form of SEM, and combines cross-lagged regression analysis and latent growth curve modelling. This allows for the modelling of dynamic intra-individual change. Moreover, LDS models allow for dynamic coupling of variables over time.

Chapter 5 assessed whether VET teachers learned to learn *with* their team members, resulting in sustained engagement in the learning activity information sharing. Because the findings from chapter 3 indicted that a purposeful environment could facilitate sustained engagement in social learning, we investigated the role of goal interdependence and the transformational leadership practice vision building therein. Additionally, we assessed possible reciprocity between these variables. This investigation also used questionnaire data gathered on three measurement occasions, which were again analyzed using a multivariate LDS model.

General discussion

Chapter 6 brings the findings from the four studies together, and it reflects on the theoretical and practical implications of the findings. It furthermore discusses the concepts, methodology, and analyses applied in the studies, as well as future research directions.

Chapter 2

Fostering teacher learning in VET colleges Do leadership and teamwork matter?

This study explores teacher learning in Vocational Education and Training colleges, combining organizational and psychological factors, such as transformational leadership, teamwork, and self-efficacy. 447 teachers participated in a survey study. Multilevel structural equation modeling was used to test 7 hypotheses derived from previous research. The results show that transformational leadership has direct and indirect effects on teacher learning as mediated by teamwork processes. Moreover, the impact of teamwork processes on teacher learning was mediated by self-efficacy. The study contributes to research on workplace learning by giving insight into the role organizational and psychological factors play in stimulating teacher learning.

This chapter is based on: Oude Groote Beverborg, A., Slegers, P.J.C., & van Veen, K. (2015). Fostering teacher learning in VET colleges: Do leadership and teamwork matter? *Teaching and Teacher Education*, 48, 22-33.

During the last decade, governments, local politicians, and school managers across the globe have been involved in efforts at improving educational systems in support of better student performance. In the Netherlands, where this study takes place, schools in general, and Vocational Education and Training (VET) colleges in particular, have been confronted with ongoing reforms, including restructuring movements, educational reform efforts, and rigid accountability policies, as strategies to improve the quality of education. VET colleges have gone through many mergers with the formation of massive educational institutions as a consequence. These institutions also are involved in educational reforms aimed at the development of learning environments designed to stimulate self-regulated, reflective, independent, authentic and social-interactive learning. To implement these reforms, VET teachers are organized into multidisciplinary teams. Teachers from different disciplines and different subjects are called to collaborate for imparting the competences students *need* to become strong professionals and thus function in a continuously changing labor market. The challenge facing individual VET teachers is to learn how to work effectively in teams directed at strengthening their professional expertise and practice, with the ultimate goal of improving student performance.

Research has shown that the implementation of teams in educational settings is not an easy task and that altering teachers' practices is even more difficult (e.g. Crow & Pounder, 2000; Fullan, 2002; Scribner, Sawyer, Watson, & Myers, 2007; Somech & Drach-Zahavy, 2007). As VET colleges are expected to improve instruction through fostering individual and collaborative learning in teams, building school- and team-level capacity through professional developing initiatives seems to be an important prerequisite for sustained improvement (Hopkins & Reynolds, 2001; Parise & Spillane, 2010; Toole & Louis, 2002; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Stoll, 2009).

To better understand how schools can enhance their school wide capacity for improvement, different studies into organizational learning, professional learning communities, and schools as learning organizations have been conducted (Bryk, Camburn, & Louis, 1999; Leithwood & Louis, 1998; Silins, Mulford & Zarins, 2002; Wahlstrom & Louis, 2008). Findings from these studies have shown that such school organizational conditions as participative decision making, teacher collaboration, trust, and transformational leadership can clearly foster teachers' professional learning in schools. Many of these studies have used a system theory of change to understand the links between the structural and cultural dimensions of the school as a workplace and professional learning.

Additionally, research has also shown that psychological factors such as self-efficacy, teacher autonomy, and sense making affect teacher learning (Coburn, 2004; Richardson & Placier, 2001; Spillane, Reiser, & Reimer, 2002). This paper meets the call for studies wherein attention is paid to the interplay between psychological and work environmental factors (Richardson & Placier, 2001; Kwakman, 2003; Smylie, Lazarus, & Brownlee-Conyers, 1996), and builds on studies that recently examined organizational and psychological antecedents to the professional learning and classroom practices of teachers. These studies have shown that the impact of transformational leadership practices and workplace conditions on professional learning appears to be mediated by psychological factors, such as self-efficacy beliefs of teachers (Geijsel, Slegers, Stoel, & Kruger, 2009; Kwakman, 2003; Smylie et al., 1996; Thoonen, Slegers, Oort, Peetsma, & Geijsel, 2011).

However, most of the relevant studies have been conducted in primary schools, being relatively small communities, and thus concerned relatively long and intense connections between the teachers with the schools and also between the teachers and

students within the schools. VET colleges, in contrast, involve a higher level of education, have gone through many mergers, and have attracted experienced professionals from the actual field to teach their students with a wide variety of experiences and expectations as a consequence — particularly when the multidisciplinary teams are formed. Additional research is thus needed to validate previous findings.

Those organizational conditions and psychological factors studied to date have been found to explain only a small to moderate portion of the variance in the professional learning of teachers. It is thus likely that *additional* factors may also affect teacher learning. Although the few available studies provide some evidence for the relationship between teamwork, especially perceived task and goal interdependence, and professional learning of teachers, more research is needed, thereby validating and expanding existing models on teacher learning in schools.

This study aimed to contribute to these lines of research by exploring the role of self-efficacy in the relationship between transformational leadership, teamwork (i.e. perceived task and goal interdependence) and teacher learning in VET colleges, which seem important antecedents of teacher learning. By placing a strong emphasis on principals' behaviors that stimulate social identification, intrinsic motivation and extra effort, transformational leadership may mobilize the interpersonal relationships for the enactment of professional learning in schools. Through facilitating interaction between teachers, teamwork may create opportunities for knowledge sharing, open discussions, exchanging information, and thus for learning. A strong sense of self-efficacy motivates teachers to meet challenges, and thereby may positively influence the professional learning of teachers. These and other assumptions will be explained and discussed in more detail in the theoretical background.

The following research question guided our study: *To what extent do transformational leadership practices and teamwork affect teacher learning, as mediated by self-efficacy?*

Theoretical Framework

The framework used to guide this study is based on a model of teacher learning as developed in research on the interplay between teachers' psychological states and organizational conditions in teacher learning in elementary schools (Geijsel et al., 2009; Thoonen et al., 2011). Teacher learning was conceptualized as the engagement of teachers in a variety of professional learning activities within an educational context. Variations in teacher learning are viewed a function of the capacities and motivations of teachers, the characteristics of the organizational setting and transformational leadership practices

In the model that guide this study (see Figure 2.1) it is assumed that self-efficacy beliefs and teamwork will have direct effects on the engagement of teachers in professional learning activities. Teamwork also has indirect effects on teachers' engagement in professional learning activities through self-efficacy. Transformational leadership practices have indirect effects on the engagement of teachers in professional learning activities through teamwork and self-efficacy. Although not measured in this study, it is assumed that teacher learning in school will affect teachers' instructional practice, and in turn enhance student learning. We will test the relationships among these factors, using data from 447 teachers and 66 teams of 6 VET colleges. In order to elaborate the model more fully, we will

now describe the different variables and pose hypotheses around the relationships between the variables of the model.

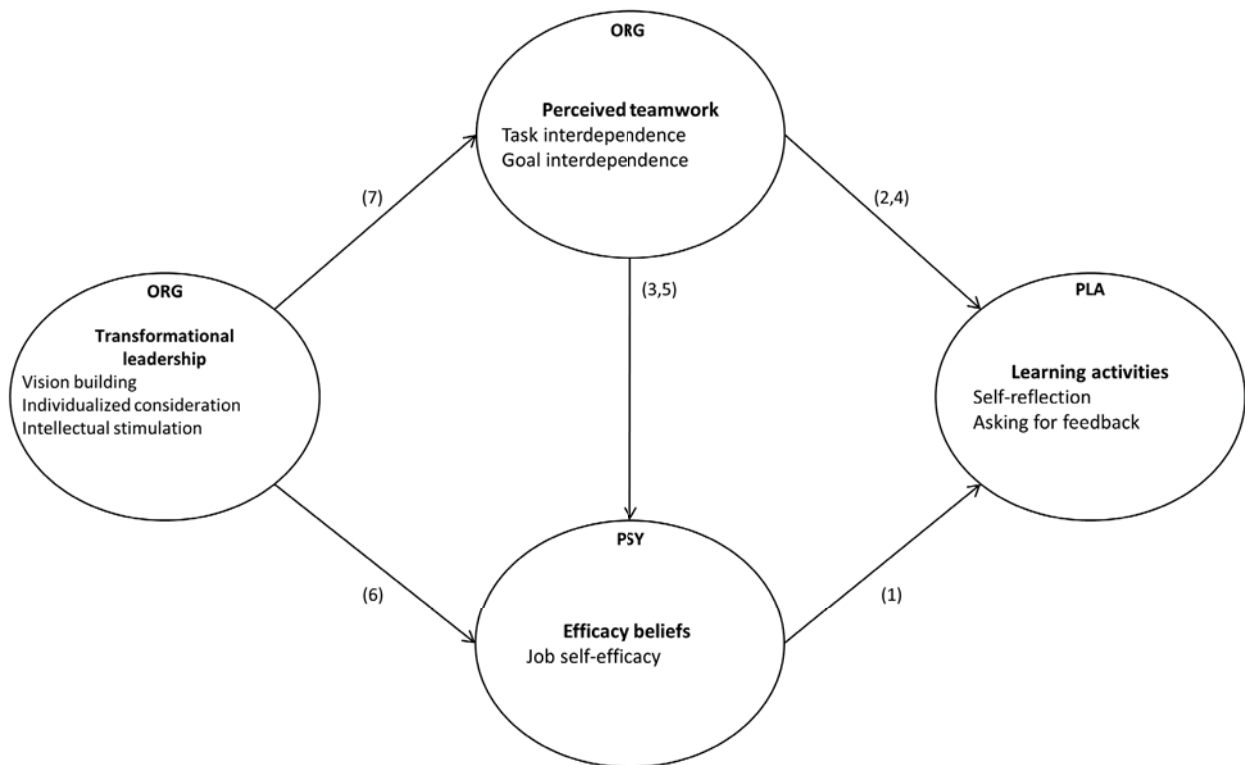


Figure 2.1

Theoretical model of the relations between transformational leadership practices, teamwork processes, teacher self-efficacy beliefs, and professional learning activities.

ORG represents the organizational conditions, PSY represents the psychological factor, PLA represents the professional learning activities. Hypotheses are in parentheses.

Teacher learning: engagement in professional learning activities

Research on professional development programs in the late 80's and early 90's provided evidence for the failure of earlier conceptions of teacher change as something that is done to teachers often based on a training paradigm that implied a deficit-mastery model and consisted of 'one-shot' professional development approaches (Richardson & Placier, 2001; Clarke & Hollingsworth, 2002). These findings caused many researchers to reconceptualize teacher professional development by using the "change as professional growth or learning" perspective to professional development. Teacher learning in the workplace is seen as an active and constructive process that is problem oriented, grounded in social settings and circumstances, and takes place throughout adults' lives (Jarvis, 1987; Marsick & Watkins, 1990; Smylie, 1995). In line with this view, researchers have emphasized the notion of ongoing and life-long teacher learning embedded in schools as a natural and thus expected component of professional activities of teachers and a key component to build school-level capacity to change and sustained improvement (Clarke & Hollingsworth, 2002; Jarvis, 1987; Marsick & Watkins, 1990; Kwakman, 2003; Putnam & Borko, 2000; Smylie, 1995). The focus of teacher learning is on teachers' engagement in a variety of

professional learning activities within schools and on becoming a participant in a community of learners (Sfard, 1998; ten Dam & Blom, 2006). This perspective on learning implies that teachers take responsibility for their own actions and acquire the necessary knowledge, skills and repertoire of activities to increase their participation in the school workplace environment. Via engagement in professional learning activities, teachers can stimulate both their own professional development and the development of the school and thus make a significant contribution to improving educational practice and, in turn increasing student performance (Desimone, 2009; Vescio, Ross, & Adams, 2008).

As research has shown that active learning (observing, discussion, planning, feedback, reflection) affect teaching practice and student learning (Garet, Porter, Desimone, Birman, & Yoon, 2001; Supovitz, 2002; Runhaar, Sanders, & Yang, 2010), we selected two professional learning activities for this study that are considered crucial for promoting professional development and school improvement: self-reflection and asking for feedback (Smylie, 1995; Korthagen, 2001; Kwakman, 2003; Lohman & Woolf, 2001). Although both learning activities stimulate reflection, the sources for self-reflection and thereby the nature of these learning activities, differ. Self-reflection can be seen as an *individual* learning activity, which recreates an experience of acting in a situation. To this 'relived' experience insights are added to create a new, altered, experience. This new experience serves as a basis for future actions of the one reflecting teacher (e.g., Barsalou, 2008). Through self-reflection, teachers are thus bound to their own experiences, values, beliefs and abilities to gain new insights, skills and knowledge. Asking for feedback is a *social* learning activity, in which a teacher asks a team member, the leader, or a student, to verbally model how to act in a situation. The teacher can use this advice to adapt future actions. By asking feedback, teachers thus gain new knowledge, skills, and ideas in social interaction with others. As such, self-reflection and asking for feedback are ways to discover the proper script for future actions aimed at adaptation to changing circumstances. In addition, both activities are nested in a social context, because both activities are about making implicit knowledge explicit (Nonaka & Takeuchi, 1995; van Woerkom, 2004). Because explicit knowledge is communicable, it is valuable for both the individual teacher and team members to find solutions to changes and challenges at work, and to formulate and monitor goals to come to such solutions. As such, self-reflection and asking for feedback are complementary ways to adapt to changing circumstances and learning.

However, engagement in these professional developmental activities is not self-evident, because of three, related, reasons. First, teachers flow with the issues of the day, and find it hard to disengage from the immediacy of their work to make time to reflect. Second, teaching traditionally had a high degree of autonomy (Clement & Vandenberghe, 2000), teachers are thus not used to interact frequently with team members to share information, knowledge or ideas, and ask for feedback. Third, asking for feedback means to expose oneself to possible criticism of others, which teachers may want to evade to avoid interpersonal conflicts.

Teacher learning and self-efficacy

One of the most important psychological factors that have been found to affect the engagement of teachers in professional learning activities is self-efficacy (Bandura, 1997). Self-efficacy beliefs are future-oriented beliefs about the level of competence that a person

expects he or she will display in a given situation. These beliefs stem from past experiences with similar – in this case teacher workplace – situations, and will be positive when these situations have been resolved positively (Bandura, 1997; Truijen, 2012). Self-efficacy works in two related ways. First, it strengthens teachers in pursuing interests and involvement in activities through setting themselves challenges (Bandura, 1997; Geijsel et al., 2009). Second, it takes away fear of failure and it strengthens persistence in pursuit of interests and goals (Runhaar et al., 2010).

When teachers engage in professional learning activities, they run the risk of receiving information which disconfirms their positive self-efficacy beliefs. Such experiences may then limit some teachers while others, who trust in their capacity to resolve problems and/or receive sufficient support, will feel competent enough to meet the new challenges; they will also more easily engage in professionalization learning activities than teachers who no longer believe in their own self-efficacy. Research has confirmed the association between self-efficacy and professional learning (Geijsel et al., 2009; Thoonen et al., 2011). Beliefs about their own effectiveness can thus, motivate (or demotivate) teachers to meet challenges, and thereby may have a positively impact on teachers' engagement in professional learning activities (Geijsel et al., 2009; Thoonen et al., 2011; Simbula, Guglielmi, & Schaufeli, 2011; Yost, 2006). Based on the aforementioned, we expect that self-efficacy positively affects teachers' engagement in professional learning activities, including self-reflection and asking for feedback (hypothesis 1).

Perceived task and goal interdependence in the facilitation of teacher learning

Previous studies into schools as professional communities have shown that organizational factors such as cooperation, participative decision making, and a climate of trust, can foster teachers' professional learning in schools (Kwakman, 2003; Leithwood, Jantzi, & Steinbach, 1999; van Woerkom, 2004). Additionally, collaborative experiences, peer interaction, and the exchange of knowledge and ideas are at the core of professional learning communities and can facilitate effective teamwork.

Teachers traditionally had a high degree of autonomy, and teachers are thus not used to work effectively in teams (Clement & Vandenberghe, 2000). Research has shown that the implementation of teams in educational settings is not an easy task, mainly because teachers do not support teamwork (Crow & Pounder, 2000; Fullan, 2002; Scribner et al., 2007; Somech & Drach-Zahavy, 2007; Truijen, 2012). For effective teamwork a certain degree of interaction between team members is required to complete tasks and attain goals. The more teachers perceive that task and goal interdependence can facilitate interaction and thus create opportunities for learning, the more they will learn to work effectively in a team (e.g., Aritzeta, & Balluerka, 2006).

Task interdependence

Task interdependence refers to the degree of interaction between team members required to complete tasks. When teacher perceive that they are more interdependent on their team members to complete their tasks successfully, they will exchange more information and resources with them (Campion, Medsker, & Higgs, 1993; Cummings, 1978;

De Jong, van der Vegt, & Molleman, 2007; van der Vegt, Emans, & van der Vliert, 2000). It may facilitate further collaboration, both collective and individual learning and, in turn, enhance team effectiveness (Truijen, 2012; Wageman, 1995).

Research on the role of collaboration between teachers for promoting professional learning has provided evidence for the positive impact of teacher interaction on teacher learning. In addition, teachers' self-efficacy beliefs have shown to mediate the effect of teacher interaction on professional learning and work engagement (Geijsel et al., 2009; Runhaar et al., 2010; Simbula et al., 2011; Thoonen et al., 2011; Staples & Webster, 2008). Collaboration and teacher interaction can thus offer teachers an "efficacy boost" (Hoy & Spero, 2005) and thereby facilitate their engagement in professional learning activities. Based on these findings, we derived the following hypotheses: perceived task interdependence will affect teachers' professional learning activities, including self-reflection and asking for feedback positively (hypothesis 2), and the effect of perceived task interdependence on teachers' professional learning activities will be mediated by teachers' sense of self-efficacy (hypothesis 3).

Goal interdependence

Goal interdependence refers to the degree of interaction needed to mutually pursue and reach a team's common goal (Deutsch, 1980; Weldon & Weingart, 1993). For teachers, perceiving goal interdependence means that their own benefits and costs depend upon not only their own goals but also those of other team members (Runhaar et al., 2010). Goal interdependence thus requires teachers to pursue a shared goal (van der Vegt & van de Vliert, 2002). We know little about how perceived goal interdependence affects teacher learning. The few available studies indicate that perceived goal interdependence is positively related with knowledge sharing, open discussions and exchanging information (Runhaar et al., 2010; Tjosvold, 2008).

When teachers perceive that they are goal interdependent, not only their engagement in professional learning activities can be expected to be enhanced but also their self-efficacy for the completion of these activities; that is, the facilitation of teacher learning by goal interdependence can be expected to be mediated by their self-efficacy. Pursuing a common goal may specify a course of action and thus reduce teachers' feelings of uncertainty and strengthen their beliefs in their ability to foster both individual and collective learning (e.g., Staples, & Webster, 2008). Research on the role of collaboration on teacher learning has shown that the more teachers collaborate, the stronger they believe in their capabilities to achieve desired results and the more they are engaged in professional learning (Geijsel et al., 2009; Thoonen et al., 2011; Tjosvold, Tang, & West, 2004). Based on these findings, we expect that perceived goal interdependence has a positive effect on teachers' professional learning activities, including self-reflection and asking for feedback (hypothesis 4), and that the effect of perceived goal interdependence on teachers' professional learning activities will be mediated by self-efficacy (hypothesis 5).

Transformational school leadership and the enhancement of teacher learning

Leadership is widely regarded as playing a significant role in school improvement and educational change, especially as it is inspired by the concept of transformational leadership

(Leithwood et al., 1999). The concept of transformational leadership, as developed by Bass (1985), has been well studied both outside and within education and provides an empirically grounded theory on the role of leadership in supporting organizational change (Bass & Avolio, 1994). Transformational leadership aims to develop teacher capacities and foster personal commitment to the organizational goals of the school, motivates teachers to do more than they originally expected and often even more than they thought possible, resulting in extra effort and changed practices (Leithwood et al., 1999; Ross & Gray, 2006). Research on transformational leadership in educational settings demonstrated positive relationships between transformational leadership and various organizational and teacher conditions (Sun & Leithwood, 2012).

Three specific dimensions of transformational leadership are identified: 1) identifying and articulating a vision which refers to the development of goals and priorities; 2) individual consideration, which includes attending to the feelings and needs of individual teachers; and 3) intellectual stimulation, which entails sufficient support of teacher professional development and the challenging of teachers to readdress their knowledge and daily practice (Geijsel et al., 2009; Leithwood & Jantzi, 2006; Leithwood et al., 1999; Thoonen et al., 2011).

Whereas direct effects of these three dimensions of transformational leaders on professional learning have been assumed in the literature, findings regarding these effects have not been consistent, however. The influence of transformational leadership on teacher learning has been sometimes positive, sometimes negative and sometimes absent (Geijsel et al., 2009; Runhaar et al., 2010; Thoonen et al., 2011). Findings from these studies also suggest that the impact of transformational leadership practices is strongly mediated by teacher commitment and self-efficacy. In addition to these insights, quite robust direct effects of transformational leadership on teacher commitment, motivation and self-efficacy and extra effort have been reported in the literature (Leithwood et al., 1999; Ross & Gray, 2006). Therefore we expect that the effect of transformational leadership on teachers' engagement in professional learning activities will be mediated by teachers' sense of self-efficacy (hypothesis 6).

Far less evidence has been found for the claim that transformational leadership can enhance teamwork in schools. Recently, some studies have shown that transformational leadership can enhance the prerequisites for effective teamwork — including related work place conditions such as teacher participation in decision making, collaboration, and trust (Moolenaar, 2012; Thoonen et al., 2011). A conceptual link can be thus be drawn between the three key dimensions of transformational leadership and the promotion of teamwork in a school. By identifying and articulating a vision or the first dimension of transformational leadership identified as critical for teacher learning, the transformational school leader inspires teachers to formulate shared goals, connect to these, identify with, commit to them, and try to attain them with increased teacher cooperation as a result (Thoonen et al., 2011). This increasingly collective effort may help teachers to better attain both their own goals and those of the school.

Individual consideration is needed as part of transformational school leadership because this requires school leaders to understand, recognize, understand, and meet the needs and concerns of team members. Acting as a role model, a transformational leader coaches, delegates challenging tasks, and provides feedback to help teachers to reach their personal potential. Teachers should feel empowered by a supportive, transformational school leader and — as a consequence — seek out to interact with other teachers to

complete their task successfully and pursue common goals (Dionne, Yammarino, Atwater, & Spangler, 2004; Geijsel et al., 2009).

Intellectual stimulation, or the third dimension of transformational leadership critical for the enhancement of teacher learning, involves the encouragement of teachers to continually question their beliefs, assumptions and values. Teamwork can be improved with the articulation of shared goals but also the establishment of a supportive environment and collective trust which enables the open discussion of new ideas, alternatives and solutions to problems (Dionne et al., 2004). Intellectual stimulation can enhance the teachers' ability to solve individual, group and organizational problems and thus help them to complete their task and formulate shared goals (Dionne et al., 2004; Geijsel et al., 2009).

In sum, it is likely that transformational leaders can have a modest, indirect impact on the engagement of teachers in professional learning activities provided sufficiently supportive workplace conditions. We therefore expect that the effect of transformational leadership on the engagement of teachers in professional learning activities will be mediated by their perceived goal and task interdependence (hypothesis 7).

Method

Sample

The data collection for this study was conducted at different multidisciplinary teams of six VET colleges. A multidisciplinary team is responsible for the coaching of a group of students, the guiding of these students' learning processes, curriculum planning and the assessment of these students. In multidisciplinary teams, teachers with different specializations work together on professional tasks aimed at preparing students for their future professions.

We used convenience sampling to obtain a sample as large as possible. The VET colleges were contacted via their board of directors. To increase the response, we aimed to present the study as personal as possible to the teacher teams by informing each team about the goal of the research and the content of the questionnaire with presentations, and we also offered them a presentation of the main findings. This was only possible in four of the six VET colleges. Within those four colleges team leaders were asked whether their teams were willing to participate. This strategy resulted in a total of 30 teams that were willing to participate. In the other two colleges, teachers were asked directly to participate in the study by email. This strategy resulted in a total of 37 teams.

The questionnaires were administered through the online program survey-monkey. Questionnaires were sent to 853 teachers of 67 teams. In one VET college 14 teachers were not part of a team, and were excluded from further analysis. Moreover, teachers from one team did not respond, resulting in an effective amount of 66 teams for further analysis. A total of 447 teachers completed the questionnaire (total response rate: 52%). Response rates of the two VET colleges whose teachers were contacted directly (by email) showed to be considerably lower (30 percent, respectively 50 percent), than those of the VET colleges whose teams were asked through their team leaders (all above 70%). Apparently, a personal approach did increase responses of teachers within teams (see Appendix A.1 for more details about response rates). As the response rates differed, we tested whether means and variances of the variables from the directly contacted teachers differ from the teachers who

were asked to participate by their team leader. We did not find significant differences, indicating that the way we asked the teachers to participate did not influence the interpretation of the results.

The teams differed in size. The smallest team held 4 teachers. The largest team held 25 teachers. Of the teachers who participated in this study 67% were men. The average age was 48 years (standard deviation 9 years, minimum age was 22, maximum age was 62). Most of the teachers that participated in our study worked more than 32 hours per week (61%). Most of the teachers had worked as a teacher for more than 20 years (33%). A sizeable portion of them had worked as a teacher for about 10 years (20%), and a small portion had just begun working as a teacher (4%). Most of the teachers had a bachelor degree (72%). 16% of the teachers had a Master degree, while 12% did not have a bachelor or master degree (secondary education as highest educational level).

Measures

The constructs were measured using existing, well validated scales on asking for feedback and reflection (Runhaar et al., 2010; van Woerkom, 2003), self-efficacy (Runhaar et al., 2010; Schyns, & Von Collani, 2002), task interdependence and goal interdependence (Runhaar et al., 2010; van der Vegt, Emans, & van der Vliert, 2000), and transformational leadership vision building, individual consideration, and intellectual stimulation (Geijsel, 2009; see also Leithwood, Dart, Jantzi, & Steinbach, 1993; Silins, 1994). All items used 5-point Likert scales (1 = strongly disagree, 2 = partially disagree, 3 = do not disagree, do not agree, 4 = partially agree, 5 = strongly agree).

Originally, the questionnaire contained 43 questions, divided over 8 scales. We performed exploratory factor analyses (with oblimin rotation) and item analyses using SPSS 20 to select the best items for each scale. This resulted in a decrease in the number of items to 39. In these initial analyses, we found that the items assessing 'asking for feedback' did not constitute one factor because the items referred to asking feedback from different people (e.g. team members, managers and students). As too few items remained for constructing separate scales, we therefore decided to remove 2 items about asking feedback from students and use one scale including 5 items referring to asking feedback from team members and managers.

We used Mplus7 (Muthén, & Muthén, 1998-2012) to analyze a measurement model. A confirmative factor analysis of the remaining 39 items measuring 8 factors showed a sufficient fit to the data: $\chi^2(674) = 1485.357$, $p < .010$, RMSEA = 0.052, CFI = 0.928, SRMR = 0.057. The internal consistencies of the scales indicated that all factors had a good reliability (Cronbach's α 's ranged between .77 and .94). The parameter estimates (i.e., the factor loadings, and residual variances), as well as the reliabilities, are presented in Appendix B. On the basis of the results of the measurement model, scales were constructed by averaging the item scores. For the means, and standard errors of the scales, and the correlations between the scales see Appendix C.1.

Analyses

The relationships between the variables depicted in Figure 2.1 were investigated through multilevel structural equation modeling (MSEM), using the computer program Mplus7 (Muthén & Muthén, 1998-2012). Given the nested structure of our sample (teachers nested within schools), and the possible dependence between subjects within schools that may result, we computed the intraclass correlations (ICC's). ICC is the proportion of the total variance that is explained by group membership. Larger ICC's indicate that respondents are more alike (Bliese, 2000). ICC values of .10 are considered as medium, and those of .15 as large, in educational contexts (Hox, 2002, page 184). Five variables had ICC's larger than .10, see Appendix C.1. Ignoring the nested structure of the data would therefore lead to incorrect results. That is, standard errors would be underestimated, leading to a higher type I error rate (i.e., finding a parameter significant when it is actually zero in the population). Given the fact that our variables were all assessed at the individual level and the fact that the study focused on important regression parameters (fixed effects) and not on school- or team-level variance (random effects), we decided to perform further analyses on the within-school covariance matrix by means of testing the "complex structure" in Mplus (Muthén & Muthén, 1998-2012). This option separates the team level from the individual level variance in which we are interested, and allows for modelling of the individual level, while taking the nested nature of the data into account. It gives maximum likelihood estimates with robust standard errors and a robust chi-square measure of overall goodness of fit (Yuan & Bentler, 2000). In addition, we also report the associated root mean squared error of approximation (RMSEA), the Comparative Fit Index (CFI, Hu & Bentler, 1999), and the standardized root mean square residual (SRMR). The fit of the model is good when the $SRMR \leq .08$ and $RMSEA \leq .06$ and the CFI is above .95 (Hu & Bentler, 1999; see also Kenny, 2012). We compared nested models by using the Satorra-Bentler scaled chi-square difference test (ΔX^2_{SB} , Satorra, & Bentler, 2001) with degrees of freedom (df) equal to the difference in numbers of parameters that are free to be estimated. If appropriate, model modifications were carried out on the basis of standardized residuals and modification indices. Effect sizes are small at .05, moderate at .15, and large at .35 (Field, 2009).

Results

The structural path model was fit to the data. This model included correlations between the three transformational leadership dimensions, the two interdependence variables, and the two variables measuring teachers' engagement in professional learning activities. The first fit of the structural model (model 1) to the data was not good as indicated by a RMSEA of .143, a CFI of .848, a SRMR of .071, and a $X^2(6)$ of 60.851 ($p = .0000$). Based on the modification indices we added three relations to the model. These were the effects of TL vision, TL consideration, and TL stimulation, on asking for feedback. The fit of this second model was good, $RMSEA = .000$, $SRMR = .004$, $CFI = 1.000$, $X^2(3) = 1.100$, $p = .777$. The second model improved the model fit significantly, $\Delta X^2_{SB}(3) = 63.976$, $p = .000$. Thus, we continued with the second model. Based on the principle of parsimony, we removed all non-significant effects from the model. This resulted in a model 3 with a good fit, $RMSEA = .005$, $SRMR = .034$, $CFI = 1.00$, and a $X^2(12) = 12.148$, $p = .434$. The findings showed that this model fits as good to the data as model 2 ($\Delta X^2_{SB}(9) = 10.985$, $p = .277$). Correlations among the

constructs are presented in Appendix C.1. Effect-sizes are presented in Figure 2.2. Direct, indirect and total effects are reported in Table 2.1.

Results of the final structural model showed that leadership, teamwork and psychological factors jointly explain variation in teachers' engagement in professional learning activities, with percentages of 29.3 for asking for feedback and 22.9 for reflection. A closer look at the relations found shows that, in line with our expectations, teachers' engagement in professional learning activities is directly influenced by self-efficacy (hypothesis 1). When teachers believe stronger in their capabilities to achieve a desired result, they are more engaged in professional learning activities. The findings also show that the effect of teachers' sense of self-efficacy on reflection (.34) is stronger than on asking for feedback (.12).

Besides teachers' sense of self-efficacy, perceived task interdependence appeared to affect teachers' engagement in professional learning activities directly (Hypothesis 2). This indicates that the more teachers perceive that they have to exchange information and resources with other team members to complete their tasks successfully, the more they are engaged in professional learning. The findings show that the effects of task interdependence on asking for feedback (.26) and self-reflection (.25) are moderate. Furthermore, the results showed that task-interdependence, also has a moderate effect on self-efficacy (.25), confirming hypothesis 3. Teachers who perceive more that they have to work together to complete their tasks successfully have stronger beliefs in their capabilities to perform effectively.

The effects of perceived goal interdependence on teachers' engagement in professional learning activities were different than we expected (hypothesis 4). The results show that goal interdependence only had a small effect on one of the professional learning activities, asking for feedback (.15). Teachers who perceive more that they work on a common goal together with their team members are more engaged in asking for feedback. In addition, the results show that goal interdependence does affect teachers' sense of self-efficacy as expected (hypothesis 5). Teachers who perceive more that they work on a common goal together with their team members have stronger beliefs that they are capable to perform effectively. This effect appeared to be small (.10) and less strong than the effect of the other teamwork process factor included in our study, task interdependence.

Table 2.1 Direct, indirect and total effects of transformational leadership practices, task and goal interdependence, and self-efficacy on learning activities

	Feedback			Reflection		
	Direct	Indirect	Total	Direct	Indirect	Total
TL-Vision	.10 [†]	.05*	.15		.01 [†]	.01
TL-Consideration		.03*	.03		.03*	.03
TL-Stimulation	.18*		.18			
Task interdependence	.26*	.03 [†]	.29	.25*	.08*	.33
Goal interdependence	.15*	n/s	.15		.03*	.03
Self-efficacy	.12 [†]		.12	.34*		.34

* = significant at $p < .01$

[†] = significant at $p < .05$

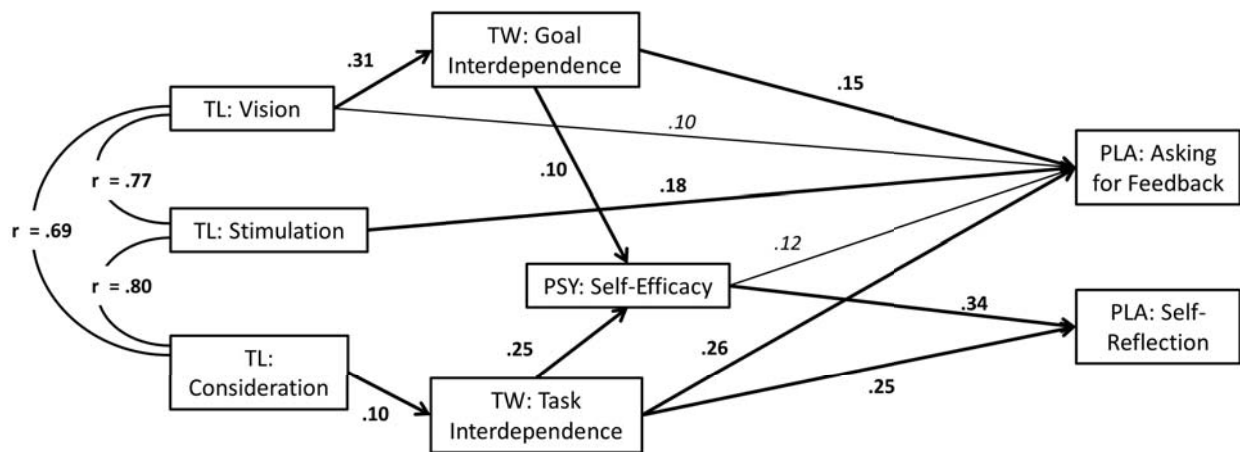


Figure 2.2

The differentiated effects of the organizational conditions transformational leadership (TL) and perceived teamwork (TW), and self-efficacy beliefs (as a psychological factor: PSY), on teachers' engagement in professional learning activities (PLA)

All bold effects are significant at $p < .01$, the italic effects are significant at $p < .05$.

With regard to the influence of transformational leadership practices, the results show that the effects were different than expected. First of all, it appeared that intellectual stimulation had a modest direct effect on one of the professional learning activities, namely asking for feedback (.18). Encouraging teachers to question their own beliefs, assumptions, and values seems to increase the degree to which teachers ask feedback. Vision building also appeared to have a modest direct effect on asking for feedback (.10). The more school leaders share their vision with teachers, the more they are engaged in asking for feedback.

Furthermore, we did not find direct effects of transformational leadership practices on teachers' sense of self-efficacy as expected (hypothesis 6). Neither building a vision, encouraging teachers to question their own beliefs, assumptions, and values, nor supporting teachers individually, appeared to enhance teachers' beliefs in their capabilities to achieve a desired result.

In addition, the findings show that the effects of the three dimensions of transformational leadership on teamwork process factors also differed from what we expected. Individual consideration appeared to have a small effect on task interdependence (.10), but not on goal interdependence. Teachers' perceptions of working together in the execution of tasks seem to be facilitated by leaders who support teachers individually. Vision building on the other hand appeared to have a moderate effect on goal interdependence (.32), but not on task interdependence. The more leaders share a vision with their teachers, the more teachers perceive that they work on a common goal. Finally, we did not find any effects of intellectual stimulation on both task and goal interdependence. These findings thus indicate that the effects of two of the three transformational leadership practices (vision building and individual support) on teachers' engagement in professional learning activities seem to be mediated by task and goal interdependence, partially confirming hypotheses 7.

Conclusion and discussion

Based on previous research in primary education, we formulated and tested a model of how transformational leadership practices, perceptions of team interdependence, and teachers' self-efficacy beliefs can facilitate teachers' engagement in professional learning activities. We tested a path model with a sample of 447 Dutch vocational education teachers in 66 teams in 6 VET colleges.

Summarizing, we found effects of self-efficacy beliefs on both asking for feedback and self-reflection. These findings indicate that teachers' sense of self-efficacy can be beneficial for teachers for becoming engaged in reflective learning. Subsequently, we may conclude that self-efficacy helps teachers to make their knowledge explicit, and to communicate it. Our results confirm the important role of teachers' sense of self-efficacy for teacher learning as found in earlier studies (Bandura, 1997; Geijsel et al., 2009; Simbula et al., 2011; Thoonen et al., 2011; Yost, 2006). Having said that, the effect of self-efficacy on asking for feedback was less strong than the effect of self-efficacy on reflection. As self-efficacy beliefs stem from positive 'relived' insights from past experiences with similar workplace situations, teachers with a high sense of self-efficacy feel more competent in resolving workplace problems effectively and meet new challenges more easily. As a consequence, they may be less inclined to share their experiences and problems with their colleagues and feel less need for asking for feedback. This may explain the differences in the impact self-efficacy has on individual (self-reflection) and social learning activities (asking for feedback). To validate our findings, future studies should focus on the differential effect teachers' self-efficacy beliefs can have on teachers' engagement in different learning activities.

Teamwork processes, including perceptions of task and goal interdependence, seem to have differential effects on teachers' engagement in professional learning activities. The data offer support for the impact of task interdependence on teacher learning in VET colleges. Perceiving to be interdependent in their tasks may stimulate them to make their knowledge more explicit and to ask for feedback from their team members. Goal interdependence, however, had an effect on asking for feedback, but not on self-reflection. These findings highlight the different role perceived task and goal interdependence may play in stimulating individual (self-reflection) and social learning activities (asking for feedback) in teacher teams. Although both task and goal interdependence facilitate teacher interactions, these teamwork processes differ in *purpose*. Task interdependence refers to interaction between team members required to complete *their tasks* successfully, while goal interdependence facilitates interaction needed to reach a *team's common goal*. Most teachers in Dutch schools in general, and the VET teachers in our study in particular, traditionally had and still have a high degree of autonomy, especially with regard to their core task: managing their classrooms and teaching their students. Moreover, given the so-called egg-crated structure of colleges, VET-teachers work most of their time isolated in their classrooms, separated from their colleagues. The more teachers perceive that task interdependence can improve their classroom practices, the more they are willing to collaborate with their team members. Moreover, by providing opportunities to learn from each other, for instance by providing feedback and advice, sharing knowledge, and solving problems related to teaching and student learning, task interdependence may stimulate the extent to which teachers try out new things and reflect individually on their classroom practices.

Goal interdependence means that teachers in teams mutually pursue a team's common goal. The more teachers perceive goal interdependence, the more they are willing to identify themselves with their team and internalize team goals into personal goals, resulting in higher levels of personal commitment to pursue shared goals, and extra effort to reach the team's common goal. By stimulating personal and social identification, increased commitment and extra effort, goal interdependence mobilizes interpersonal relationships between team members and offers them the opportunities to exchange ideas, explore and understand mutual perspectives and become engaged in open discussions to achieve mutually pursued goals. Although both task and goal interdependence thus facilitate teacher interaction, goal interdependence seems to be less directed towards improving teachers individual classroom practice, and thus enhance self-reflection than task interdependence. This may explain the different impact task and goal interdependence have on fostering social (asking for feedback) and individual learning activities (self-reflection) of VET teachers.

In the literature, it is often proposed that the nature of the work has to be assessed on whether both task and goal interdependence are needed for the team to function effectively. Incongruence between the amount of task and goal interdependence can have detrimental effects (van der Vegt & van de Vliert, 2002). However, at the time we administered the questionnaire working in multidisciplinary teams was relatively new for VET teachers and their practice was thus in a state of transition. VET teachers in this study had been used to working rather independently, and need to adapt to working in teams. Also, no clear policy about the way teachers were interdependent was present, so that teachers had to discover for themselves what working in a team means, and how to function in one. Because of this, we hypothesized task and goal to have a unique impact on teachers' learning. Furthermore, the congruence hypothesis assumes that teachers would benefit only from congruent high levels of task and goal interdependence. The mean scores, however, show that this assumption does not hold for our case: levels of perceived task interdependence were high, and levels of goal interdependence were on the mean of the scale. Whereas this could mean that these forms of interdependence were not suited to the teachers' work demands, our results indicate that perceptions of task and goal interdependence impact teacher learning activities in their own distinctive way. Future research must assess how these VET teachers' perceptions of collaborating on tasks and goals unfold over time.

Additionally, the findings show that the effects these teamwork process factors have on teachers' engagement in professional learning activities are mediated by teachers' sense of self-efficacy. These results confirm the key role self-efficacy plays in fostering teacher learning in schools and underline the need for conducting more research that focuses on the interplay between psychological factors and organizational conditions (e.g., Staples & Webster, 2008).

Although not expected, we found a moderate direct effect of intellectual stimulation on asking for feedback. Being challenged by their school leader may raise teachers' awareness that exchanging knowledge, skills, information and ideas in social interaction may help them to improve their professional expertise and craftsmanship. So, school leaders appeared to be strong sources of support for enhancing social learning activities, including asking for feedback, of their teachers.

We also found that vision building had a direct effect on asking for feedback, although this effect was small to moderate. In the context of the different change processes going on in the VET colleges that participated in our study, including the implementation of

teaming, this finding suggests that a vision may stimulate teachers to find a meaningful content to elaborate on. Especially when these different change processes coincide, the sharing of a vision may enhance teachers to seek advice and to ask feedback from colleagues. In addition, vision building appeared to have a strong effect on goal interdependence. By sharing a vision, teachers perceive to be working together on a common goal more. This supports the theoretical claim that by initiating and identifying a vision, a transformational school leader inspires teachers to formulate, identify with, commit to, and reach shared goals (Thoonen et al., 2011) and concurs with findings from previous research (Geijsel et al., 2009; Thoonen et al., 2011).

In contrast to vision building, individual consideration had an effect on task interdependence. This means that when teachers' needs are noticed and attended to by a transformational leader, teachers tend to exchange information and resources more with other team members to complete their tasks successfully. These findings suggest that teacher perceptions of interdependence in goals and tasks can be enhanced by specific transformational leadership practices and that these enhancements seem to follow differentiated paths.

Intellectual stimulation, however, seems to play a totally different role, as for this transformational leadership practice the found effect on teachers' engagement in professional learning activities is not mediated by task and goal interdependence. Encouraging teachers to question their beliefs, assumptions, and values may play a more important role in fostering affective and cognitive team processes, such as trust and collective problem solving than in creating opportunities for teachers to coordinate their actions. This may explain the different effect found for intellectual stimulation. Future studies should therefore include more and different work processes at the team-level, including affective and cognitive ones. The findings from these studies can help to increase our understanding of the role different teamwork processes may play in the link between leadership and individual and collective learning.

Unlike previous research done in elementary schools that showed a convincing role of teacher self-efficacy as a mediator between transformational leadership practices and teacher professional learning activities (Geijsel et al., 2009; Thoonen et al., 2011), our results did not confirm these findings. Contrary to our expectations self-efficacy was not affected by any of the transformational leadership practices. Possibly, this lack of an effect may be explained by the more complex and multi-level nature of leadership practices in VET colleges. As mentioned earlier, most of the studies have been conducted in elementary schools, being relatively small communities, with often relatively intense and long term relationships among teachers and between teachers and students. Contrary to elementary schools, where the lines between all people working in one building are much shorter, VET colleges are more loosely coupled organizations with multiple levels or subsystems. As such, VET-teachers may feel less empowered by school leaders who are responsible for a subsystem at a higher organizational level, such as a faculty or department, of which their team is just one of the organizational subunits. In this situation, interaction with team members may have a stronger impact on their motivation, as expressed by the effects of perceived goal and task interdependence on self-efficacy, than their formal leader who is less visible and approachable. Although the few available studies provide some evidence for the relationship between perceived task and goal interdependence, and professional learning of teachers, more research is needed, thereby validating our findings.

By including teamwork processes, especially perceived task and goal interdependence, this study has expanded existing models on teaching in schools as used in previous research. The findings clearly show that these variables play an important role in enhancing learning activities. Whereas task interdependence affects both learning activities, goal interdependence specifically affects teachers' engagement in asking for feedback. Including these additional variables has deepened our understanding about the interplay between organizational and psychological factors in teacher learning and the school as a workplace. Moreover, two clearly differentiated paths can be discerned to explain the variation of teachers' engagement in learning activities. The first path leads from a leader who shows consideration for teachers individually, through teachers' perceptions of working together on tasks and their senses of self-efficacy, to both teacher reflection and their asking for feedback. From a care for their individual needs and the possibility to observe a role model, teachers may feel empowered to interact with team members, further strengthening their beliefs to overcome problems, and subsequently to individually reflect on their interactions and experiences, as well as engage in making their knowledge explicit for, and asking for such knowledge from team members. As such, teacher learning is situated in a context of past experiences of collaboration and can be cultivated through a leader's consideration of needs and individual support.

The second path leads from a leader that shares a vision, through teachers' perceptions of being goal interdependent, to teachers asking for feedback. Vision building seems to help teachers to work together and pursue their common goals as a team. Subsequently, they ask each other for advice, possibly to monitor the collective progression towards their goals. As such, asking for feedback seems to be situated more in a context of immediate interaction towards a common goal and can be cultivated when a leader keeps sharing the school's vision.

These findings add to the evidence (Thoonen et al., 2011) in support of the model of Dionne et al. (2004). Like in their model, specific transformational leadership practices improved specific teamwork processes, and specific teamwork processes differentially enhanced teachers' engagement in specific professional learning activities. As such, the argument that researchers should focus on the impact of particular leadership practices, rather than the total effect of leadership, has just become more important to increase knowledge about effective leadership practices in educational settings (Leithwood et al., 2008; Thoonen et al., 2011). But these findings also show that particular leadership practices are only effective through specific workplace conditions. Teacher perceptions of these conditions have an impact on their engagement in learning activities in more or less the same degree. These findings suggest that both knowing how, and to what aim, team members function in their teams, is of equal importance for enhancing teacher learning in schools.

Limitations and further directions

A first limitation is the single source nature of our data. The data for this research were gathered with self-report questionnaires. Despite that these instruments correspond to the lingual and reflective nature of the constructs we were interested in, surveys may result in response shifts. The formulation, ordering, and presentation of the scales in one survey may evoke teachers unknowingly to make overly consistent evaluations that result in

invalidly found correlations. Other methods, such as large-scale observations, individual logs, and case studies may provide a detailed picture of the mechanisms through which leadership practices and teamwork processes affect teachers' engagement in professional activities. Also more in-depth studies may bring to light how VET teachers cope with diversity in their teams, conflict resolution, and the possibility of the emergence of sub cultures (Grossman & Stodolsky, 1995; Grossman, Wineburg, & Woolworth, 2001; Knippenberg, de Dreu, & Homan, 2004; van Veelen, Otten, & Hansen, 2013). The findings from these studies may validate the results found here.

As leadership inspired by the concept of transformational leadership can have an important facilitating role in fostering conditions for effective teamwork and teacher learning, we focused on three leadership practices. Our findings indicate that these transformational leadership practices are differentially effective, depending on the circumstances (see also Hallinger & Heck, 2011). More recently, different scholars have proposed to use a more integrated model, in which transformational leadership and instructional leadership coexist as a further 'challenge' to future research on school leadership (Hallinger, 2003; Marks & Printy, 2003; Robinson, Lloyd, & Rowe, 2008; Thoonen et al., 2011). We agree with the argument that researchers should focus more on a broader set of leadership activities, including transformational and instructional ones and distributed forms of leadership (Spillane et al., 2002). Findings from these studies may help to increase our understanding of the complex paths through which leadership has an impact on school improvement.

Additionally, despite the relatively high explained variance of the professional learning activities, the residual variance is high enough to warrant more or other variables to be included in the model. Future research should furthermore explore the influence of other organizational characteristics and team attributes often considered as crucial to enhance professional learning, including participation in decision making, collective efficacy, trust and team processes such as constructive conflicts and consensus (Geijsel et al., 2009, Thoonen et al., 2011). Additionally, professional learning is not limited to self-reflection and asking for feedback. Other individual and social learning activities as used in previous studies into teacher learning in schools, such as keeping up to date (Kwakman, 2003; Geijsel et al., 2009), innovative practices (Runhaar et al., 2010), and sharing knowledge (van Woerkom, 2003) may also be included in future research. The model tested in our study might function as a useful framework for follow-up research as it can help to hypothesize the relations between variables on more than just the individual level. With such multi-level models we can adequately capture the complexity of education today and yield useful information about the interplay between organizational characteristics, team features, and psychological factors in teacher learning and the school as a workplace (House, Rousseau, & Thomas-Hunt, 1995).

A last possible limitation of our study is its cross-sectional nature. This means that the structural equation analysis we used cannot ascertain causal relations. As the study shows a "snapshot image" of the situation, it may have exposed coincidental temporary relationships. In order to ensure causality, more longitudinal studies are needed than the few available yet (e.g. Hallinger & Heck, 2011; Heck & Hallinger, 2009). Findings from these studies could indicate whether teachers engage more in learning activities over time, how this is caused by leadership practices, teamwork processes, and efficacy beliefs, and how forms of learning communities can be sustained over time (Giles & Hargreaves, 2006).

Chapter 3

Promoting VET teachers' individual and social learning activities The empowering and purposeful role of transformational leadership, interdependence, and self-efficacy

This study explores the interaction between organizational and psychological factors that play a role in professional teacher learning. More specifically, how teachers' engagement in learning activities (e.g. keeping up to data, self-reflection, and experimenting, respectively, asking for feedback and information sharing) is influenced by the organizational factors transformational leadership and perceived interdependence, and the psychological factor self-efficacy. The study is conducted in the context of Vocational Education and Training (VET) colleges in the Netherlands, using a survey among 447 VET teachers working in 66 teams. Results showed that self-efficacy and task interdependence directly, and positively, influence a variety of learning activities. Task interdependence influenced self-efficacy positively. Goal interdependence influenced self-efficacy positively, but from the learning activities it only affected information sharing and social reflection positively. From the transformational leadership practices vision building positively affected goal interdependence, and consideration and stimulation positively affected task interdependence. In general, two configurations for the facilitation of teacher learning were found: one that empowers individual teachers to acquire new knowledge, and another that helps teachers to focus on shared goals and binds them to social learning. Teachers' engagement in learning activities, and consequently VET colleges' change capacities, is optimally facilitated by empowerment and purpose.

This chapter is based on: Oude Groote Beverborg, A., Sleegers, P.J.C., & van Veen, K. (2015). Promoting VET teachers' individual and social learning activities: The empowering and purposeful role of transformational leadership, interdependence, and self-efficacy. *Empirical Research in Vocational Education and Training*, 7(5).

This study explores the interaction between organizational and psychological factors that play a role in professional teacher learning in the context of Vocational Education and Training (VET) colleges in the Netherlands. Most studies that explore this interaction have been conducted in primary schools, involved small communities, and thus concerned relatively long and close connections between the teachers with the schools and also the teachers and students within the schools. VET colleges, in contrast, involve a higher level of education and have gone through many mergers with the formation of massive educational institutions as a consequence. These institutions have attracted experienced professionals from the actual field to teach their students but with a wide variety of experiences and expectations as a consequence – particularly when multidisciplinary teams are formed.

Moreover, this context of VET colleges is interesting because of the current changes in Dutch VET Colleges, which require teachers to collaborate and learn. During the past decade, VET colleges have been confronted with the implementation of so-called Competence-Based Education (CBE). For teachers, CBE means the integration of new theory, practices and subject matter into either existing or new courses (Ritzen, 2004). Teachers from different disciplines and different subjects are called to collaborate for CBE and thereby instill in students the competences necessary for their future professions. Successful implementation of CBE requires that teachers attune the content of their individual lessons, and that they coordinate to align their collective curriculum. To come to understand how to effectively adjust to such demands, individual and social professional learning activities are deemed necessary (Jarvis, 1987; Onderwijscoöperatie, 2012; Smylie, 1995; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; van Woerkom, 2003).

This transition seems to require not only an effort from individual teachers, but also from the organization. To facilitate contact between teachers, they have been organized into multidisciplinary teams (Meirink, Imants, Meijer, & Verloop, 2010; Meirink, Meijer, Verloop, & Bergen, 2009; Poortman, 2007; Truijen, 2012). This ought to facilitate coordination and may also create more potential learning opportunities. However, working in teams does not always accumulate in these desired effects (Meirink et al., 2010; Mueller, Procter, & Buchana, 2000; Slavin, 1990). Working in multidisciplinary teams is often foreign to teachers due to the traditionally individualistic nature of the profession. Teachers had been given much autonomy, and they consequently developed a personal responsibility for their classrooms (Somech & Boehler 2002). Formation of teams in an educational setting is therefore not an easy task and altering the practices of teachers is even more difficult (e.g. Crow & Pounder, 2000; Fullan, 2002; Scribner, Sawyer, Watson, & Myers, 2007; Somech & Drach-Zahavy, 2007). The challenge facing these teachers is thus to come to understand how to work effectively together as a team, and take collective responsibility for all students. Adjustment to a policy which requires engagement in both individual and team learning is assumed to be a major hurdle for teachers to overcome today.

To facilitate the transition from more autonomous forms of teaching to teaching in multidisciplinary teams, the building of a school-wide capacity to promote professional learning appears to be a major prerequisite for the successful formation of those teams. The question of how schools can build a capacity to promote teacher professional learning has been addressed in a wide variety of studies concerned with organizational learning, professional learning communities and schools as learning organizations (Bryk, Camburn, & Louis, 1999; Leithwood & Louis, 1998; Silins, Mulford, & Zarins, 2002; Stoll, 2009). These studies show the beneficial role of teamwork related factors (such as task and goal interdependence, participative decision making, teacher collaboration, and an open and

trustful climate) in affecting teacher learning. Additionally, other studies show that teamwork interacts with leadership (such as transformational leadership practices) and psychological factors (such as self-efficacy, experienced autonomy, and individual sense making) in fostering professional learning on the part of the teachers (van Veen, Sleegers, & van de Ven, 2005; Coburn, 2004; Richardson & Placier, 2001; Smylie, Lazarus, & Brownlee-Conyers, 1996; Spillane, Reiser, & Reimer, 2002). Especially in the context of teachers required to learn in teams, this interaction between organizational and psychological factors seems to be relevant. The current study extends these findings by placing these factors together in a model that hypothesizes their specific relations, and their effects on a variety of professional learning activities teachers can engage in.

In sum, this study aims to explore how VET teachers' engagement in professional learning activities is influenced by organizational and psychological factors. The following research question guides our inquiry: To what extent do organizational and psychological factors affect teacher learning in VET colleges?

In the next section we provide an overview of the key professional learning activities of teachers and the interplay between organizational factors and psychological factors in teacher learning. To understand their relationships, we draw on theories on adult learning, teacher motivation, teamwork and transformational leadership. Based on these theories and previous research, we will discuss the relationships between specific organizational and psychological factors and teachers' engagement in professional learning activities.

Theoretical background

The main assumption of this study is that in the context of VET teachers' learning in teams, organizational and psychological factors both play a role in professional teacher learning (cf. Kwakman, 2003; Richardson & Placier, 2001; Smylie et al., 1996). However, as will be argued in this section, each factor is assumed to play a specific role and this study aims to understand the contribution of each factor and the interaction between those factors. Figure 3.1 summarizes the factors that are taken into account and their assumed relationships.

The interplay between organizational and psychological factors in teacher learning

The organizational and psychological antecedents to the professional learning and classroom practices of teachers have recently been examined (Geijsel, Sleegers, Stoel, & Kruger, 2009; Thoonen, Sleegers, Oort, Peetsma, & Geijsel, 2011). These studies have shown specific dimensions of the school as a workplace environment (i.e. collaboration, participation, trust) to affect teacher learning but be mediated by such psychological factors as teacher motivation and commitment. Those organizational and psychological factors studied to date have been found to explain only a small to moderate portion of the variance in the professional learning of teachers. It is thus likely that *additional* organizational and psychological factors may affect teacher learning – particularly when a larger set of professional learning activities is considered than is currently the case. Keeping up to date, experimentation and reflection have been considered in this context, for example, but not

social forms of teacher learning such as asking for feedback and sharing of information. Additional research is thus needed to not only validate existing causal models but also expand these models to include additional organizational conditions, psychological factors and professional learning activities for a variety of educational sectors (e.g. secondary education, vocational education, higher education; van Veen, Zwart, & Meirink, 2012). Only with such multi-level models can we adequately capture the complexity of education today and yield useful information on the interplay between organizational and psychological factors in teacher learning and the school as a workplace (House, Rousseau, & Thomas-Hunt, 1995).

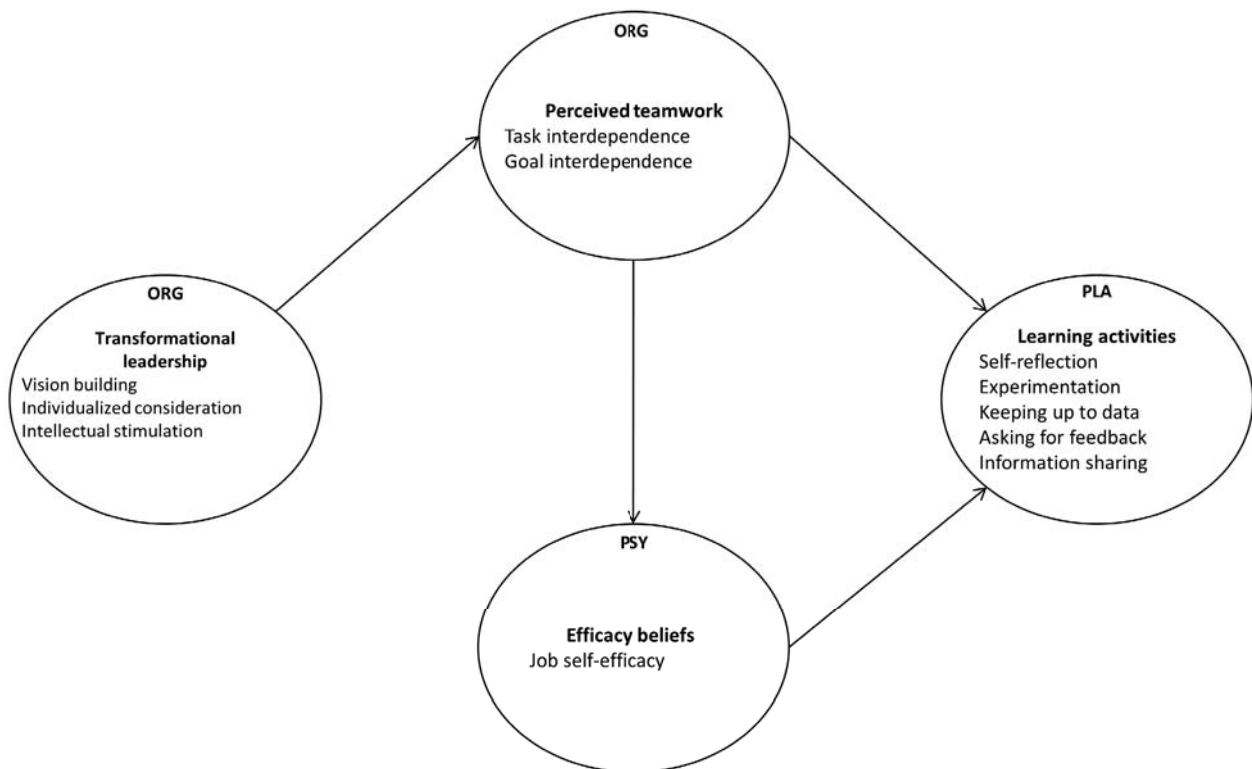


Figure 3.1

Theoretical model of the associations between the organizational conditions transformational leadership practices and teamwork, the psychological factor self-efficacy, and professional learning activities

Engagement in professional learning activities

Research has shown attendance of professional development workshops and training courses to hardly improve the teaching practices of teachers or help them adapt to changing teaching circumstances (Clarke & Hollingsworth, 2002; Richardson & Placier, 2001). A more promising approach is one in which teachers professionally learn in their workplaces, where their learning is defined as an active, constructive process that is mostly problem oriented, largely grounded in social interaction, and takes place during adulthood (Jarvis, 1987; Marsick & Watkins, 1990; Smylie, 1995). Ongoing, life-long learning is also considered a natural and thus expected component of the professional activities of teachers to improve

the quality of instruction and the school itself (Sleegers, Bolhuis, & Geijsel, 2005; Clarke & Hollingsworth, 2002; Cochran-Smith & Lytle, 1999; Desimone, 2009; Jarvis, 1987; Putnam & Borko, 2000; Smylie, 1995).

The focus of teacher learning should thus be on *engagement* in a variety of professional learning activities within the education context and becoming part of a community of learners (Sfard, 1998; ten Dam & Blom, 2006). Engagement in five core professional learning activities can be considered crucial for promoting the professional development of teachers and thereby school improvement (Kwakman, 2003; Lohman & Woolfe, 2001; Smylie, 1995; van Woerkom, 2004). These five vary from being individual, where others are not necessarily needed, to social learning activities requiring others, though it also can be claimed that the individual forms are more powerful if conducted with others.

The first professional learning activity is keeping up to date (Geijsel et al., 2009; Kwakman, 2003). This includes gaining and maintaining expert knowledge by reading professional literature, and keeping up to date with new developments with regard to teaching, instructional methods, curricula and education in general. Keeping up to date stresses the importance of obtaining new information and insights as part of the individual teacher's professional knowledge base.

The second professional learning activity is experimentation (Kwakman, 2003; van Woerkom, 2003). This refers to efforts to find ways to adapt current teaching practices to changed insights. By experimenting with new approaches and novel methods of instruction, teachers can determine what works in their classrooms. Experimentation is an individual learning activity in which 'knowledge is created by doing'. As much of this knowledge may not be verbal, observation of other teachers' experimentation may be the best way to obtain such knowledge.

The third professional learning activity is self-reflection (Runhaar, 2008; van Woerkom, 2003). This refers to a person recreating the experience of acting in a given situation. When insight is gained into the acting, the 'relived' experience can be supplemented with this information to create an altered and thus new experience. This new experience can then serve as the basis for future action (e.g., Barsalou, 2008; Clarke & Hollingsworth, 2002). Self-reflection is thus an individual learning activity aimed at discovering – among other things – a workable script for adaptation to changing circumstances. Although generated by one person, the knowledge gained in such a manner can be made explicit and shared as possibly of value for other individuals and the team, to find solutions to ongoing changes and challenges at work, and to formulate and monitor goals for further development and improvement.

The fourth professional learning activity is asking for feedback (van Woerkom, 2003). This is a social learning activity which resembles, in our view, keeping up to date in that it also entails gathering information (i.e. feedback) but now to identify suitable and not just potential ways of acting. Asking for feedback entails a further commitment to the feedback provided in one way or another (e.g. acceptance or provision of reasons for rejection). Teachers requesting feedback expose themselves to their colleagues, and may thus be accompanied by feelings of uncertainty. Colleagues providing feedback must be explicit for the feedback to be of any use.

The fifth professional learning activity is the sharing of information. This is also a social learning activity and refers to the effort of any team member to keep the flow of information going within a team. Ongoing information sharing means not only making

knowledge explicit but also discussing how this information is to be used, and to what purpose. In contrast to asking for feedback, sharing of information is less concerned with something which has come to one teacher's attention for improvement, and more concerned with stimulating all teachers to attend to things that may be improved. Similar to self-reflection, information sharing helps the team in general to monitor its progress (Cochran-Smith & Lytle, 1999; van Woerkom, 2003).

As such, professional learning activities of teachers can differ with regard to just how the new ideas and practices are generated, where the new ideas and practices come from, who will implement them, and whether they are of an individualistic or social nature (Cochran-Smith & Lytle, 1999; Geijssels et al., 2009; Runhaar, 2008; van Woerkom, 2003). Whereas the individualistic learning activities contribute to the generation of knowledge, engagement in these learning activities make this knowledge only *potentially* available for others. Through engagement in social learning activities new knowledge becomes available for, and can spread in, the whole team (Stoll et al., 2006). As such, research on just how engagement in social learning, in addition to individualistic learning, can be enhanced by psychological factors such as self-efficacy, and organizational conditions, such as interdependence and leadership, contributes to understanding how effective teams and schools' change capacities can be established.

Teacher learning and self-efficacy

Amongst the psychological factors that have been found to affect teachers' engagement in professional learning activities, self-efficacy beliefs play an important role (Bandura, 1997; Geijssels et al., 2009). Self-efficacy beliefs refer to the level of competence that a person *expects* to display in a given situation. Self-efficacy can develop from solving problematic or uncertain situations satisfactorily (i.e., mastery experience) (Bandura, 1997). Teachers with higher levels of self-efficacy challenge themselves to reach more difficult goals, will persist when faced with obstacles, are less constrained by doubt, and will thus arrive more often at satisfying solutions (Bandura, 1993; Caprara et al., 2008; Schwarzer & Hallum, 2008).

When teachers engage in professional learning activities, they run the risk of receiving information which disconfirms their positive self-efficacy beliefs. Such experiences may then limit some teachers while others, who trust in their capacity to resolve problems, will feel competent enough to meet the new challenges; teachers with higher levels of self-efficacy will therefore more easily engage in learning activities. Research has confirmed this positive effect of self-efficacy on professional learning (Moolenaar, Sleegers, & Daly, 2012; Simbula, Guglielmi, & Schaufeli, 2011; Yost, 2006). Self-efficacy beliefs can thus motivate teachers to meet challenges and thereby positively influence their engagement in professional learning activities (Geijssels et al., 2009; Runhaar, 2008; Thoonen et al., 2011).

Task and goal interdependence in the facilitation of teacher learning

Research into schools as professional communities has shown organizational factors such as cooperation, participative decision making and a climate of trust to foster professional learning on the part of teachers (Kwakman, 2003; Leithwood Jantzi, &

Steinbach, 1999; van Woerkom, 2004). Collaboration and the exchange of knowledge, ideas, and information are further known to lie at the core of professional learning communities (Stoll et al., 2006). Where teaching has traditionally had a high degree of individual autonomy (Clement & Vandenberghe, 2000) – and teachers are thus not accustomed to extensive cooperation and the generation and sharing of knowledge, ideas, and information – working in teams and sharing responsibility to get the work done successfully might overcome this habituation. But little is known about the role of teamwork in the facilitation of teacher learning (Dionne, Yammarino, Atwater, & Spangler 2004). What we do know is that task and goal interdependence can effectively stimulate the members of a team to interact, cooperate and pursue shared goals. Task and goal interdependence can thus facilitate collaboration and thereby both individual and team learning.

Task interdependence

Task interdependence refers to the degree of interaction between team members and coordination of efforts required to complete a task. For teachers, task interdependence should thus require the exchange of information and resources for successful task completion but also require them to coordinate their actions with those of others (van der Vegt, Emans, & van de Vliert, 2000). Task interdependence can thus be seen to provide the infrastructure needed to stimulate teacher interaction and the effective coordination of such interaction (Campion, Medsker, & Higgs, 1993; Cummings, 1978; de Jong, van der Vegt, & Molleman, 2007). It may thereby facilitate group effectiveness (Truijen, 2012), further collaboration and both social and individual learning (Wageman, 1995). Research on the role of collaboration in the facilitation of teacher learning has indeed revealed direct effects of teacher interaction on the professional learning activities undertaken by teachers as well as indirect effects of collaboration on their learning as mediated by their self-efficacy (Geijssel et al., 2009; Runhaar, 2008; Simbula et al., 2011; Staples & Webster, 2008; Thoonen et al., 2011).

Goal interdependence

Goal interdependence refers to the degree of coordination and interaction needed for the members of a team to attain both their own goals and the goals of the team (Deutsch, 1980; Weldon & Weingart, 1993). For teachers, goal interdependence thus means that their own costs and benefits depend upon the attainment of not only their own goals but also those of other team members (Runhaar, 2008). Goal interdependence thus requires teachers to pursue a shared goal (van der Vegt & van de Vliert, 2002). This can be the general enhancement of student learning, the creation of an authentic learning environment for students to practice the skills which they will need outside the school setting or – for example – the establishment of competence-based education.

Research has shown goal interdependence to be positively associated with knowledge sharing, open discussion and the exchange of information (Runhaar, 2008; Tjosvold, 1998; Tjosvold, Tang & West, 2004). Additionally, the more teachers have internalized the goals of the school as personal goals, the stronger the belief of the teachers in their capacity to achieve these goals and the greater the degree of engagement of the

teachers in professional learning activities (Geijsel et al., 2009; Runhaar, 2008; Thoonen et al., 2011). This makes it likely that an infrastructure that facilitates teachers to be interdependent in goal attainment does not only facilitate teachers' engagement in professional learning activities, but can be expected to also enhance their self-efficacy, that is, the facilitation of teacher learning by goal interdependence can be expected to be mediated by their self-efficacy.

Transformational school leadership

Transformational leadership is widely assumed to play a major role in the promotion of school improvement efforts and educational change (Leithwood et al., 1999; Leithwood & Slegers, 2006). Transformational school leadership aims to help teachers develop themselves, and foster personal commitment to the organizational goals of a school in order to change the practices of teachers and the school (Leithwood et al., 1999; Ross & Gray, 2006). Research has shown transformational school leadership to correlate with various organizational and teacher conditions (Sun & Leithwood, 2012) including increased participation in decision making and commitment to school improvement as well as increased teacher motivation to implement — for example — accountability policies (Geijsel, Slegers, Leithwood, & Jantzi, 2003; Leithwood & Jantzi, 2005; Leithwood, Steinbach & Jantzi, 2002). The findings regarding the influence of transformational leadership on teacher *learning* have not been consistent, however. The impact has been sometimes positive, sometimes negative and sometimes absent (Geijsel et al., 2009; Runhaar, 2008; Thoonen et al., 2011).

Three dimensions of transformational leadership have been identified as critical for the facilitation of teacher learning: 1) identifying and articulating a vision which fosters the development of shared goals and priorities; 2) attention to individual needs and feelings; and 3) intellectual stimulation with sufficient challenge and support (Geijsel et al., 2009; Geijsel, Slegers, & van den Berg, 1999; Leithwood & Jantzi, 2006; Leithwood et al., 1999; Nguni, Slegers, & Denessen, 2006; Thoonen et al., 2011). In addition to these insights, it has recently been shown that transformational school leadership can enhance the prerequisites for effective teamwork — including teacher participation in decision making, teacher collaboration and trust (Moolenaar et al., 2012; Thoonen et al., 2011). A conceptual link can thus be drawn between the three key dimensions of transformational leadership and the promotion of teamwork in a school.

With the articulation of a shared vision or the first dimension of transformational leadership identified as critical for teacher learning, the transformational school leader inspires teachers to formulate shared goals, connect to these, commit to them and try to attain them with increased teacher cooperation as a result (Thoonen et al., 2011). With this increasingly collective effort, individual teachers may then gain greater confidence in their ability to realize both their own goals and those of the school (Geijsel et al., 2003).

Individual support and attention are needed as part of transformational school leadership because this requires school leaders to recognize, understand and meet the needs and concerns of team members. Transformational school leaders should also act as role models, delegate challenging tasks, offer feedback and provide coaching in order to help individual teachers reach their personal potential. Teachers should feel empowered by a supportive, transformational school leader and — as a consequence — seek to interact with

other teachers and coordinate responsibility in the tasks they share (Dionne et al., 2004; Geijsel et al., 2009).

Intellectual stimulation or the third dimension of transformational leadership critical for the enhancement of teacher learning involves the encouragement of teachers to continually question their beliefs, assumptions and values. It tries to incite a critical attitude towards oneself and one's team members, that there are alternative solutions for the same problems, and that conflict can be functional for effective teamwork. As such, it can improve teamwork by enhancing teachers' abilities to solve individual, group and organizational problems (Dionne et al., 2004; Geijsel et al., 2009).

In sum, it is likely that transformational leaders can have a modest, indirect impact on the engagement of teachers in professional learning activities if sufficiently supportive workplace conditions are provided and teachers have a strong sense of self-efficacy.

The present study

The aim of the present study is to examine the impact transformational leadership, teamwork, and self-efficacy, have on teacher learning in VET colleges. The conceptual model of the study that summarizes the various paths via which teachers' engagement in professional learning activities can be influenced was already presented in Figure 3.1. Based on previous studies, we hypothesize that self-efficacy positively affects teachers' engagement in professional learning activities (hypothesis 1). With regard to the impact teamwork processes may have on teacher engagement in professional learning activities, we hypothesize that perceived task and goal interdependence will affect teachers' engagement in learning activities positively (hypothesis 2) and that the effect of perceived task and goal interdependence on teachers' engagement in professional learning activities will be mediated by teachers' sense of self-efficacy (hypothesis 3). Regarding the impact of transformational leadership practices (e.g., vision building, individualized support and intellectual stimulation) on teacher engagement in professional learning activities, we expect that transformational leadership indirectly fosters the engagement of teachers in professional learning activities with perceived goal and task interdependence mediating the effects (hypothesis 4).

Method

Context, data collection, and sample

The data collection for this study was conducted in multidisciplinary teams of six Vocational Education and Training colleges in the Netherlands in 2010. VET colleges have four levels, which represent a certain amount of mastery of an occupation. Students who have successfully finished the fourth level have, ideally, acquired all knowledge and skills to practice their profession fully and independently. People of any age (but at least 15 years old) may enroll to learn a (new) occupation.

Multidisciplinary teams consist of teachers who have complementary specializations needed to teach students their future professions. Some of those teachers have been educated as teachers themselves (and have at least a bachelor's degree), and some teachers

have gained much experience in the professional field (and may have any degree). The multidisciplinary teams were responsible for the coaching of a specific group of students, the guidance of their learning processes, the planning of the curricula for the group and assessment of their progress. Each team of teachers is responsible for the education of students for a profession in areas such as laboratory technology, electro technology, media technology, ICT, engineering, automobile technology, transport, tourism, catering industry, bakery and pastry, retail trade, business administration, law, and so on.

We used convenience sampling to obtain a sample as large as possible. The VET colleges were contacted via their board of directors. To increase the response, we provided the teacher teams information about the aim of study, the content of the questionnaire and offered them a presentation of the main findings in four of the six VET colleges. This strategy resulted in a total of 30 teams (7 or 8 per college) that were willing to participate. In the other two colleges, teachers were asked directly to participate in the study by email. This strategy resulted in a total of 37 teams (23, respectively 14, per college).

The questionnaires were administered through the online program survey-monkey. Questionnaires were sent to 853 teachers of 67 teams. In one VET college 14 teachers were not part of a team, and were excluded from further analysis. Moreover, teachers from one team did not respond, resulting in an effective amount of 66 teams for further analysis. A total of 447 teachers completed the questionnaire (total response rate: 52%). Response rates of the two VET colleges whose teachers were contacted directly (by email) showed to be considerably lower (30 percent, respectively 50, percent), than those of the VET colleges whose teams were asked through their team leaders (all above 70%).

These differences, and especially the low response rates in some of the teams, hindered a comparison between teams. Moreover, the teams differed in size: the smallest team held 4 teachers, and the largest team held 25 teachers.

Of all the teachers who responded, 67% was male. The average age of the respondents was 48 years (standard deviation of 9, minimum of 22, maximum of 62). The majority of the respondents worked more than 32 hours per week (61%). Many of the respondents had worked as a teacher for more than 20 years (33%); a sizeable percentage had worked around 10 years as a teacher (20%); and a small percentage had just begun working as a teacher (4%). Most of the teachers had a bachelor's degree (72%); 16% had a master's degree; and 12% had completed only a secondary level of education.

Measures of the model variables

As we aimed to explore how transformational leadership practices, perceived task and goal interdependence, teachers' self-efficacy beliefs affect teachers' their engagement in professional learning activities within the context of VET colleges and how these findings are related to findings of previous cross-sectional studies into teacher learning in primary education, we chose a survey design. The variables examined in our study were assessed using already existing, well-validated measurement scales: transformational leadership vision building, individual consideration and intellectual stimulation (Geijsel et al., 2009; see also Geijsel, Sleegers, van den Berg, & Kelchtermans, 2001; Leithwood, Dart, Jantzi, & Steinbach, 1993; Silins, 1994); perceived task and goal interdependence (Runhaar, 2008; van der Vegt et al., 2000); job self-efficacy (Runhaar, 2008; Schyns & Von Collani, 2002); keeping

up to date (Geijsel et al., 2001; Geijsel et al., 2009); and teacher reflection (Runhaar, 2008; van Woerkom, 2003).

In addition, experimentation was measured using two items selected from the experimentation and reflective-action scale developed by Geijsel et al. (2009) and two newly formulated items. Asking for feedback and information sharing were measured using items from the knowledge-sharing and feedback-asking scales developed by van Woerkom (2003) together with two items selected from a validated experimentation and reflective-action scale (Geijsel et al., 2009).

All questionnaire items were responded to along a 5-point Likert scale (1 = disagree much, 2 = disagree, 3 = do not disagree, do not agree, 4 = partially agree, 5 = agree much).

Our questionnaire initially contained 56 questions distributed across 11 scales. Preliminary exploratory factor analysis, (with oblimin rotation and maximum likelihood extraction; using SPSS 20) revealed only two as opposed to three transformational leadership variables (i.e. vision building and the combination of intellectual stimulation with individual support) and only four on stead of five professional learning activities (i.e. keeping up to date, experimentation, self-reflection and the scale called 'information sharing and social reflection'). The combination of individualized consideration and intellectual stimulation, but not vision building, suggests that teachers distinguish between leadership practices that address the whole team versus those that address them individually, but that they do not distinguish in whether they are individually empowered or individually challenged. The combination of asking for feedback and information sharing suggest that teachers do not distinguish in the direction information travels in, and consequently in whether they receive or provide information. Based on these findings, the number of items was reduced to 50 and the number of factors reduced to 9.

To see if the theoretical constructs (factors) such as we measured them fitted well to the data in relation with one another, a measurement model was next created using Mplus7 (Muthén and Muthén, 1998-2012). The findings showed a sufficient fit of the model to the actual data, $\chi^2(1139) = 2643.266$, $p=.000$, RMSEA = 0.054, CFI = 0.889, SRMR = 0.051. The scales were found to show good reliability (Cronbach's α 's ranged from .718 to .956). The parameter estimates (i.e. factor loadings and residual variances), as well as the α 's for each scale, are presented in Appendix B. In order to conduct multilevel analysis, we needed to reduce the number of parameters in the model. On the basis of the findings from the measurement model, we therefore constructed scales by averaging the item scores. For the means, standard errors, and correlations between the scales, see Appendix C.2.

Analysis-procedure for the structural model

The relationships between the variables depicted in Figure 3.1 were investigated through multilevel structural equation modeling (MSEM), using the computer program Mplus7 (Muthén & Muthén, 1998-2012). Given the nested structure of our sample (teachers nested within teams), and the possible dependence between teachers within teams that may result, we computed, the intraclass correlations (ICC's). ICC is the proportion of the total variance that is explained by group membership. Larger ICC's indicate that respondents are more alike (Bliese, 2000). ICC values of .10 are considered as medium, and those of .15 as large, in educational contexts (Hox, 2002, page 184). Five variables had ICC's larger than .10, see Appendix C.2. Ignoring the nested structure of the data would therefore lead to

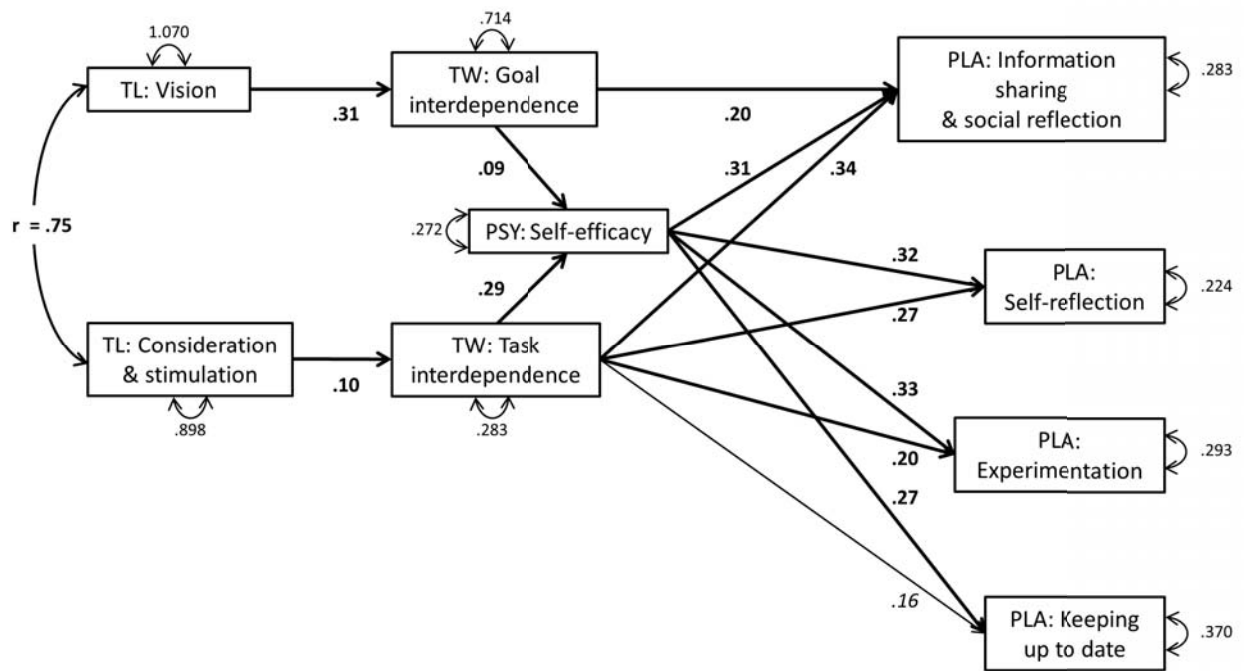
underestimated of the standard errors, which would lead to a higher type I error rate (i.e., finding a parameter significant when it is actually zero in the population). Given the fact that our variables were all assessed at the individual level and the fact that the study focused on important regression parameters (fixed effects) and not on school- or team-level variance (random effects), we decided to perform further analyses on the within-school covariance matrix by means of testing the “complex structure” in Mplus (Muthén & Muthén, 1998-2012). This option separates the team level from the individual level variance in which we are interested, and allows for modelling of the individual level, while taking the nested nature of the data into account. It gives maximum likelihood estimates with robust standard errors and a robust chi-square (X^2) measure of overall goodness of fit (Yuan & Bentler, 2000). In addition, the associated Root Mean Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI, Hu and Bentler, 1999) and the Standardized Root mean Square Residual (SRMR) were calculated. The fit of the model was found to be good when X^2 is not significant, the SRMR $\leq .08$, the RMSEA $\leq .06$ and the CFI $\geq .95$ (Hu & Bentler, 1999; see also Kenny, 2012).

We compared nested models using the Satorra-Bentler scaled chi-square difference test (ΔX^2_{SB} , Satorra and Bentler, 2001) with degrees of freedom (df) equal to the difference in the numbers of parameters left free for estimation. When appropriate, model modifications were made on the basis of the standardized residuals and modification indices. Effect sizes were judged to be small at .05, moderate at .15 or large at .35 (Field, 2009).

Results

The structural path model as specified by our hypotheses (see also Figure 3.1) was fit to the data. The fit of this model (model 1) to the data was good as indicated by a RMSEA of .041, a CFI of .989, an SRMR of .033, and a $X^2(10)$ of 17.682 ($p = .061$). One possible association to be added to the model was indicated by the modification index: This was the reversed effect of information sharing and social reflection on goal interdependence. We did not add this association to the model, but the finding indicates the possibility of a reciprocal relation between goal interdependence and social learning and is therefore worthy of further exploration in the future. In keeping with the principal of parsimony, we removed all non-significant effects from the model. These were the effect of vision building on task interdependence, and the effect of consideration and stimulation on goal interdependence, as well as the effects of goal interdependence on self-reflection, experimentation, and keeping up to date. This resulted in a model with a good fit, RMSEA = .027, SRMR = .035, CFI = 0.993 and $X^2(15) = 19.873$ ($p = .177$). The more parsimonious model (model 2) fitted just as well as the first model, $\Delta X^2_{SB}(5) = 2.362$, $p = .797$. The effect sizes are included in Figure 3.2. Direct, indirect and total effects are reported in Table 3.1.

The final structural modeling results show leadership practices, perceived goal and task interdependence and self-efficacy to jointly explain a significant amount of the variation in the engagement of VET teachers in professional learning activities: 33.6% of the variation in information sharing and social reflection; 16.3% for experimentation; 23.8% for self-reflection; and 9.0% for keeping up to date.

**Figure 3.2**

Significant associations between the organizational conditions transformational leadership practices (TL) and teamwork (TW), teacher self-efficacy (as a psychological factor: PSY), and engagement in professional learning activities (PLA) by 447 VET teachers working in 66 teams

All bold effects are significant at $p < .01$; all italic effects are significant at $p < .05$. For reasons of readability, correlations between teamwork processes (i.e. goal and task interdependence) and professional learning activities are not depicted in the figure.

Table 3.1 Direct, indirect and total effects of TL practices, teamwork, and self-efficacy on learning activities

		Information sharing & social reflection	Self-reflection	Experimentation	Keeping up to date
TL: vision	direct				
	indirect	0.07	0.01	0.01	0.01
	TOTAL	0.07	0.01	0.01	0.01
TL: consideration & stimulation	direct				
	indirect	0.04	0.04	0.03	0.02
	TOTAL	0.04	0.04	0.03	0.02
Task interdependence	direct	0.34	0.27	0.20	0.16
	indirect	0.09	0.09	0.10	0.08
	TOTAL	0.43	0.36	0.30	0.24
Goal interdependence	direct	0.20			
	indirect	0.03	0.03	0.03	0.02
	TOTAL	0.23	0.03	0.03	0.02
Self-efficacy	direct	0.31	0.32	0.33	0.27
	indirect				
	TOTAL	0.31	0.32	0.33	0.27

TL = Transformational Leadership

A closer look at the effects showed – in keeping with what we hypothesized – teacher engagement in the four professional learning activities to be directly influenced by self-efficacy (hypothesis 1). When teachers show stronger beliefs in their capacity to achieve a desired result, they also show greater engagement in professional learning activities. The significant effects of self-efficacy on information sharing and social reflection, self-reflection, experimentation, and keeping up to date were moderate to strong with values of .31, .32, .33 and .27, respectively.

Task interdependence was also found to directly affect teacher engagement in all four types of professional learning activity (hypothesis 2). The more teachers perceive a need to exchange information and resources with other team members to successfully complete tasks, the more they engage in professional learning. While all of the effects of task interdependence were moderate (i.e., .34 for knowledge sharing and social reflection, .27 for reflection, .20 for experimentation, .16 for keeping up to date), the effect of task interdependence on knowledge sharing and social reflection was double the size of the effect on keeping up to date. The results further showed a moderate effect (.29) of task interdependence on individual self-efficacy, which is in keeping with our hypothesis 3. Teachers who see themselves more as having to work together to successfully complete tasks also believe more in their capacity to perform effectively (i.e., greater self-efficacy is associated with greater task interdependence).

The effects of goal interdependence on teacher engagement in professional learning activities proved different than expected (hypothesis 2). Only a moderate effect (.20) on information sharing and social reflection was found. Teachers who report working on a shared goal more are also more engaged in sharing of information, discussion and seeking of advice. As expected (hypothesis 3), goal interdependence exerted a small (.09) but nevertheless significant effect on the individual self-efficacy of the teachers responding in our study. Those teachers who perceive more goal interdependence also report higher levels of self-efficacy. This effect was less strong than the effects of task interdependence on the individual self-efficacy of the teachers (see Figure 3.2).

We found the two transformational leadership practices to significantly influence the engagement of teachers in professional development activities but differently than expected (hypothesis 4). On the one hand, consideration and stimulation exerted a small effect on task interdependence (.10), as expected, but not on goal interdependence, which was counter to what we expected. On the other hand, vision showed a moderate effect on goal interdependence (.31), as expected, but not on task interdependence. These findings show different leadership practices to have a differential impact on teamwork processes. Teacher perceptions of working together towards a shared goal are facilitated by leaders working to create a shared vision, shared goals, and shared priorities. Teacher perceptions of working together to complete tasks are facilitated by leaders who provide individual support and intellectual stimulation to teachers. Consequently, vision building had its indirect effect mostly on the learning activity information sharing and social reflection, whereas consideration and stimulation had its indirect effects on all learning activities distributed more evenly (Table 3.1).

Discussion

We formulated and tested a model that was previously assessed in primary education, and selected organizational and psychological factors that were shown to affect Vocational Education and Training teachers' engagement in professional learning activities. More specifically, we assessed how transformational leadership practices, perceptions of interdependence and self-efficacy beliefs can facilitate teacher engagement in both individual and social professional learning activities, using a sample of 447 Dutch VET teachers working in 66 teams in 6 VET colleges.

Results from the factor analyses showed one instead of two social learning activities. Apparently, teachers do not distinguish between asking for feedback and information sharing, but tend to perceive it as one, social, learning activity. Although asking feedback and sharing information are often distinguished as two analytic different learning activities in the literature, our findings indicate that VET teachers do not consider these as separate activities in their daily practice. This may suggest that most interaction between VET teachers is strongly reciprocal in nature: while collaborating, teachers are simultaneously engaged in sharing information and asking feedback. To more fully understand the process of social learning, future research could assess whether different social learning activities may be related to environmental factors such as learning climate and trust, or rather to more personal factors such as uncertainty, expertise, or task demands (e.g., Little, 1990; Spillane, Kim, & Frank, 2012). Additionally, factor analysis on the transformational leadership dimensions showed two instead of three dimensions. Apparently, teachers do not distinguish between leadership practices directed at attending and supporting their needs, and practices that are meant to stimulate teachers intellectually and encourage them to question their beliefs, assumptions, and values. This may indicate that teachers perceive these practices as efforts to empower them to and improve their teaching (c.f., Jung & Sosik, 2002).

The findings from the parsimonious structural model showed high effects of teacher *self-efficacy* on engagement in all four categories of professional learning activities. This finding confirms the importance of self-efficacy for teacher learning, as found in previous studies (Geijsel et al., 2009; Thoonen et al., 2011; Bandura, 1993; Simbula et al., 2011; Yost, 2006),

With respect to the role of teamwork in teachers' engagement in professional development activities, task and goal interdependence were found to have differential effects – which was counter to what we hypothesized. Our data shows perceived *task interdependence* to clearly affect the learning of teachers in VET colleges. Organizing teachers to be interdependent for task performance thus appears to stimulate them to engage in a variety of learning activities which include making knowledge explicit, the sharing of information and the gathering of new information.

Our data further shows perceived *goal interdependence* to only affect the learning activity of information sharing and social reflection. That is, teachers working towards a shared goal appear to have better interpersonal communication but not necessarily greater personal reflection, independent acquisition of knowledge from external sources or modification of current teaching methods.

Although both task and goal interdependence facilitate teacher interactions, they differ in purpose. Task interdependence refers to interaction between team members required to complete their tasks successfully, while goal interdependence facilitates

interaction needed to reach a team's common goal. Given that teachers teach their classes mostly individually, the interdependence they perceive in tasks mostly refers to the content they provide their students in their lessons. Task interdependence therefore seems to drive any activity to improve individual teachers' instruction by means of collecting and generating new knowledge and skills. Perceptions of goal interdependence on the other hand refer to the mutual pursuit of a team's common goal. It stimulates identification with the team, mobilizes interpersonal relationships, and offers opportunities to exchange ideas, and explore and understand mutual perspectives in order to achieve the team's aims. Goal interdependence seems therefore specifically directed at coordinating and discussing shared team goals, whereas task interdependence seems generally directed at the generation of knowledge for the improvement of individual teacher's classroom practices. Thus, the difference in purpose of task and goal interdependence (c.f. van der Vegt and van de Vliert, 2002), may explain the differential effect of task and goal interdependence on teachers' engagement in social and individual learning activities.

Given the different role task and goal interdependence play in explaining teacher learning, the findings also show that the influences of both are mediated – as we hypothesized – by the teacher's sense of self-efficacy. These findings thus confirm the importance of considering individual psychological factors in connection with teacher learning and underline the need for more research on the interplay between psychological and teamwork processes (e.g., Staples & Webster, 2008).

With regard to school leadership, vision building showed a strong, direct effect on goal interdependence but not task interdependence. This supports the claim that with the formulation of a clear and shared vision, the transformational school leader can inspire teachers to formulate, identify with, commit to and strive to realize shared goals (Thoonen et al., 2011). In contrast to vision building, individual consideration and intellectual stimulation from the school leader showed only a – direct – effect on task interdependence. When school leaders attend more to the needs and feelings of teachers, and teachers are also challenged more by school leaders to explore new things, seek new methods and reflect on existing practices, teachers are inclined to perceive a stronger need to work together. This finding shows leadership practices to clearly empower teachers and encourage them to engage in variety of professional learning activities (Dionne et al., 2004; Tjosvold, Yu, & Hui, 2004).

Limitations of the present study

The present study found that self-efficacy and task interdependence directly, and positively, influence a variety of learning activities (at least all included in this study), and that task interdependence influences self-efficacy positively as well. Goal interdependence also influenced self-efficacy positively, but from the learning activities it only affected information sharing and social reflection (positively). From the transformational leadership practices vision building positively affected goal interdependence, and consideration and stimulation positively affected task interdependence.

The model tested here obviously simplifies what actually happens in a vocational teaching context. Teaching occurs, by definition, in a complex environment with numerous factors interacting at numerous levels not included in the current model (House et al., 1995). The model might therefore be expanded to include – among other things – distributed forms

of leadership (Spillane et al., 2002), emotions such as anxiety and uncertainty (van Veen et al., 2005), the role of conflict in teacher engagement (Johnson & Johnson, 2009) and identification with the team (or not) (van Veelen, Otten, & Hansen, 2013). Future research may also assess the role different learning activities play in changing teaching practices and elevating student results (Thoonen et al., 2011).

Additionally, measurement instruments and the formulation of items in surveys should be situation specific. Consequently, we used measures that tapped into general workplace circumstances (e.g., *job* self-efficacy). However, the findings from the current study might be validated with measures that are more adjusted to the teacher profession, such as *teacher* self-efficacy (Schwarzer et al., 1999).

The role of team-level factors might also be examined at the level of the team in addition to the individual level, by using multilevel analysis techniques that model variables that are conceptually relevant at the team level (e.g. Preacher, Zyphur, & Zhang, 2010; Truijen, 2012), such as team leadership, and team learning (Yammarino, Dionne, Schriesheim, & Dansereau, 2008). Such models may also include team measures such as the degree of diversity and longevity (Schipper, den Hartog, Koopman, & Wienk, 2003), collective efficacy (Moolenaar et al., 2012), shared mental models (Tjosvold et al., 2004) or and other variables needed to create multilevel models.

In future research, the beneficial effects teacher learning has on both their teaching practices and student performance should also be considered. Finally, longitudinal research is needed to ascertain the direction of causality for the associations identified in the present research (Heck and Hallinger, 2010). We can ask, for example, whether greater teacher engagement in professional learning activities over time is caused by steady states or concomitant growth in leadership practices, improvement of teamwork and enhanced self-efficacy (Sleegers, Thoonen, Oort, & Peetsma, 2014). Longitudinal research also provides opportunities to examine how the relationships between the variables we examined in our study are mutually shaped over time.

Conclusion

In conclusion, our context specific findings (Edmundson, Dillon, & Roloff, 2007) indicate two different paths that link transformational leadership practices, goal and task interdependence as an infrastructure for peer interaction, teachers' beliefs about their self-efficacy, and, consequently, their engagement in professional learning activities. The first path to explain the variation in teachers' engagement in professional learning activities leads from a school leader who attends the needs and feelings of individual teachers and challenges them intellectually, to teachers working together to complete tasks and having a positive sense of self-efficacy, to teachers' engagement in professional learning activities. With personal attention from the school leader acting as a positive role model, teachers tend to be more motivated to collaborate with their team members, believe more in their capacity to overcome problems and – as a result – are more engaged in individual learning activities such as self-reflection, and keeping up to date. This link between the variables examined indicates how teachers can be empowered to become engaged in individual learning activities aimed at generating new knowledge. As a multifaceted approach to teacher empowerment, the findings suggest that transformational leadership and team interaction can help teachers to cope with individual solutions for ongoing changes.

The second path links a leader who shares a vision, to teacher perceptions of being goal interdependent, to teachers sharing information and engaging in social reflection. These links indicate how school leaders can provide shared focus that binds teachers together. With the clear formulation and sharing of the school's mission (i.e., vision), transformational school leaders can encourage teachers to formulate and share related team goals and to work together to achieve these goals. The teachers may subsequently ask each other for advice and monitor their collective progress towards the achievement of these goals. Sharing information and social reflection are thus situated within the context of achieving shared goals and thus cultivated when the school leader continues to articulate and share the school's mission.

We therefore agree with pleas that teacher development research should focus on *specific* school leadership practices rather than the effects of the school leadership as a whole (Leithwood, Harris, & Hopkins, 2008; Thoonen et al., 2011). To effectively steer towards improved teacher learning in schools, school leaders can engage in supportive and stimulating practices, given the right infrastructure for collaboration. Free from barriers, and supported by structural resources, teachers will be motivated and become empowered to engage in learning activities that can generate new knowledge. When a school leader is particularly interested in elevating the exchange of knowledge and information amongst teachers, vision building practices and an environment that necessitates shared goals as an organic norm (Rowan, 1990) contribute additional to influences aimed at stimulating empowerment. Supplying content and purpose seem especially strong to overcome the persistence of privacy (Little, 1990) and enhance the change capacity of schools to implement educational reforms such as competence-based education.

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Chapter 4

Towards sustaining levels of reflective learning How do transformational leadership, task interdependence, and self-efficacy shape teacher learning in schools?

Whereas cross-sectional research has shown that transformational leadership, task interdependence, and self-efficacy are positively related to teachers' engagement in reflective learning activities, the causal direction of these relations needs further inquiry. At the same time, individual teacher learning might play a mutual role in strengthening school-level capacity for sustained improvement. Building on previous research, this longitudinal study therefore examines how transformational leadership, task interdependence, self-efficacy, and teachers' engagement in self-reflection mutually affect each other over time. Questionnaire data gathered on three measurement occasions from 655 Dutch Vocational Education and Training teachers was analyzed using a multivariate Latent Difference Score model. Results indicate that self-reflection and task interdependence reciprocally influence each other's change. A considerate and stimulating transformational leader was found to contribute to this process. Change in self-efficacy *was influenced by* self-reflection, indicating that learning leads to competency beliefs. Together, the findings point to the important role transformational leadership practices play in facilitating teamwork, and sustaining teachers' levels of learning in schools.

This chapter is based on: Oude Groote Beverborg, A., Sleegers, P.J.C., Endedijk, M.D., & van Veen, K. (2015). Towards sustaining levels of reflective learning: How do transformational leadership, task interdependence, and self-efficacy shape teacher learning in schools? *Societies*, 5.

During the past decade, teachers and schools over the globe have been confronted with all kind of changes, including changes in students' demographics, large-scale educational reforms, and accountability policies aimed at improving the quality of education. Building school-wide capacity by promoting teachers' individual and collective learning is considered an important prerequisite for school's ability to change and sustain improvement.

To be able to understand the mechanisms underlying sustained improvement, researchers have started to examine how teacher learning is embedded in schools and linked with building school-improvement capacity (Clarke & Hollingsworth, 2002; Geijsel, Sleegers, Stoel, & Kruger, 2009; Sleegers, Bolhuis, & Geijsel, 2005; Stoll, 2009; Stoll, Bolam, McMahon, Wallace, & Thomas, 2009). In line with this focus, empirical studies into the interplay between leadership, workplace conditions, and psychological factors in teacher learning have been conducted (Kwakman, 2003; Richardson & Placier, 2001; Smylie, Lazarus, & Brownlee-Conyers, 1996). Findings from these studies indicate that both psychological (e.g. self-efficacy, motivation) and organizational factors (e.g. transformational leadership, an open and trustful climate, task and goal interdependence) affect teacher learning such as self-reflection (Geijsel et al., 2009; Kwakman, 2003; Runhaar, Sanders, & Yang, 2010; Thoonen, Sleegers, Oort, Peetsma, & Geijsel, 2011; van Woerkom, 2004). Moreover, the impact of transformational leadership practices on self-reflection seems to be mediated by both teamwork and teacher motivational factors, including teachers' self-efficacy beliefs (Geijsel et al., 2009; Kwakman, 2003; Smylie et al., 1996; Thoonen et al., 2011). More specifically, a recent cross-sectional study has shown how transformational leadership, perceived task interdependence, and self-efficacy are positively related to teachers' engagement in reflective learning activities (Oude Groote Beverborg, Sleegers, & van Veen, 2015, or chapter 3 in this dissertation). Additionally, research has found that teachers' engagement in professional learning activities contributes to changing teachers' instructional practices with the ultimate goal of increasing student achievement (Desimone, 2009; Garet, Porter, Desimone, Birman, & Yoon, 2001; Sleegers, Thoonen, Oort, & Peetsma, 2014; Thoonen et al., 2011; Vescio, Ross, & Adams, 2008).

Although this research has contributed to a deeper understanding of mechanisms underlying educational change and teacher learning in schools, most of the studies are cross-sectional in nature, limiting valid and reliable claims about the direction of influence of the relations found. As cross-sectional estimates may generate misleading interpretations of mediation, longitudinal research can make stronger claims about causality (Cole & Maxwell, 2003; Eschleman & LaHuis, 2013; Maxwell, Cole, & Mitchell, 2011; McArdle, 2009). Moreover, longitudinal studies can make an important contribution to a complete understanding of the nature and dynamics of teacher learning as an important catalyst to foster sustained school improvement. Modeling the influences of transformational leadership, task interdependence, and self-efficacy on teachers' reflective learning over time will enable us to both validate previous findings from cross-sectional studies, and investigate possible reciprocal relations undetected by cross sectional models (e.g., Heck & Hallinger, 2010; Salanova, Bakker, & Llorens, 2006; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). For example, sustained engagement in self-reflection, as one of the key professional learning activities of teachers, may help teachers to discover how to benefit from workplace conditions such as being task interdependent. Coming to understand how their team members' knowledge and skills can function as resources, in turn, can then be beneficial to further their own learning (e.g., Horn & Little, 2010; Nonaka, 1994; Spillane, Reiser, &

Reimer, 2002). Additionally, longitudinal research also provides opportunities to investigate the type of change of teachers' engagement in professional learning activities and its antecedents. Levels may be enhanced or declined or sustained, as the result of a variable's (e.g., self-reflection) own dynamics or a coupling with other variables (e.g., transformational leadership and self-efficacy), and change rates may differ for individual teachers depending on their previous levels (e.g., Ferrer & McArdle, 2010). Exploration of these dynamics yields valuable insights in how teacher learning in schools, and its organizational and psychological antecedents, changes over time and what drive their changes. Although different scholars have emphasized the need for using more longitudinal designs in school improvement research (Feldhoff, Radisch, & Klieme, 2014; Hallinger & Heck, 2011; Heck & Hallinger, 2014; Slegers et al., 2014; Thoonen, Slegers, Oort, & Peetsma, 2012) there is still little systematic evidence for how organizational and psychological factors shape teacher learning in the context of the school over time. More longitudinal research is thus needed to increase our understanding of the nature and dynamics of these relationships and how change in schools occurs over time. This study aimed to make a significant contribution to this line of research by conducting a longitudinal study into the nature and dynamics of the paths that link transformational leadership practices, task interdependence, teachers' self-efficacy beliefs, and, consequently, their engagement in self-reflective learning activities (e.g., Geijssel et al., 2009; Leithwood, Jantzi, & Mascal, 2002).

The study was conducted within the context of Vocational Education and Training (VET) colleges in the Netherlands. During the past decade, VET colleges have become massive educational institutions due to many mergers and have also been involved in large educational reforms aimed at stimulating students' self-regulated and competence-based learning. One prominent issue in the implementation of these reforms is the reorganization of teachers' working conditions into multidisciplinary teams. Teachers from different disciplines and different subjects are called to collaborate for imparting the competences students need to become strong professionals and thus be better prepared for occupational participation in continuously changing labor market (Kwakman, 2003; Poortman, 2007; Truijen, 2012). As a consequence, individual VET teachers are challenged to learn how to work effectively in teams directed at strengthening their professional expertise and, in turn, fostering student learning. The study builds on earlier, cross-sectional, work in which we examined the influence of transformational leadership practices (e.g., vision building, stimulation and consideration), task and goal interdependence as aspects of teamwork, and self-efficacy on teachers' engagement in professional learning activities (e.g. self-reflection, asking for feedback) in Dutch VET colleges (Oude Groote Beverborg et al., 2015). The findings showed two clearly differentiated paths to explain the variation of teachers' engagement in learning activities of which one path leads from a transformational leader that shares a vision, through teachers' perceptions of being goal interdependent, to teachers asking for feedback. As such, asking for feedback seems to be situated in a context of immediate interaction towards a common goal and can be cultivated when a transformational leader keeps sharing the school's vision. The second path leads from a transformational leader who shows consideration for teachers individually, through teachers' perceptions of working together on tasks and their senses of self-efficacy, to teacher self-reflection. These findings suggest that teachers' engagement in self-reflective activities is situated in a context of past experiences of collaboration and can be cultivated through a leader's consideration of needs and individual support. The purpose of this longitudinal study was to investigate whether this latter path that links the relations

between transformational leadership practices, task interdependence, self-efficacy, and teacher self-reflection can still be found when assessed over time, thereby validating and extending previous models and findings from cross-sectional research. We also use the added value of a longitudinal design to explore reciprocal relations between these variables, and assess the dynamics of change that occur.

The main research question that guided our research was: How do transformational leadership practices, task interdependence, self-efficacy, and teacher self-reflection mutually shape each other over time?

Theoretical framework

An important contribution of our study lies in our attempts to examine changes in transformational leadership practices, task interdependence, teachers' self-efficacy beliefs and their engagement in professional learning activities and how the relationships among these variables evolve over time, by using Latent Difference Score modeling (LDS; see for a more detailed elaboration, below). To understand these relationships, we draw on theories on adult learning, teacher motivation, teamwork and transformational leadership, and use previous findings from cross-sectional research on the interplay between teachers' psychological states and organizational conditions in teacher learning. The model that guided our inquiry is depicted in Figure 4.1. To test this model, we used data from a sample of 655 Dutch VET teachers. We discuss the variables of our study more fully, and the expected relationship among them in further detail below.

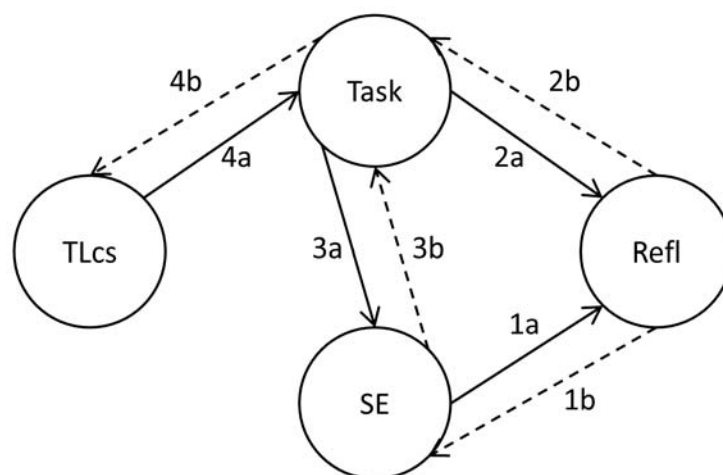


Figure 4.1

Theoretical framework of how self-reflection (Refl) is influenced by self-efficacy (SE), perceived task interdependence (Task), and the transformational leadership practices individualized consideration and intellectual support (TLcs)(solid arrows), as well as the reciprocal relations that will be explored (dashed arrows)

The numbers 1a-4b represent the hypotheses.

Professional learning through engagement in self-reflection

Inspired by adult learning theories and situated cognitive perspective on teacher learning, we conceptualized professional learning as an on-going informal learning process that is embedded within the school and that takes place during the entire career (Jarvis, 1987; Kwakman, 2003; Marsick & Watkins, 1990; Putnam & Borko, 2000; Slegers et al., 2005; Smylie & Hart, 1999). In line with this perspective, the focus of teacher learning in the context of the school is on teachers' engagement in a variety of professional learning activities aimed at stimulating their own professional development and the development of the school as a whole.

Although scholars have studied a variety of different professional learning activities to capture the content of professional learning (e.g., Kwakman, 2009; Meirink, Meijer, Verloop, & Bergen, 2009), a distinction between individual and social professional learning activities can be depicted from the literature (Kwakman, 2009; Lohman, 2005; Schön, 1983; van Woerkom, 2003). Individual learning activities refer to activities aimed to explore and reflect on one's own values, interests, abilities, and career goals, and are carried out individually without any assistance from colleagues or supervisors. Examples of individual learning activities are reflecting on past performances, reading professional material, and focusing on future career goals. Social learning activities refer to activities aimed at acquiring new knowledge, skills, information and ideas that are acquired in social interaction with others. Examples of social learning activities are sharing knowledge, asking for feedback and challenging groupthink. Although both types of learning activities are ways to discover the proper script for future actions and are nested in a social context, the sources and thereby the nature of these learning activities thus differ. As indicated, in this study we focus on self-reflection as one of the most important individual learning activities teachers are engaged in during their daily practice (Jarvis, 1987; van Woerkom, 2003).

Self-reflection is an introspective activity and refers to a person recreating the experience of acting in a given situation. In 'reliving' this experience a person supplements the memory of the experience with new ideas that can either be self-generated or based on information gained from others. This creates an altered and thus new experience, which can then serve as the basis for future action (e.g., Barsalou, 2008). Self-reflection allows teachers to broaden their teaching repertoire, generate new knowledge, and make knowledge explicit aimed at discovering a workable script for adaptation to changing circumstances (Jarvis, 1987; van Woerkom, 2003). These adaptations may in turn fuel continuance of individual teachers' own reflections (Clarke & Hollingsworth, 2002), and can be of value for team members (van Woerkom, 2004), as knowledge gained through self-reflection can be made explicit and shared. Moreover, as circumstances continuously change old solutions expire, and hence sustained levels of engagement in self-reflection are important for maintaining high levels of craftsmanship (Klarner, Probst, & Soparnot, 2008; Korthagen & Vasalos, 2005). Newly generated knowledge can be experimented with to fit to changed circumstances (Eraut, 2004; McArdle & Coutts, 2010). Research has shown that self-reflection contributes to changing instructional practices, and in turn improved student performance (Desimone, 2009; Garet et al., 2001; Korthagen, 2001; Kwakman, 2009; Slegers et al., 2014; Thoonen et al., 2011). The importance of teacher reflection for improving the quality of education therefore leads to the question how to facilitate reflection, and how to sustain sufficient levels of learning over time (Giles & Hargreaves, 2006; Timperley & Alton-Lee, 2008).

Self-efficacy beliefs

Self-efficacy represents the level of competence a person expects to display in a given situation. Self-efficacy develops, for instance, from coping with various difficult and complex situations successfully as the experience of mastery is one of the most important sources of self-efficacy, next to modeling or vicarious experiences, social persuasion, and physiological and emotional states (Bandura, 1997). In addition, repeatedly perceiving team members resolving problems can facilitate the development of a teacher's own self-efficacy through vicarious learning or modeling. Persons with higher levels of self-efficacy will persist in the face of difficulties, feel empowered, are less constraint by doubts, and will thus arrive quicker at a satisfying solution (Bandura, 1993; Caprara et al., 2008).

Cross-sectional research has shown that teachers who have higher levels of self-efficacy are more engaged in learning activities (e.g. self-reflection) that may challenges existing knowledge, beliefs, and classroom practices than their colleagues with lower levels of self-efficacy (Geijsel et al., 2009; Katz-Navon & Erez, 2005; Runhaar, 2008; Thoonen et al., 2011; Walumbwa, Lawler, Avolio, Wang, & Shi, 2005). Additionally, longitudinal research indicates that self-efficacy has predictive power over time on levels of vigor and dedication of teachers (Simbula, Guglielmi, & Schaufeli, 2011), as well as on changing instructional practices (Sleegers et al., 2014). Interestingly for the present study, empirical evidence suggests that self-efficacy is not a stable phenomenon: it grows in primary school children (Phan, 2012), declines in adolescents (Caprara et al., 2008), and fluctuates in teachers (Thoonen et al., 2012). To what extent teachers' beliefs in their self-efficacy changes, and the manner in which these changes relate over time to engagement in self-reflection, has yet to be addressed. It seems however likely that increases in beliefs about their own effectiveness motivate teachers to meet challenges, and thereby may positively affect their engagement in professional learning activities over time. Additionally, reflection may also impact self-efficacy. Generating knowledge to adapt to changing circumstances helps to resolve problems and come to satisfying solutions. Sustained levels of self-reflection can therefore lead to mastery experiences, and thus help to develop beliefs of self-efficacy, which makes it worthwhile to explore whether a bidirectional link between these variables can be found. As only a few available studies have examined this reciprocal relationship (Bandura, 1993; Malmberg, Hagger, & Webster, 2014), more research is needed. Based on previous cross-sectional studies, we expect that higher reported levels of self-efficacy will increase teachers' engagement in self-reflection (Hypothesis 1a). In line with the outcomes of the few available studies studying the reciprocal relationship (Bandura, 1993; Malmberg et al., 2014), we also hypothesize that as teachers' engagement in self-reflection increases over time, their self-efficacy beliefs will also increase (Hypothesis 1b).

Perceived task interdependence

Task interdependence refers to the perceived degree of interaction between team members required to complete tasks. Thus, task interdependence can be seen as providing the infrastructure needed to stimulate teacher interaction as well as the exchange of information and resources for successful task completion (Camion, Medsker, & Higgs, 1993; Cummings, 1978; de Jong, van der Vegt, & Molleman, 2007; van der Vegt, Emans, & van de Vliert, 2000). Research on the role of collaboration between teachers for promoting

professional learning has provided evidence for the positive impact of teacher interaction on teacher learning, and, in turn, enhance team effectiveness (Truijen, 2012; Wageman, 1995). Because teachers can use knowledge that team members have made explicit as input for their own reflection, interacting with team members facilitates teacher engagement in self-reflective activities (Meirink, Imants, Meijer, & Verloop, 2010; Meirink et al., 2009; Runhaar, 2008). In addition, teachers' self-efficacy beliefs have been shown to mediate the effect of teacher interaction on professional learning and vigor and dedication of teachers (Geijsel et al., 2009; Simbula et al., 2011; Thoonen et al., 2011) by removing uncertainty and ambiguity (Staples & Webster, 2008). Collaboration and teacher interaction can thus offer teachers an "efficacy boost" (Hoy & Spero, 2005), thereby facilitating their engagement in professional learning activities. Although these findings make it likely that perceptions of task interdependence have a positive impact on engagement in self-reflection and self-efficacy beliefs, we know little about how interactions with peers who are directly engaged in the same task affect teachers' sense of self-efficacy and their self-reflective activities over time.

As teachers need time to come to understand how to interact with colleagues to complete tasks, generating knowledge to adapt to changing circumstances might help (Mulford, 2010; Scribner, Hager, & Warne, 2002). When teachers find adequate ways to interact with each other, obtained knowledge from colleagues can be beneficial to further promote their own learning (Desimone, 2009; Horn & Little, 2010; Nonaka, 1994; Spillane et al., 2002). Additionally, enhanced efficacy beliefs about resolving conflict in teams through vicarious team experience have been found to positively affect expected outcomes of teams (Stone & Bailey, 2007). Therefore, self-efficacy may also influence change in perceptions of task interdependence: having a more positive view of intra-team conflict and having confidence that conflicts will be resolved may lead to more frequent and more positive interactions. Teachers may thus come to value more interdependence in working on tasks. In this study, we therefore hypothesize that higher levels of perceived task interdependence will increase teachers' engagement in self-reflection (Hypothesis 2a). Based on a more dynamic representation of the assumed associations between these variables, we also expected that as teachers' engagement in self-reflection increases over time, perceived task interdependence would also increase (Hypothesis 2b). In addition, we hypothesize the time-based dynamic relations between self-efficacy and task interdependence as follows: as teachers perceive higher levels of perceived task interdependence, higher level beliefs about their own self-efficacy are expected to follow (Hypothesis 3a) and vice versa (Hypothesis 3b).

Transformational leadership

Leadership is widely assumed to play a major role in the promotion of school improvement efforts and educational change, particularly when the leadership is characterized as what is called 'transformational leadership' (Leithwood, Jantzi, & Steinbach, 1999). A transformational leader aims at development in a context of organizational change and is committed to the empowerment of individual teachers and teacher teams as a whole (Avolio, Zhu, Kho, & Bhata, 2004; Bass & Avolio, 1994; Leithwood et al., 2002; Leithwood & Slegers, 2006; Yammarino, Dionne, Schriesheim, & Dansereau, 2008). Three transformational leadership dimensions have been found critical for the enhancement of individual learning activities (Geijsel, Slegers, & van den Berg, 1999). The first dimension of initiating and identifying a vision refers to a leader who works on the development of shared

goals and priorities by inspiring teachers to formulate shared goals, connect to these, commit to them, and try to attain them. The second dimension of individualized consideration refers to support and attention for individual needs and feelings. Teachers should feel empowered by a considerate transformational school leader and — as a consequence — seek to interact with other teachers and coordinate responsibility in the tasks they share (Dionne, Yammarino, Atwater & Spangler, 2004; Geijsel et al., 2009). Intellectual stimulation as the third dimension of transformational leadership involves the encouragement of teachers to continuously calibrate the adequacy of their knowledge and instructional practices. It tries to incite a critical attitude towards oneself and one's team members through the idea that not one solution is absolute, that there alternatives to problems, and that conflict can be functional for effective teamwork. As such, it can improve team-work by enhancing teachers' abilities to solve individual, group and organizational problems (Dionne et al., 2004; Geijsel et al., 2009).

Whereas the three dimensions of transformational leadership would appear to directly influence self-efficacy and teacher learning (e.g., Geijsel, Sleegers, Leithwood, & Jantzi, 2003; Sleegers et al., 2014; Yost, 2006), empirical research that addressed these effects did not consistently find these effects, however (e.g., Nielsen & Munir, 2009; Tims, Bakker, & Xanthopoulou, 2011). Instead of a direct link, it seems more likely that the relation between transformational leadership on the one hand, and self-efficacy and self-reflection on the other hand, is mediated by perceptions of workplace conditions (e.g., Geijsel et al., 2009; Korek, Felfe, & Zäpernick-Rothe, 2010; Nielsen, Randall, Yarker, & Brenner, 2008; Nir & Kranot, 2006; Thoonen et al., 2011). Previous studies have indeed found that transformational leadership practices is related to various workplace conditions and have an initiating role in enhancing these conditions (e.g., Sun & Leithwood, 2012).

In addition, it has recently been shown that transformational school leadership can enhance the prerequisites for perceiving interdependence — including teacher collaboration and trust (Moolenaar, Sleegers, & Daly, 2012; Thoonen et al., 2011). In our previous cross-sectional research on the impact of transformational leadership practices on teamwork, self-efficacy and teacher learning in VET colleges, we have found that individualized consideration and intellectual stimulation affect task interdependence directly, while vision building did not. Moreover, it appeared that the influence of transformational leadership on teachers' efficacy beliefs and self-reflection was mediated by perceived task interdependence (Oude Groote Beverborg et al., 2015). Although the few available studies provide some evidence for the relationship between teamwork processes, especially perceived task interdependence, and two of three dimensions of transformational leadership, including individualized consideration and intellectual stimulation, more research is needed to assess how these transformational leadership practices affects perceptions of task interdependence over time, thereby validating and expanding previous findings.

Furthermore, a bi-directional link between transformational leadership and task interdependence seems likely. In the long term, building teacher craftsmanship, may distribute the sources of leadership in a school from one (or few) to many sources. Leadership may diffuse first through the team, and finally through the organization (Day et al., 2010; Hallinger & Heck, 2011). Interacting and collaborating with colleagues might contribute to this process, because it elevates levels of potentially useful knowledge individual teachers and teacher teams may use to become more proficient. Based on the aforementioned, we therefore hypothesize that as transformational leadership practices (e.g. individual consideration and intellectual stimulation) increases over time, teachers'

perceptions of their task interdependence would also increase (Hypothesis 4a). In addition, as interacting and collaborating with colleagues might contribute to more distributive forms of leadership, we expected that higher levels of perceived task interdependence would lead to slow changes in transformational leadership over time (Hypothesis 4b).

The present study

The aim of the present study is to longitudinally assess the mutual relations between transformational leadership (i.e., individualized consideration and intellectual stimulation), perceived task interdependence, self-efficacy, and teachers' engagement in self-reflection over time.

On the basis of findings from previous studies, we formulated four hypotheses regarding the reciprocal relations between self-reflection, self-efficacy, task interdependence and the transformational leadership practices individualized consideration and intellectual support. These hypotheses are visualized in Figure 4.1. We tested these assumed dynamic associations between our variables, using data gathered on three yearly-based measurement occasions from 655 Dutch Vocational Education and Training teachers. As such, this study will make a unique contribution to a deeper understanding of the dynamics and complexities underlying sustainable school improvement.

Method

In order to assess the time-based dynamics of the relationship between these variables, we used Latent Difference Score (LDS) modeling (Ferrer & McArdle, 2010; McArdle, 2009; McArdle & Hamagami, 2001). LDS modeling, derived from dynamic system theory (Ferrer & McArdle, 2010), is a form of Structural Equation Modeling (SEM), and combines cross-lagged regression analysis and latent growth curve modeling. This allows for the modeling of dynamic intra-individual change. Dynamic modeling of this nature provides opportunities to explore and test the hypothesized reciprocity of the relationships amongst the variables examined in our study by illustrating how changes in one variable (e.g., self-reflection) over time depend on the state of another variable (e.g., self-efficacy, and task interdependence) and any prior change in the system as a whole. Details regarding sample, measures and analytic strategy are described below.

Sample

Data were collected from teachers of multidisciplinary teams from the various departments of six VET colleges (e.g., a technology department, an economics and business department, a health and welfare, department, an education department). The multidisciplinary teams within these departments were responsible for the coaching of a specific group of students, the guidance of their learning processes, the planning of the curricula for the group and assessment of their progress.

We used convenience sampling to obtain a sample as large as possible. The six VET colleges were contacted via their boards of directors. For two of the colleges, the teachers

were contacted directly to invite them to participate in the present study. For the other four colleges, the team leaders were asked if their teams would be willing to participate. Questionnaires were sent to the teachers of the teams that were willing to participate. To maximize responding, we informed each team about the goals of our research, told them about the content of the questionnaire and offered to give a presentation on the main findings once the study was completed.

The questionnaires were administered using the online program 'survey monkey'. During three years (from 2010 to 2012), questionnaires were sent to more than 800 teachers. On each measurement occasion about 400 returned the questionnaire, with response rates of 53%, 52%, and 47% for the three sequential occasions. Not all returned questionnaires could be used for further analysis, because, for example, respondents did not fill out the questionnaire completely. Subsequent analyses are based on the data of 655 unique respondents, of which 144 responded on all three occasions, 181 responded on two occasions, and 330 responded on only one occasion. Moreover, Mplus, the software we used to analyze the data with, provides maximum likelihood estimation for missing data, and it computes the standard errors for the parameter estimates using the observed information matrix (Muthén & Muthén, 1998-2012). See Appendix A.2 for a more detailed description of the responses.

Over three measurement occasions with one year intervals and of all the teachers who responded, the average age was 48 years (standard deviation of 10). The majority of the respondents worked more than 32 hours per week (about 60%). Many of the respondents had worked as a teacher for more than 20 years (32%); a sizeable percentage had worked around 10 years as a teacher (21%). Most of the teachers had a bachelor's degree (72%); 16% had a master's degree; and 12% had completed only a secondary level of education. See Appendix A.3 for a more detailed description of the sample on the three measurement occasions.

Measures

The following variables were assessed using already existing, well-validated measurement scales: transformational leadership individualized consideration and intellectual stimulation (11 items)(Geijsel et al., 2009; Oude Groote Beverborg, et al., 2015; Thoonen et al., 2011), task interdependence (4 items)(Oude Groote Beverborg et al., 2015; Runhaar et al., 2010; Runhaar, 2008; van der Vegt et al., 2000), occupational self-efficacy (6 items)(Oude Groote Beverborg et al., 2015; Runhaar et al., 2010; Runhaar, 2008; Schyns & von Collani, 2002), and self-reflection (5 items)(Oude Groote Beverborg et al., 2015; Runhaar et al., 2010; Runhaar, 2008; van Woerkom, 2003). Teachers indicated the extent to which the item content applied to them on five-point scales (1= strongly disagree, 2= partially disagree, 3= do not disagree, do not agree, 4=partially agree, 5=strongly agree). The items in the questionnaire referred to the above mentioned concepts (see Appendix B for an overview of the scaled variables and related items).

As mentioned earlier, two dimensions of transformational leadership, including individualized consideration and intellectual stimulation, were measured based on previous cross-sectional research (Geijsel et al., 2009; Oude Groote Beverborg et al., 2015; Thoonen et al., 2011). Individualized consideration was defined as the extent to which the school leader -acknowledging teachers' efforts – provides individualized support for teachers and

was measured using five items. The second scale, providing intellectual stimulation, consisted of six items and concerned the degree to which the school leader provides teachers with intellectual stimulation. The reliability of these subscales has been found to be satisfactory (Geijssel et al., 2009; Oude Groote Beverborg et al., 2015; Sleegers et al., 2014; Thoonen et al., 2011): Cronbach's alpha coefficients for individualized consideration varied from .87 to .93 and for intellectual stimulation from .88 to .94.

Task interdependence refers to the extent to which teachers perceive that the interaction and coordination of team members is required to complete tasks (four items). Cronbach's alpha coefficients, ranging from .70 to .79, have been reported in literature (Oude Groote Beverborg et al., 2015; Runhaar, 2008; van der Vegt et al., 2000).

Occupational self-efficacy was defined as the extent to which teachers have a future-oriented belief about their level of competence that they expect to display in a given situation. This scale consists of six items. The reliability of this scale has been found to be satisfactory (Oude Groote Beverborg et al., 2015; Runhaar, 2008; Runhaar et al., 2010): Cronbach's alpha coefficients for occupational self-efficacy varied from .75 to .80.

Teachers' engagement in self-reflection refers to the extent to which teachers are engaged in individual activities aimed at making implicit knowledge explicit (5 items). Cronbach's alpha coefficients, ranging from .72 to .82 have been reported in the literature (Oude Groote Beverborg et al., 2015; Runhaar, 2008; Runhaar et al., 2010).

In preliminary analysis we first conducted confirmatory factor analysis per variable on all three measurement occasions, using Mplus 7.1 (Muthén & Muthén, 1998). The findings showed that, for all three measurement occasions, the items loaded well on their factors.

Second, we investigated whether the variables were longitudinally valid by testing models with unrestrained factor loading per item on each of the three measurement occasions, versus models in which each item's factor loading was constraint to be equal over time (McArdle & Prindle, 2013). The findings showed that our measures were invariant, and the latent or true scores of the variables could be separated from the random error of measurement. Moreover, all variables significantly predicted themselves over time, indicating that they were stable (see Appendix D.1).

Finally, we constructed a measurement model to assess whether the theoretical constructs (factors) such as we measured them fitted well to the data in relation with one another. To obtain factor means we had to apply the assumption of measurement error with means of 0. The findings showed an acceptable fit of the model to the data, $\chi^2(2977) = 6055.275$ ($p=.000$), RMSEA = 0.040, CFI = 0.838, SRMR = 0.073. The items and their parameter estimates (i.e. factor loadings and residual variances) are presented in Appendix B, and the means, standard errors of the means, and the correlations between all variables at all measurement occasions are presented in Appendix C.3.

Analytic strategy

As indicated above, we analyzed the data from this study using Latent Difference Score (LDS) structural equation modeling programmed in Mplus 7.1 (Muthén & Muthén, 1998-2012). The key elements of an LDS approach are the variables' latent difference factors, which specify the variable's change score at each time point (see for instance McArdle & Prindle, 2008; Sbarra & Allen, 2009). Unique in the LDS approach is that this change score consists of two components:

1. A constant change component, which is a constant underlying growth parameter or the underlying constant slope (latent slope);
2. A proportional change component, which is the autoregressive coefficient (Ferrer & McArdle, 2010).

Together they form the so-called dual change score model, in which both components together model the intra-individual change. Changes in the LDS model accumulate over subsequent time points (Ferrer & McArdle, 2010; Hu & Bentler, 1999; McArdle, 2009). For the reader's complete understanding, a bivariate dual change Latent Difference Score (LDS) model, is visualized and discussed briefly in Appendix E.

The dual change model (constant change and proportional change) might not be the model that fits best to the intra-individual change present. For example, if the variables do not show a constant increase (or decline) within the timeframe that was measured, a model including only the proportional change component will fit the data better than the full dual change model. As a first step in our analysis we, therefore, tested for every variable separately (univariate LDS model) which type of change model fitted the data best. We tested three versions of the univariate LDS models against each other (Eschleman & LaHuis, 2013):

1. an LDS model with invariant autoregressions and a latent slope (dual change model) against an LDS model with freed autoregressions and without a latent slope (proportional change model);
2. an LDS model with invariant autoregressions and a latent slope (dual change model) against an LDS model without autoregressions and with a latent slope (constant change model);
3. an LDS model without autoregressions and with a latent slope (constant change model) against an LDS model with freed autoregressions and without a latent slope (proportional change model).

The models were compared using the Chi-square difference (ΔX^2) test with degrees of freedom (df) equal to the difference in numbers of parameters left free for estimation. Additionally, a good fit of a model to the data is indicated by a Chi-square ($X^2(df)$) that is not significant, an RMSEA (Root Mean Square Error of Approximation) $\leq .06$, a CFI (Comparative Fit Index) $> .95$, and an SRMR (Root Mean Square Residual) $\leq .08$ (Hu & Bentler, 1999). After selection of the best fitting models we performed subsequent analyses to see whether better fits were obtained by freeing or constraining other parameters.

In the second step we extended the best fitting univariate change score model to multivariate LDS models. As multiple variables are included, the initial factors and slope factors of different variables will also be correlated. More interesting however are the coupling parameters (γ 's, see Appendix E) between difference factors at time t and measurement occasion factors at time $t-1$. These coupling parameters may be in one direction, but the coupling may also be bidirectional, such that reciprocity between variables becomes a testable property of the model. The couplings relate variables on all occasions, that is, they are now dynamically related. This means that a variable's change depends on the variable's level at a previous time point and on a systematic growth rate, as well as, when coupled with another variable, on the level of the other variable at a previous time point. Change patterns therefore depend on the presence of these parameters, and even when parameter values are constant over time non-linear trajectories may be obtained (see for an example Sbarra & Allen, 2009). The parameters are interpreted together, because

they jointly bring about the dynamics of the system (Ferrer & McArdle, 2010). For testing our hypotheses, the coupling parameters are studied because they test for the prediction (over time) of one variable (e.g. self-efficacy) on another (e.g. self-reflection), and therefore strengthen claims of causality, and provide a strong basis for claims of mediation (Eschleman & LaHuis, 2013; McArdle, 2009). Moreover, these predictions are independent of outcome variables' histories.

In order to explain the multivariate LDS model we used Mplus 7.1 (Muthén & Muthén, 1998-2012) to test the dynamics of the assumed paths that link the variables in our study (see Figure 4.1), the multivariate model was assessed in three steps. First, the variables were modeled in a 'straightforward' causal manner, based on findings from our previous cross-sectional research. Second, corresponding 'reversed causal' coupling parameters were added to assess the reciprocal relations between variables. Third, on the basis of the principle of parsimony, non-significant effects were removed from the model. More detailed information about the Mplus codes used, are available on request by the author.

Results

Univariate model selection

We started our data analysis with examining which univariate LDS models fitted best the intra-individual change of each variable in our study. As mentioned earlier, we tested three versions of the univariate LDS models against each other. These tests indicated for all variables that the proportional change models (model with freed autoregressions and without a latent slope) fitted the data best (see for Model selection and ΔX^2 tests Appendix D.2). This means that overall the variables did not show a constant increase (or decline) within the timeframe that we measured.

Subsequent tests to assess whether the models would fit the data better if their proportional change parameters were held invariant (Eschleman & LaHuis, 2013), indicated this to be the case for self-reflection, self-efficacy, and task interdependence. Subsequent tests showed that levels of self-reflection declined between occasion 1 and 2 ($\mu_{\text{Ref}12} - \mu_{\text{Ref}11} = -.072$, $p=.015$), after which its level was sustained, self-efficacy increased between occasion 1 and 2 ($\mu_{\text{SE}2} - \mu_{\text{SE}1} = .057$, $p=.045$), after which its level was sustained, task interdependence remained constant, and that consideration and support increased between occasion 1 and 2 ($\mu_{\text{TLCS}2} - \mu_{\text{TLCS}1} = .123$, $p=.024$), as well as between occasion 2 and 3 ($\mu_{\text{TLCS}3} - \mu_{\text{TLCS}2} = .088$, $p=.041$)¹. But despite that the values of consideration and stimulation appear incremental they are not constant enough to prefer a model with a constant change factor (i.e., a dual

¹ Because proportional change models were selected (and not dual change models), the equation to calculate difference scores with is the following:

$$\Delta Y_{it} = \mu_{\Delta t} + \beta Y * Y_{it-1} \quad (1)$$

where $\mu_{\Delta t}$ is the estimated intercept of the difference score at a certain occasion. To test whether measurement occasion scores significantly differ from occasion to occasion, measurement occasion scores are compared. Measurement occasion scores are calculated by adding an occasion's difference score and its previous measurement occasion score.

change model) over a proportional change model (as indicated by the results of the model comparisons). Univariate proportional change models, their values, fit measures, as well as their corresponding trajectories, are presented in Appendix F.1.

Testing the multivariate model

Based on these findings, we subsequently examined the dynamic relationships between the variables of our study with a multivariate proportional change model. The coupling parameters are of primary interest, as they provide the evidence for causal relations.

A four-variable proportional change model was fit to the data. The included variables were consideration and stimulation, perceived task interdependence, self-efficacy, and self-reflection. In this first model only those unidirectional coupling parameters were included that had been found in our previous cross-sectional study, resulting into a path that led from a transformational leader who shows consideration for teachers individually and stimulate teachers intellectually, through teachers' perceived task interdependence (Hypothesis 4a), to self-efficacy (Hypothesis 3a), and self-reflection (Hypothesis 1a and 2a). The fit of the model to the data was acceptable: $\chi^2(3028) = 6222.830$ ($p = .000$), RMSEA = .040, CFI = .832, SRMR = .084. In the second model reciprocal relations were included. We therefore added the 'reversed causal' coupling parameters from task interdependence to consideration and stimulation (Hypothesis 4b), from self-efficacy to task interdependence (Hypothesis 3b), from self-reflection to task interdependence (Hypothesis 2b), and from self-reflection to self-efficacy (Hypothesis 1b). The fit of this second, modified, model to the data was acceptable: $\chi^2(3024) = 6207.606$ ($p = .000$), RMSEA = .040, CFI = .832, SRMR = .082, and this less restraint model fitted the data better than the first model: $\Delta\chi^2(4) = 15.224$ ($p = .004$). Based on the principal of parsimony, we removed the following non-significant coupling parameters from the second model: from self-efficacy to self-reflection (Hypothesis 1a), from self-efficacy to task interdependence (Hypothesis 3b), from task interdependence to self-efficacy (Hypothesis 3a), and from task interdependence to consideration and stimulation (Hypothesis 4b). This resulted in a third model with an acceptable fit: $\chi^2(3028) = 6213.389$ ($p = .000$), RMSEA = .040, CFI = .832, SRMR = .083, and this more parsimonious model fitted the data as well as the less restrained second model: $\Delta\chi^2(4) = 5.783$ ($p = .216$). Allowing the coupling parameters to be variant did not improve the fit of the model to the data. Parameter values of the third, parsimonious multivariate LDS model are presented in Table 4.1. For complete understanding, the correlations between the initial factors and the coupling parameters of this third model are presented in Figure 4.2.

As can be seen in Figure 4.2, the most parsimonious model indicates:

- a leading role of consideration and stimulation on perceived task interdependence (Hypothesis 4a);
- reciprocity between task interdependence and self-reflection (Hypothesis 2a and 2b),
- a peripheral role of self-efficacy, as only the level of self-reflection influenced the levels of self-efficacy, but not vice versa.

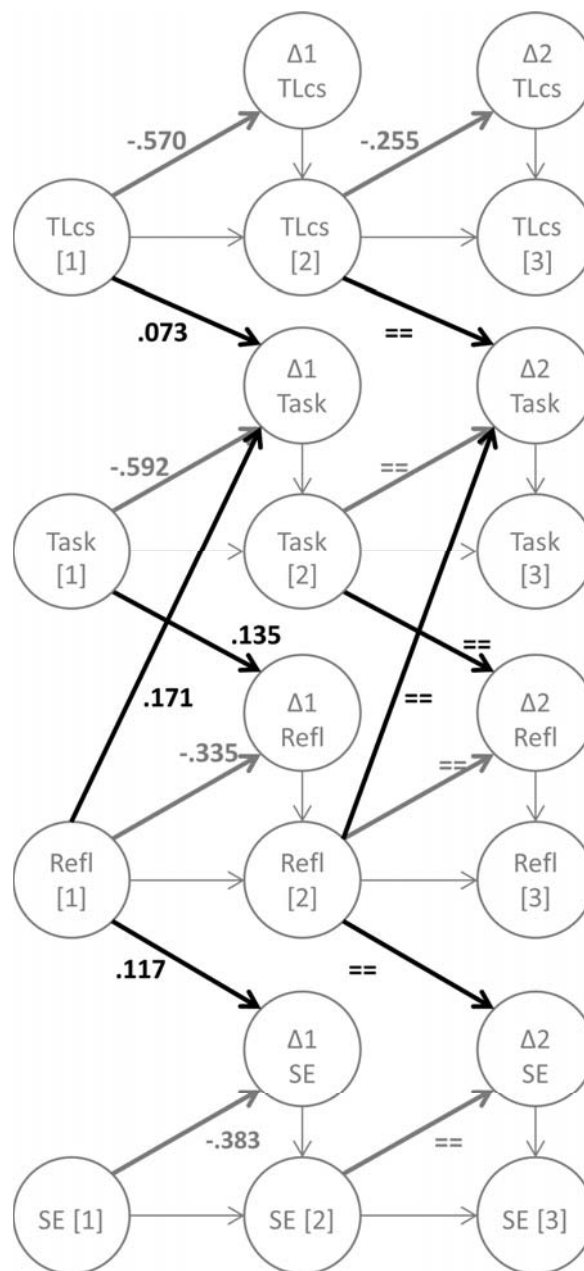


Figure 4.2

Simplified representation of the parsimonious multivariate proportional change LDS model

Values in the figure are significant. TLcs = transformational leadership consideration and stimulation; Task = task interdependence; SE = self-efficacy; Refl = self-reflection. TLcs[t] represents its measurement occasion factor at time t. Δ[#]TLcs represents its latent difference factors for subsequent occasions. The black single headed arrows are the invariant couplings from one variable to another (the γ's) with their values. The double equality signs represent invariance. The bold grey arrows are the autoregressions (β's) with their values. The grey arrows without values are fixed at 1. TLcs does not have invariant autoregressions, Task, SE, and Refl do. The model is simplified to stress the influences over time and to ease interpretation.

Table 4.1 Parameter estimates from the final multivariate latent proportional change score model

Parameter	TLcs	Task	SE	Refl
Autoregression (proportion) β_1	-.570	-.592	-.383	-.335
Autoregression (proportion) β_2	-.255	==	==	==
Initial mean μ_1	3.676	4.551	4.087	4.346
Difference factor1 intercept $\mu_{\Delta 1}$	2.216	1.634	1.112	.768
Difference factor2 intercept $\mu_{\Delta 2}$	1.058	1.621	1.064	.820
Coupling γ				
TLcs[t- Δ t] \rightarrow Δ Task[t]		.073		
Refl[t- Δ t] \rightarrow Δ Task[t]		.171		
Refl[t- Δ t] \rightarrow Δ SE[t]			.117	
Task[t- Δ t] \rightarrow Δ Refl[t]				.135
Initial variance ϕ_1^2	1.051	.259	.261	.236
Difference factor1 variance $\omega_{\Delta 1}^2$	.574	.182	.097	.136
Difference factor1 variance ω_{Δ}^2	.316	.221	.169	.132
Correlations ρ	I TLcs	I Task	I SE	I Refl
I TLcs	1			
I Task	.126	1		
I SE	.119	.089	1	
I Refl	.063	.099	.122	1

Values in the table are significant. Double equality signs indicate that this parameter was held invariant. N = 655, number of free parameters = 131. TLcs = transformational leadership consideration and stimulation; task = task interdependence; SE = self-efficacy; Refl = self-reflection. Factor loadings from the measurement occasion factors are not listed. See therefor Appendix B. Error variances are not listed. See for an approximation Appendix B. Error variances from the final structural model deviate from those in the measurement model with a maximum of .004, .003, .006, and .007 for TLcs, Task, SE, and Refl, respectively.

This final model explained 37.3% of the variance of the first latent difference score of consideration and stimulation, and 13.6% of its second, 28.8% of task interdependence's first and 27.5%, of its second, 23.8% of self-efficacy's first, and 14.5% of its second, and 14.0% of self-reflection's first, and 17.3% of the variance of its second latent difference score.

We will elaborate on the most important findings from the parsimonious multivariate LDS model by first giving interpretations of the initial levels from each variable, followed by our interpretations of the parameters relating the variables (following the order of the parameters in Table 4.1). Change of the separate variables was already discussed in the univariate model selection section (see autoregressions and difference factors intercepts in Table 4.1 and Appendix F.1).

All initial factor means were significant (see μ_1 in Table 4.1). Consideration and stimulation's initial factor mean was above average (about 3.7 on a 5-point scale). Self-efficacy's initial factor mean was high, and task interdependence's and self-reflection initial factor means were very high (all above 4 on a 5-point scale).

All initial mean factors were significantly and positively correlated (see ρ 's in Table 4.1), suggesting that higher perceptions of consideration and stimulation of the transformational leader co-occurred with higher perceptions of task interdependence,

higher beliefs in efficacy, and higher engagement in self-reflective activities, at the onset of the study (first measurement occasion).

The variables were related over time in the parsimonious multivariate LDS model through four significant, and invariant, coupling parameters (see Figure 4.2, and γ 's in Table 4.1). The first coupling parameter is from consideration and stimulation to task interdependence. Intra-individual increases in a transformational leader's consideration and stimulation practices lead to intra-individual increases in perceptions of the need to interact to complete tasks. This supports our Hypothesis 4a. The second coupling parameter is from task interdependence to self-reflection, and the third is from self-reflection to task interdependence. Intra-individual increases in perceptions of the need to interact to complete tasks lead to intra-individual increases in engagement in self-reflective actions, as well as vice versa. As we hypothesized (Hypotheses 2a & 2b), task interdependence and self-reflection are thus reciprocally related. The fourth coupling parameter is from self-reflection to self-efficacy. Intra-individual increases in engagement in self-reflective actions lead to intra-individual increases in beliefs of competence (Hypothesis 1b).

Overall these results show a leading role of the transformational leadership practices consideration and stimulation. Task interdependence was found to be directly influenced by consideration and stimulation. Task interdependence and self-reflection were found to have reciprocal roles in sustaining each other's levels. Surprisingly, self-efficacy was only coupled to self-reflection, and levels of self-efficacy were sustained by levels of self-reflection.

Discussion

The present investigation tested the longitudinal effects of transformational leadership practices (i.e., consideration and stimulation), perceptions of task interdependence, and self-efficacy beliefs, on VET teachers' engagement in self-reflection. In addition, possible reciprocal relations between these variables were explored. Data of three measurement occasions with yearly intervals from a total of 655 participants were used for the analyses. Each variable was analyzed with univariate LDS models to assess their change. To analyze the time-based dynamic relations between the variables, a multivariate LDS model was tested. As the LDS approach enables us to represent dynamic relations between our variables over time, this approach can be considered as a strong and innovative approach for examining the role teacher learning may play in building school's capacity to change and sustained improvement.

None of the variables showed systematic constant change. Interestingly reflection declined between measurement occasion 1 and 2, after which its (still high) level was sustained. The decline on the second measurement occasion might indicate that teachers had become more critical on their own levels of reflection. However, such a critical attitude did not result in sustained decline. To understand more about the process through which self-reflection progresses, future studies must address self-reflection not only in terms of an activity, but also in terms of the content that is reflect on, to distinguish reflection on reflection from reflection to improve, for instance, instructional practices. Levels of self-efficacy were found to increase between occasion 1 and 2, after which they remained stable. These findings partly concur with findings from previous studies into the variability of teacher self-efficacy (Raudenbush, Rowan, & Cheong, 1992; Ross, Cousins, & Gadalla, 1996; Thoonen et al., 2012). These findings showed variability in teacher-self-efficacy according to

contextual (i.e., student groups) and person (i.e., teacher) effects as well as quite stable effects over time. More research is needed to increase our knowledge on the variability of teacher self-efficacy, using more time-intense intervals; for example monthly or weekly-based time intervals instead of yearly-based (e.g., Caprara et al., 2008). Task interdependence did not change. This may be the most surprising finding of this study, as we expected that teachers' perceptions of task interdependence would have increased after the implementation of multidisciplinary teams in VET colleges. However, the finding that initial levels of task interdependence were already very high might indicate that teachers had welcomed an infrastructure that facilitated more contact with colleagues (e.g., Scribner et al., 2002; Stoll et al., 2009). Although consideration and stimulation increased over time, we did not find a systematic constant change factor. Apparently, after the initiation of teams, and over the course of the study, school leaders seem to attend to individual teachers' needs and feelings more, and challenged their beliefs, values, and practices more.

All four variables' initial factors were significantly and positively correlated. This suggests that those teachers scoring higher on any one variable tend to score higher in all other variables at the onset of the study. This means that people who reflect more, have higher levels of self-efficacy, perceive more interaction with team members to complete tasks, and also perceive their leader to be more considerate and more stimulating. Thus, higher personal and organizational resources that are assumed to be beneficial to take charge of change tend to go together.

Variables were sustained by the influence of other variables, but not all our hypotheses were confirmed. First, contrary to our hypothesis (Hypothesis 1a), self-efficacy did not influence self-reflection: the coupling parameter from self-efficacy to self-reflection was not significant. This finding is not in line with previous cross-sectional findings which have suggested that self-efficacy beliefs are a critical component for self-reflection (Geijsel et al., 2009; Sleegers et al., 2014). Furthermore, it contrasts with the claim that self-efficacy has a pivotal role as a psychological lever between leadership and performance (Schyns, 2004), at least when performance consists of the generation of new knowledge. As such, the assumed causal influence of self-efficacy on self-reflection seems not to withstand the test of time. One explanation may be that teachers with high sustained levels of self-efficacy are less motivated to learn. As they already feel excessively confident, they may think that they have nothing left to learn. However, we did find the reversed effect (Hypothesis 1b): self-reflection had a positive influence on self-efficacy. Teachers who generate more knowledge and try to find better workable scripts for changing circumstances through engagement in self-reflective practices also strengthen their beliefs of competence to overcome future obstacles. Given that under changing circumstances, one must continuously experience small successes that add up in order to sustain levels of self-efficacy (Bandura, 1986; Caprara et al., 2008), it thus seems that generating new knowledge to improve one's functioning leads to such small successes. This finding can therefore be seen as indirect evidence of the beneficial role of self-reflection in adapting teaching practices to the circumstances at hand (e.g., Thoonen et al., 2012). So, rather than that beliefs of competence motivate teachers to learn, does learning generate beliefs of competence.

Secondly, we found evidence for the assumed relationship between task interdependence and self-reflection (Hypotheses 2a and 2b). Teachers' perceptions of needing to interact to complete tasks positively influenced their engagement in self-reflective activities. This finding adds to the existing evidence regarding the beneficial role of collaboration for teachers' engagement in learning activities (Runhaar et al., 2010; Sleegers

et al., 2014; Meirink et al., 2010; Staples & Webster, 2008). Exploration of the dynamic relations between perceived task interdependence and self-reflection pointed towards the reversed effect: Apparently, self-reflection significantly contributes to sustain teachers' perceptions of task interdependence. Together, these effects indicate that perceptions of task interdependence and engagement in self-reflection are reciprocally related. While teachers are reflecting on how to interact with team members, they discover workable scripts for possible future interactions. Thus when enacting their newly developed scripts, teachers are able to discover that team members provide them with new information, given that they perceive these interactions with team members as beneficial to complete the tasks at hand. In turn, they can then use this information to further reflect on how to improve. As such, self-reflection and perceptions of task interdependence co-develop (e.g., Clement & Vandenberghe, 2000; Horn & Little, 2010; Little, 1990; Somech & Bogler, 2002; Truijen, 2012). Their co-development implies that change in either one of these processes can initiate change in the other, given that there is potential to interact.

Thirdly, with respect to the relations between self-efficacy and task interdependence (Hypotheses 3a and 3b), we did not find time-based dynamic relations between task interdependence and self-efficacy. Apparently, levels of beliefs in one's own competence stem both from previous levels of those beliefs as well as from levels of engagement in self-reflection, rather than from perceptions of task interdependence. This finding contrasts with claims about the mediational role collaboration, or more generally, workplace conditions play in the relation between leadership practices and self-efficacy beliefs (e.g., Geijsel et al., 2009, Nir & Kranot, 2006; Thoonen et al., 2011; Tims et al., 2011).

Fourthly, as assumed in hypothesis 4a, consideration and stimulation positively influenced task interdependence: a leader who considers the needs and feelings of a teacher more, and challenges that teacher to calibrate the adequacy of knowledge more, positively influences teacher's perception of task interdependence. This suggests that when teachers feel more supported by their leader, they also feel more empowered to interact with their team members to complete tasks (e.g., Jung & Sosik, 2002; Maynard et al., 2013; Scribner et al., 2002), validating the impact of leadership practices on collaboration, and more generally, working conditions in schools as found in previous studies (Dionne et al., 2007; Nir & Kranot, 2006). Given the effects of task interdependence on self-reflection as found in this study, this finding substantiates claims of the indirect effect of leadership on teacher learning as mediated by teacher collaboration (Geijsel et al., 2009; Thoonen et al., 2011). A leader who enacts, and also grows into, a transformational role is in an indirect way beneficial for teachers to become more engaged in self-reflection. Additionally, exploration of the opposite effect (Hypothesis 4b) gave no signs that the fit of the model could be strengthened by adding the influence from task interdependence to consideration and stimulation. This indicates that, at least within the short timeframe that we measured, collaboration on tasks does not lead to more distributed forms of leadership, nor does it offer an explanation of the increase in transformational leadership that we found. Subsequent longitudinal research using data collected over a longer period of time might capture such processes better.

In sum, our longitudinal study provides some strong evidence for causality and time-based dynamic relations. The findings contradict the central role of self-efficacy in elevating teacher engagement in learning activities (Runhaar et al., 2010; Yost, 2006). It did however corroborate the initiating role of transformational leadership practices (Leithwood et al., 1999; Leithwood & Slegers, 2006) in affecting teacher collaboration. More specifically, its

increase helped to sustain levels of task interdependence. Additionally, we were able to provide some initial evidence for the reciprocity between task interdependence and self-reflection in sustaining each other on the one hand, and the subsequent positive influence of self-reflection on sustaining levels of self-efficacy on the other hand. This provides some evidence for the beneficial role of working in teams to foster teacher learning, and shows that, after teams have been formed, teachers' engagement in knowledge generating activities helps to sustain their perceptions of being interdependent to complete tasks successfully. This suggests that teachers co-create their own learning environment through collaboration and engagement in reflective learning, while being supported by a considerate and stimulating leader. Important to note, this investigation does not only provide evidence for the fact that variables are causally related, but it sheds some light on how variables are related, as the multivariate LDS model allows tracking the mutual influences of the variables from occasion to occasion. In our opinion, this is only an intermediate step in moving from understanding which variables cause change in, ultimately, teaching practices and student learning, to understanding how changing organizational and psychological factors interact to build school-wide capacity for sustained improvement (Giles & Hargreaves, 2006; Stoll et al., 2009).

Limitations

In this study we made use of a versatile model type for longitudinal data: the Latent Difference Score model (McArdle, 2009). It allowed to model change in a way similar to latent growth curve models but extended on them by adding proportional change to constant change. Change is thereby defined in a precise way, which makes interpretations of influences on change more robust.

Despite this benefit, a model without constant change factors fitted better to the data than a model with constant change factors. Given the high initial means of task interdependence, self-efficacy, and self-reflection, little systematic constant positive change might have been expected after the first measurement occasion. That is, finding growth of these variables may have been hindered by a ceiling effect. This issue might be resolved by using different instruments, such as 7-point questionnaires that can capture more variation. However, measurement instruments may not be the main problem. The little systematic constant change found may also be explained by the differences in the frames of reference respondents may have when answering the questionnaires, resulting in "response shift" (Oort, Visser, & Sprangers, 2009). With response shift, observed changes in respondents' test scores at different measurement occasions may reflect something other than true changes in the attributes that we want to measure. Over a period of time teachers may have changed their internal standards or redefined their targets. For example, VET teachers may become more critical about team work, their own competence and their motivation to learn, due to institutional policy (formation of multidisciplinary teams) and the social settings in which they are embedded. The measurement of changed teachers' perceptions of task interdependence, their self-efficacy beliefs and engagement in self-reflective learning activities can bring about the additional problem that teachers may also change their frame of reference, rendering scores from different measurement occasions incomparable. On the other hand, it also may be that these variables are already beneficial for teachers' improvements when they remain constant. For instance, self-reflection stimulates teachers

to remain proficient employees, now and in the future. Whereas professional learning is a core competence of teachers, their productivity lies at the knowledge and skills they can teach their pupils (e.g., Timperley & Alton-Lee, 2008). Moreover, most of the participants had many years of service, and seem to experience a high level of competence in their profession. For experienced teachers sustaining high levels of self-reflection may be important for adapting effectively to the (changing) circumstances at hand. Their development, in this sense, would be similar to the innovation of new services as found in other organizations and industries (Nonaka, 1994). Future research must establish whether a sustained level of self-reflection can continuously generate solutions to challenges at the moments the challenges present themselves.

A second caution for interpreting our findings, however, is the fit of the model to the data. Although the RMSEA value was good and the SRMR value was acceptable, the CFI value indicated a weak fit (Hu & Bentler, 1999). Although this could at first sight leave some concerns about whether other types of models may fit the data better, such as more simple cross-lagged models (Eschleman & LaHuis, 2013), the inclusion of latent difference factor means allowed us to assess whether, and when, any change occurred. Moreover, a series of ΔX^2 tests indicated that the parsimonious multivariate proportional change model fitted the data best, and that none of the variables was spurious. An additional analytic caution for interpreting our findings is that data were collected from teachers who were nested in teams. We were unable to correct for this dependency in the data, because we did not have enough power to do so: the amount of parameters vastly exceeded the amount of teams. Future research must establish to what extent being a member of a team affects the coupling of reflective activities to and from other variables.

Lastly, despite the benefits of a longitudinal design, inferring causality must still be done with caution, as unmeasured variables may account for the found effects better than the measured variables (Eschleman & LaHuis, 2013; McArdle, 2009). Although we used variables which were shown to be important to elevate self-reflection, we used only a small set of variables that make up a school's capacity for change (i.e., teachers' learning activities, personal and structural resources, and directive influences such as leadership). Additionally, self-reflection's initial level and changes were not fully explained by the variables in the model. Inclusion of variables tapping into such concepts as the sharing of information, teacher commitment, functional team conflict, distributed leadership practices, and shared focus on teacher learning, would validate and expand our findings (Fullan, 2007; Hallinger & Heck, 2011; Johnson & Johnson, 2009; Spillane, Kim, & Frank, 2012; Thoonen et al., 2012; Tjosvold, Yu, & Hui, 2004). Investigating whether these relations also hold over time using data gathered from principals and students, or in other organizations or industries, would be a fruitful endeavor for future research (e.g., Edmondson, Dillon, & Roloff, 2007).

Conclusion

All in all, an image rises from this longitudinal study that, in a Dutch VET context, educational improvements are driven by the reciprocity between self-reflective activities and perceptions of task interdependence. Interacting with team members to complete tasks provides input for teachers' reflections about one's functioning, which in turn provide input for subsequent interactions, and so on. Sustained engagement in self-reflection then results in sustained beliefs in self-efficacy, which suggests that the reciprocity between interaction

and reflection can thus continuously offer teachers mastery experiences. Finally, a considerate and stimulating transformational leader can furthermore facilitate this process. Together, the present findings point to the important role transformational leadership practices play in facilitating teamwork and sustaining teachers' levels of reflection, and thereby facilitate teachers' level of learning in schools.

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Chapter 5

Keep on learning for a purpose

A longitudinal assessment of the influence of vision building and goal interdependence on teacher information sharing

Because it may be difficult for teachers to keep up levels of social reflective learning, needed to continuously adapt to changing circumstances, this longitudinal study examines the impact thereon of workplace conditions that facilitate formulation and pursuit of common goals. More specifically, we investigate whether the transformational leadership practice vision building and perceptions of goal interdependence can sustain, or even enhance, information sharing over time. Additionally, we exploit the benefits of a longitudinal design by exploring possible reciprocity between the variables. Questionnaire data gathered on three measurement occasions from 655 Dutch Vocational Education and Training teachers was analyzed using a multivariate Latent Difference Score model. Results indicate that levels of information sharing were sustained over the measurement period, and that levels of both goal interdependence and vision building had significant, and invariant, influences on the levels of information sharing over each measurement occasion. Moreover, we found a reciprocal relation between vision building and goal interdependence, meaning that they strengthen each other. These results indicate that an environment rich in purpose facilitates teachers' continued social reflective learning for the benefit of facing change.

In an increasingly complex world that is continuously changing teacher lifelong engagement in professional learning in the workplace is vital to sustain the educational quality that is needed to prepare students for societal and occupational participation (Klarner, Probst & Soparnot, 2008; Kwakman, 2003; Smylie, 1995; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; van Veen, Zwart, Meirink & Verloop, 2010). Moreover, effective adaptation to new demands requires more than mere individual reflective learning (Jarvis, 1987; Onderwijscoöperatie, 2012; Stoll, et al., 2006; Stoll, 2009). To enhance effective adaptation scholars have suggested that teachers exchange knowledge and skills (Fullan, 2001; Stoll et al., 2006; Toole & Louis, 2002; Vescio, Ross, & Adams, 2008; van Woerkom, 2003). Through such sharing of information teachers generate knowledge upon which they can continuously build their individual professional capacities. However, sustaining levels of sharing of information over time is notoriously difficult, even when teachers recognize the affordances of the resources their colleagues can provide for their own learning, and are motivated to pool their expertise to determine a course of action aimed at improving education (Gabelica, Van den Bossche, De Maeyer, Segers, & Gijssels, 2014; Horn & Little, 2010; Little, 1990; Schippers, den Hartog, Koopman, & Wienk, 2003). Additionally problematic is that even after a decade in which governments, local politicians, and school managers worldwide have been involved in efforts at improving educational systems in support of better student performance, little is known about how support conditions sustain, or possibly elevate, teacher learning over time (Slegers, Thoonen, Oort, & Peetsma, 2014; Thoonen, Slegers, Oort, & Peetsma, 2012). Understanding how educational institutions can provide supportive conditions that sustain or even elevate learning is therefore needed (Giles & Hargreaves, 2006; Timperley & Alton-Lee, 2008).

The conditions scholars repeatedly point towards for playing a central role in supporting teacher learning, and consequently student performance, are collaboration and perceptions of interdependence, having shared purposes, and leadership (Cabrera & Cabrera, 2005; Johnson & Johnson, 2009; Mulford, 2010; Mullen & Huting, 2008; Ortiz, Johnson & Johnson, 1996; Scribner, Sawyer, Watson, Myers, 2007; Stoll et al., 2006; Tjosvold, 1986). Empirical research into professional reflective learning has indeed shown the positive effect of conditions such as goal interdependence and a shared vision building transformational leader (Geijsel, Slegers, Stoel, & Kruger, 2009; Runhaar, Sanders, & Yang, 2010; Thoonen, Slegers, Oort, Peetsma, & Geijsel, 2011; Tjosvold, Tang, & West, 2004; Tjosvold, Yu, & Hui, 2004; Wahlstrom & Louis, 2008; Wiley, 2001). Additionally, research on teacher information sharing and how teachers make use of their leader and workplace conditions for purposeful peer interaction and support (e.g., Edmundson Dillan & Roloff 2007; Geijsel et al., 2009; Leithwood, Jantzi, & Mascal, 2002; Nissilä, 2005; Tjosvold, 1986), found that a shared vision and transformational leadership have initiating roles, and that goal interdependence serves as a mediator (e.g., Sun and Leithwood, 2012; Wong, Tjosvold, & Liu, 2009). These antecedents do not need to be implemented, but can be discovered as naturally occurring resources of the workplace (Horn & Little, 2010; Spillane, Reiser, & Reimer, 2002). They provide an environment that facilitates interaction and coordination, and provides direction and support. Essentially, this environment structures uncertainty and ambiguity, enabling teachers to continue acting, share information, and come to understand how to take charge of change (Coburn, 2004; Staples & Webster, 2008). Additionally, research has found that teachers' engagement in professional learning activities contributes to changing teachers' instructional practices with the ultimate goal of increasing student

achievement (Desimone, 2009; Garet, Porter, Desimone, Birman, & Yoon, 2001; Slegers, Thoonen, Oort, & Peetsma, 2014; Thoonen et al., 2011; Vescio, Ross, & Adams, 2008).

Although this research has contributed to a deeper understanding of mechanisms underlying educational change and teacher learning in schools, most of the studies are cross-sectional in nature, limiting valid and reliable claims about the direction of influence of the relations found. As cross-sectional estimates may generate misleading interpretations of mediation, longitudinal research can make stronger claims about causality (Cole & Maxwell, 2003; Eschleman & LaHuis, 2013; Maxwell, Cole, & Mitchell, 2011; McArdle, 2009). Moreover, longitudinal studies can make an important contribution to a complete understanding of the nature and dynamics of teacher learning as an important catalyst to foster sustained school improvement. Modeling the influences of transformational leadership and goal interdependence on teachers' reflective learning over time will enable us to both validate previous findings from cross-sectional studies, and investigate possible reciprocal relations undetected by cross sectional models (e.g., Heck & Hallinger, 2010; Salanova, Bakker, & Llorens, 2006; Xanthopoulou, Bakker, Demerouti, & Schaufeli, 2009). Additionally, longitudinal research also provides opportunities to investigate the type of change of teachers' engagement in professional learning activities and its antecedents (Nissilä, 2005; Slegers et al., 2014). Moreover, the type of change of information sharing and its antecedents is largely under-investigated. Levels may be enhanced or declined or sustained, as the result of a variable's own dynamics or a coupling with other variables, and change rates may differ for individual teachers depending on their previous levels (e.g., Ferrer & McArdle, 2010). Exploration of these dynamics yields valuable insights about how the variables change and what drives their changes.

Although different scholars have emphasized the need for using more longitudinal designs in school improvement research (Feldhoff, Radisch, & Klieme, 2014; Hallinger & Heck, 2011; Heck & Hallinger, 2014; Slegers et al., 2014; Thoonen et al., 2012) there is still little systematic evidence for how information sharing can be sustained, or elevated, in the context of the school over time. More longitudinal research is thus needed to increase our understanding of the dynamic relations between visions, perceptions of interdependence and information sharing over time. This study aimed to make a significant contribution to this line of research by conducting a longitudinal study into the nature and dynamics of the paths that link purpose enhancing organizational conditions and teachers' social learning activities.

The study was conducted within the context of Vocational Education and Training (VET) colleges in the Netherlands. Dutch VET teachers have undergone several changes in the past few years. First, their colleges have had many mergers with the formation of massive educational institutions as a consequence. Second, from the idea that a craft is not learned at school but in practice, their institutions are involved in educational reforms aimed at the development of authentic learning environments. Third, to bridge the gap between school and practice further, VET colleges have attracted experienced professionals from the actual field to teach their students, resulting in a wide variety of experiences and expectations amongst teachers. To successfully implement these changes, and to supply teachers with means to clear this hurdle, VET teachers have been organized into multidisciplinary teams and are called to collaborate for imparting the competences students need, to become skilled in the professions they are being educated for. The challenge facing these VET teachers is therefore to come to understand how to work effectively in teams that are directed at strengthening their professional expertise and

practice and have the ultimate goal of improving student performance (Meirink, Meijer, Verloop & Bergen, 2009; Meirink, Imants, Meijer & Verloop, 2010; Poortman, 2007; Truijen, 2012). The study builds on earlier cross-sectional work in which we found that goal interdependence mediated the impact of the transformational leadership practices vision building on information sharing (Oude Groote Beverborg, Slegers, & van Veen, 2015, or chapter 3 in this dissertation). The current longitudinal study therefore examines whether the relations between these variables can still be found when assessed over time, thereby validating and extending previous models and findings from cross-sectional research. We also use the added value of a longitudinal design to explore reciprocal relations between these variables, and assess their manner of change.

The main research question that guided our research was: How do the transformational leadership practice vision building, goal interdependence, and teacher information sharing mutually shape each other over time?

Theoretical framework

An important contribution of our study lies in our attempts to examine changes in transformational leadership practices, especially vision building, perceived goal interdependence, and teachers' engagement in information sharing, and how the relationships among these variables evolve over time, by using Latent Difference Score modeling (LDS; see for a more detailed elaboration, below). To understand these relationships, we draw on theories on adult learning, and teamwork and transformational leadership, and use previous findings from cross-sectional research on the role of the interplay between working conditions and leadership in fostering social learning activities of teachers. The model that guided our inquiry is depicted in Figure 5.1. To test this model, we used data, collected at three measurement occasions with yearly intervals, from a sample of 655 Dutch VET teachers. We discuss the variables of our study more fully, and the expected relationship among them, in further detail below.

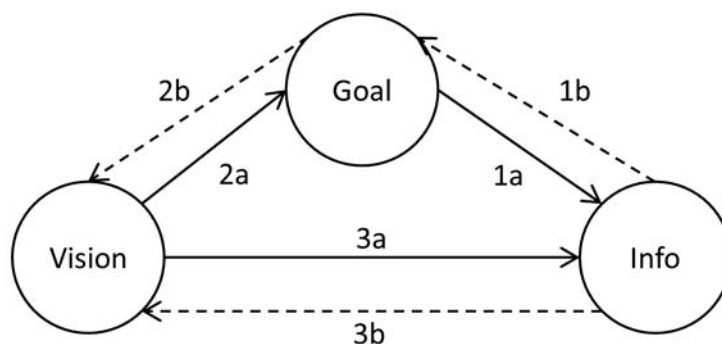


Figure 5.1

Theoretical framework of how information sharing (Info) is influenced by perceived goal interdependence (Goal), and the transformational leadership practice vision building (Vision)(solid arrows), as well as the reciprocal relations that will be explored (dashed arrows)

The numbers 1a-3b represent the hypotheses.

Information sharing

Information sharing is a social and reflective learning activity that entails providing or receiving ideas, insights, advice, feedback, and skills. When such knowledge is tacit, it needs to be made explicit to be transferred. By the exchange of information teachers generate and spread knowledge, and its adequacy for adaptation and improvement can be discussed (Spillane, Kim, & Frank, 2012; van Woerkom, 2003; van Woerkom, 2004). By having access to more knowledge, individual teachers may improve their teaching practices, and consequently contribute to organizational improvement (Desimone, 2009; Garet, Porter, Desimone, Birman, & Yoon, 2001; Korthagen, 2001; Kwakman, 2003; Thoonen et al., 2011). Information sharing is furthermore seen as a facilitator of innovation and decision quality (Nonaka, 1994; Knippenberg, de Dreu, & Homan, 2004), and has been found to positively relate to innovation and performance (Quigley, Tesluk, Locke, & Bartol, 2007; Staples & Webster, 2008; Tjosvold, Tang, & West, 2004).

Moreover, sustained levels of reflective learning over time are important for maintaining high levels of craftsmanship, because solutions that were once found expire as circumstances continuously change (Klarner et al., 2008; Korthagen & Vasalos, 2005; Tjosvold, 1991). It would therefore seem logical that teachers keep a flow of information going to keep up their developed educational quality, and to share more information when circumstances change and call for adaptation. The adaptations made may then fuel continuance of information sharing (e.g., Clarke & Hollingsworth, 2002).

Teachers seem to have difficulty to do this however (Giles & Hargreaves, 2006). One reason may be that team members who have a longer history together tend to engage less in social reflective learning (Schipper et al., 2003). Another, more important, reason may be that focusing on performance (e.g., student results) leads to a drop in learning as situations become more difficult (e.g., when circumstances have changed for an already complex task such as teaching; Locke & Latham, 2002). Collaboration and interaction with colleagues, as well as being engaged in the attainment of a shared vision and pursuing common goals have been found to positively affect social and reflective learning (Geijsel et al., 2009; Runhaar et al., 2010; Thoonen et al., 2011; Tjosvold, Tang, & West, 2004) and could therefore counter a decline in the sharing of information, and possibly even enhance it.

Goal interdependence

Goal interdependence refers to the degree to which teachers perceive that interaction is required to reach their own goals as well as for the team members to reach theirs (Deutsch, 1980; van der Vegt & Janssen, 2003; Weldon, & Weingart, 1993). This means that employees' personal benefits and costs depend on the successful goal attainment of their other team members (Runhaar, 2008; van der Vegt, Emans, & van de Vliert, 2000). By pursuing a common goal teachers may provide each other with direction and support, thereby specifying a course of action. This structures uncertainty and ambiguity, and thus strengthens teachers' information sharing (Staples, & Webster, 2008). Goal interdependence furthermore sustains group-identification, which fosters social reflective learning in teams where members are interdependent but also have dissimilar backgrounds (Cabrera & Cabrera, 2002; Knippenberg et al., 2004; van der Vegt, van de Vliert, Oosterhof, 2003).

Research on the role of collaboration between teachers for promoting professional learning has provided evidence for the positive impact of teacher interaction on teacher reflective learning, and, in turn, enhance team effectiveness (Meirink et al., 2010; Truijen, 2012; Wageman, 1995). More specifically, goal interdependence has been found to positively relate to knowledge sharing, exchanging information and the development of new insights and discoveries, as well as with heightened social reflective learning, and consequently innovation (Runhaar, ten Brinke, Kuijpers, Wesselink & Mulder, 2014; Runhaar et al, 2010; Tjosvold, Tang & West, 2004; Tjosvold, Yu & Hui, 2004). Moreover, teachers may need some time to perceive the extent of the utility of goal interdependence, before it can facilitate (growth in) information sharing (e.g., Aritzeta & Balluerka, 2006; Ortiz et al, 1996). Although these findings make it likely that perceptions of goal interdependence have a positive impact over time on information sharing, the manner in which these relations manifest over time has yet to be addressed.

Oppositely, teachers may need to learn how to interact with colleagues to formulate and pursue common goals. “They may need to lose time in order to gain time” (Mulford, 2010). Information sharing may then help to find adequate ways to formulate and monitor goals to come to solutions to changes and challenges at work. When teachers find adequate ways of interaction for goal attainment, sharing and discussing information with colleagues can be beneficial to further their own learning (Horn & Little, 2010; Desimone, 2009; Nonaka, 1994; Spillane et al., 2002; Weick, Sutcliffe, Obstfeld, 2005). In this study, we therefore hypothesize that higher levels of perceived goal interdependence will increase teachers’ engagement in information sharing (Hypothesis 1a). Based on a more dynamic representation of the assumed associations between these variables, we also expect that as teachers’ engagement in information sharing changes over time perceived goal interdependence changes accordingly (Hypothesis 1b).

Vision building by transformational leaders

Leadership is widely assumed to play a major role in the promotion of school improvement efforts and educational change, particularly when the leadership is what is called ‘transformational leadership’ (Leithwood, Jantzi, & Steinbach, 1999). A transformational leader aims at development in a context of organizational change and is committed to the empowerment of individual teachers and the team as a whole (Avolio, Zhu, Kho & Bhata, 2004; Bass & Avolio, 1994; Leithwood et al., 2002; Leithwood & Slegers 2006; Yammarino, Dionne, Schriesheim & Dansereau, 2008). Three transformational leadership dimensions have been found critical for enhancement of individual learning activities (Geijsel, Slegers & van den Berg, 1999). The first transformational leadership dimension of initiating and articulating a vision refers to a leader who works on the development of shared goals and priorities, by inspiring teachers to formulate shared goals, connect to these, commit to them and try to attain them. The second dimension of individualized consideration refers to support and attention for individual needs and feelings. Teachers should feel empowered by a considerate, transformational school leader and — as a consequence — seek to interact with other teachers and coordinate responsibility in the tasks they share (Dionne, Yammarino, Atwater, & Spangler, 2004; Geijsel et al., 2009). Intellectual stimulation or the third dimension of transformational leadership involves the encouragement of teachers to continuously calibrate the adequacy of their

knowledge and instructional practices. It tries to incite a critical attitude towards oneself and one's team members, through the idea that not one solution is absolute, that there are alternatives to problems, and that conflict can be functional for effective teamwork. As such, it can improve teamwork by enhancing teachers' abilities to solve individual, group and organizational problems (Dionne et al., 2004; Geijsel et al., 2009).

Research has shown transformational school leadership to correlate with various organizational and teacher conditions, it fosters participation in decision making, and it strengthens the effect of a professional community on student achievement (Sun and Leithwood, 2012; Thoonen et al., 2011; Wiley, 2001). In addition, it has recently been shown that transformational school leadership can enhance the prerequisites for perceiving interdependence — including teacher collaboration and trust (Moolenaar, Sleegers, & Daly, 2012; Thoonen et al., 2011). In our own cross-sectional studies we have found that vision building affects goal interdependence but that individualized consideration and intellectual stimulation did not. Also, especially vision building seems to be able to impact forms of social learning both directly and indirectly (Oude Groote Beverborg et al., 2015, or chapter 3 in this dissertation; Runhaar, 2008). Hence, only vision building will be included as a variable in this study. Moreover, a shared vision has been found to positively affect perceptions of (cooperative) goal interdependence (Wong et al., 2009). Although it seems therefore likely that vision building affects goal interdependence and information sharing, more longitudinal research is needed to assess the manner in which transformational leadership impacts perceptions of goal interdependence and information sharing over time.

Furthermore, a bi-directional link between transformational leadership and task interdependence may also exist. A vision cannot manifest when teachers do not enact it. By interacting to attain common goals, and learning how to effectively do so through sharing information, teachers may inspire their leader to remain inspirational. Consequently, teachers may develop their capacities to look beyond their own teaching and take part in the organization of their departments (e.g., Cochran-Smith and Lytle, 1999). It has indeed been proposed that, in the long term, building teacher craftsmanship may strengthen organizations' capacity for change and transform leadership from an individual characteristic to more distributed forms, such that it diffuses first through the team, and finally through the organization (e.g., Day et al., 2010; Hallinger & Heck, 2011). Interacting and learning with colleagues in pursuit of common goals might contribute to this process, because it elevates levels of potentially useful knowledge individual teachers and their team members may use to become more proficient. Based on the aforementioned, we therefore hypothesize that as the transformational leadership practice vision building increases over time, teachers' perceptions of their goal interdependence would also increase (Hypothesis 2a). In addition, as interacting and collaborating with colleagues might contribute to more distributive forms of leadership, we expect that higher levels of perceived goal interdependence would lead to slow changes in vision building over time (Hypothesis 2b). Regarding the link between vision building and information sharing, we hypothesize their dynamic relations as follows: as levels of vision building increase, higher levels of information sharing are expected to follow (hypothesis 3a), and vice versa (hypothesis 3b).

The present study

The aim of the present study is to longitudinally assess the mutual relations between transformational leadership (i.e., vision building), goal interdependence, and teachers' engagement in information sharing. On the basis of findings from previous studies, we formulated three hypotheses regarding the reciprocal relations between information sharing, goal interdependence, and the transformational leadership practice vision building. These hypotheses are visualized in Figure 5.1. We tested these assumed dynamic associations between our variables, using data gathered on three yearly-based measurement occasions from 655 Dutch Vocational Education and Training teachers. As such, this study will make a unique contribution to a deeper understanding of the dynamics and complexities underlying sustainable school improvement.

Method

In order to assess the time-based dynamics of the relationships between these variables, we used Latent Difference Score (LDS) modeling (LDS; Ferrer & McArdle, 2010; McArdle, 2009; McArdle & Hamagami, 2001; see for a more detailed elaboration below). LDS modeling, derived from dynamic system theory (Ferrer & McArdle, 2010), is a form of Structural Equation Modelling (SEM), and combines cross-lagged regression analysis and latent growth curve modelling. This allows for the modelling of dynamic intra-individual change. Dynamic modeling of this nature provides opportunities to explore and test the reciprocity and complexity of the relationships amongst the variables examined in our study by illustrating how changes in one variable (e.g., information sharing) over time depend on the state of another variable (e.g., goal interdependence) and any prior change in the system over time. Details regarding sample, measures and analytic strategy are described below.

Sample

Data were collected from teachers of multidisciplinary teams from the various departments of six VET colleges (e.g., a technology department, an economics and business department, a health and welfare, department, an education department). The multidisciplinary teams within these departments were responsible for the coaching of a specific group of students, the guidance of their learning processes, the planning of the curricula for the group and assessment of their progress.

We used convenience sampling to obtain a sample as large as possible. The six VET colleges were contacted via their boards of directors. For two of the colleges, the teachers were contacted directly to invite them to participate in the present research. For the other four colleges, the team leaders were asked if their teams would be willing to participate in the present research. To the teachers of the teams that were willing to participate were sent questionnaires. To maximize responding, we informed each team about the goals of the present research, told them about the content of the questionnaire and offered to give a presentation on the main findings once the study was completed.

The questionnaires were administered using the online program 'survey monkey'. During three years (from 2010 to 2012), questionnaires were sent to more than 800

teachers. On each measurement occasion about 400 returned the questionnaire, with response rates of 53%, 52%, and 47% for the three sequential occasions. Not all returned questionnaires could be used for further analysis, because, for example, respondents did not fill out the questionnaire completely. Subsequent analyses are based on the data of 655 unique respondents, of which 144 responded on all three occasions, 181 responded on two occasions, and 330 responded on only one occasion. Moreover, Mplus, the software we used to analyze the data with, provides maximum likelihood estimation for missing data, and it computes the standard errors for the parameter estimates using the observed information matrix (Muthén & Muthén, 1998-2012). See appendix A.2 for a more detailed description of the responses.

Over three measurement occasions with one year intervals and of all the teachers who responded, the average age was 48 years (standard deviation of 10). The majority of the respondents worked more than 32 hours per week (about 60%). Many of the respondents had worked as a teacher for more than 20 years (32%); a sizeable percentage had worked around 10 years as a teacher (21%). Most of the teachers had a bachelor's degree (72%); 16% had a master's degree; and 12% had completed only a secondary level of education. See Appendix A.3 for a more detailed description of the sample on the three measurement occasions.

Measures

The following variables were assessed using already existing, well-validated measurement scales: transformational leadership vision building (5 items; Geijsel et al., 2009; Oude Groote Beverborg et al., 2015; Thoonen et al., 2012), goal interdependence (3 items; e.g., Oude Groote Beverborg et al., 2015; Runhaar, 2008; van der Vegt et al., 2000), and information sharing (7 items; Oude Groote Beverborg et al., 2015; Runhaar, 2008; van Woerkom, 2003) See Appendix B for an overview of the scaled variables and related items. In preliminary analysis we first conducted confirmatory factor analysis per variable on all three measurement occasions, using Mplus 7.1 (Muthén & Muthén, 1998-2012). The findings showed that, for all three measurement occasions, the items loaded well on their factors.

Second, we investigated whether the variables were longitudinally valid by testing models with unrestraint factor loading per item on each of the three measurement occasions, versus models in which each item's factor loading was constraint to be equal over time (McArdle & Prindle, 2013). The findings showed that our measures were invariant, and the latent or true scores of the variables could be separated from the random error of measurement. Moreover, all variables significantly predicted themselves over time, indicating that they were stable (see Appendix D.3).

Finally, we constructed a measurement model to assess whether the theoretical constructs (factors) such as we measured them fitted well to the data in relation with one another. To obtain factor means we had to apply the assumption of measurement error with means of 0. The findings showed an acceptable fit of the model to the data, $\chi^2(989) = 2001.073$ ($p=.000$), RMSEA = 0.043, CFI = 0.882, SRMR = 0.080. The items and their parameter estimates (i.e. factor loadings and residual variances) are presented in Appendix B, and the means, standard errors of the means, and the correlations between all variable factors at all measurement occasions are presented in Appendix C.4.

Analytic strategy

As indicated above, we analyzed the data from this study using Latent Difference Score (LDS) structural equation modeling programmed in Mplus 7.1 (Muthén & Muthén, 1998-2012). The key elements of an LDS approach are the variables' latent difference factors, which specify the variable's change score at each time point (see for instance McArdle & Prindle, 2008; Sbarra & Allen, 2009). Unique in the LDS approach is that this change score consists of two components:

1. A constant change component, which is a constant underlying growth parameter or the underlying constant slope (latent slope);
2. A proportional change component, which is the autoregressive coefficient (Ferrer & McArdle, 2010).

Together they form the so-called dual change score model, in which both components together model the intra-individual change. Changes in the LDS model accumulate over subsequent time points (Ferrer & McArdle, 2010; Hu & Bentler, 1999; McArdle, 2009). For the reader's complete understanding, a bivariate dual change Latent Difference Score (LDS) model, is visualized and discussed briefly in Appendix E.

The dual change model (constant change and proportional change) might not be the model that fits best to the intra-individual change present. For example, if the variables do not show a constant increase (or decline) within the timeframe that was measured, a model including only the proportional change component will fit the data better than the full dual change model. As a first step in our analysis we, therefore, tested for every variable separately (univariate LDS model) which type of change model fitted the data best. We tested three versions of the univariate LDS models against each other (Eschleman & LaHuis, 2013):

1. an LDS model with invariant autoregressions and a latent slope (dual change model) against an LDS model with freed autoregressions and without a latent slope (proportional change model);
2. an LDS model with invariant autoregressions and a latent slope (dual change model) against an LDS model without autoregressions and with a latent slope (constant change model);
3. an LDS model without autoregressions and with a latent slope (constant change model) against an LDS model with freed autoregressions and without a latent slope (proportional change model).

The models were compared using the Chi-square difference (ΔX^2) test with degrees of freedom (df) equal to the difference in numbers of parameters left free for estimation. Additionally, a good fit of a model to the data is indicated by a Chi-square ($X^2(df)$) that is not significant, an RMSEA (Root Mean Square Error of Approximation) $\leq .06$, a CFI (Comparative Fit Index) $> .95$, and an SRMR (Root Mean Square Residual) $\leq .08$ (Hu & Bentler, 1999). After selection of the best fitting models we performed subsequent analyses to see whether better fits were obtained by freeing or constraining other parameters.

In the second step we extended the best fitting univariate change score model to multivariate LDS models. As multiple variables are included, the initial factors and slope factors of different variables will also be correlated. More interesting however are the coupling parameters (γ 's, see Appendix E) between difference factors at time t and measurement occasion factors at time $t-1$. These coupling parameters may be in one

direction, but the coupling may also be bidirectional, such that reciprocity between variables becomes a testable property of the model. The couplings relate variables on all occasions, that is, they are now dynamically related. This means that a variable's change depends on the variable's level at a previous time point and on a systematic growth rate, as well as, when coupled with another variable, on the level of the other variable at a previous time point. Change patterns therefore depend on the presence of these parameters, and even when parameter values are constant over time non-linear trajectories may be obtained (see for an example Sbarra & Allen, 2009). The parameters are interpreted together, because they jointly bring about the dynamics of the system (Ferrer & McArdle, 2010). For testing our hypotheses, the coupling parameters are studied because they test for the prediction (over time) of one variable (e.g. self-efficacy) on another (e.g. self-reflection), and therefore strengthen claims of causality, and provide a strong basis for claims of mediation (Eschleman & LaHuis, 2013; McArdle, 2009). Moreover, these predictions are independent of outcome variables' histories.

In order to explain the multivariate LDS model we used Mplus 7.1 (Muthén & Muthén, 1998-2012) to test the dynamics of the assumed paths that link the variables in our study (see Figure 4.1), the multivariate model was assessed in three steps. First, the variables were modeled in a 'straightforward' causal manner, based on findings from our previous cross-sectional research. Second, corresponding 'reversed causal' coupling parameters were added to assess the reciprocal relations between variables. Third, on the basis of the principle of parsimony, non-significant effects were removed from the model. More detailed information about the Mplus codes used, are available on request by the author.

Results

Univariate model selection

We started our data analysis with examining which univariate LDS models fitted best the intra-individual change of each variable in our study. As mentioned earlier, we tested three versions of the univariate LDS models against each other. These tests indicated for all variables that the proportional change models fitted the data best (see for Model selection and ΔX^2 tests Appendix D.4). This means that overall the variables did not show a constant increase (or decline) within the timeframe that we measured.

Tests to assess whether the models would fit the data better if their proportional change parameters were held invariant (Eschleman & LaHuis, 2013), indicated this to be the case for information sharing. Subsequent tests showed that levels of information sharing were constant, and that goal interdependence and vision building increased between occasions 1 and 2 ($\mu_{\text{Goal}1} - \mu_{\text{Goal}2} = .107, p=.032$; $\mu_{\text{Vision}1} - \mu_{\text{Vision}2} = .112, p=.042$), after which their levels were sustained². Univariate proportional change models and their values, their fit measures, as well as their corresponding trajectories, are presented in Appendix F.2.

² Because proportional change models were selected (and not dual change models), the equation to calculate difference scores with is the following:

$$\Delta Y_{it} = \mu_{\Delta 1} + \beta_Y * Y_{it-1} \quad (1)$$

Testing the multivariate model

Based on these findings, we subsequently examined the dynamic relationships between the variables of our study with a multivariate proportional change model. The coupling parameters are of primary interest, as they provide the evidence for causal relations.

A three-variable proportional change model was fit to the data. The included variables were vision building, goal interdependence, and information sharing. In this first model only those unidirectional coupling parameters were included that were similar to those found in our cross-sectional study. These led from vision building to goal interdependence and from both vision building and goal interdependence to information sharing. The fit of the model to the data was acceptable: $\chi^2(1014) = 2304.513$ ($p = .000$), RMSEA = .044, CFI = .875, SRMR = .092. In the second model reciprocal relations were included. Additional to the relations initially specified, we added the 'reversed causal' coupling parameters from goal interdependence to vision building, and from information sharing to both goal interdependence and vision building. The fit of this second, modified, model to the data was acceptable: $\chi^2(1011) = 2287.202$ ($p = .000$), RMSEA = .044, CFI = .876, SRMR = .088, and this less restraint model fitted the data better than the first model: $\Delta\chi^2(3) = 17.311$ ($p = .001$). Based on the principal of parsimony, we removed the two non-significant coupling parameters leading from information sharing to goal interdependence and vision building from the second model. This resulted in a third model with an acceptable fit: $\chi^2(1013) = 2287.546$ ($p = .000$), RMSEA = .044, CFI = .876, SRMR = .088, and this more parsimonious model fitted the data as well as the less restrained second model: $\Delta\chi^2(2) = .344$ ($p = .842$). Allowing the coupling parameters to be variant did not improve the fit of the model to the data. Parameter values of the third, parsimonious, multivariate model are presented in Table 5.1. For complete understanding, the correlations between the initial factors and the coupling parameters of this third model are presented in Figure 5.2.

As can be seen in Figure 5.2, the most parsimonious model indicates:

- a leading role of both goal interdependence and vision building in sustaining levels of information sharing (Hypotheses 1a and 3a, respectively), and
- reciprocity between vision building and goal interdependence (Hypotheses 2a and 2b)

The final model significantly explained 43.0% of the variance of the first latent difference score of vision building, and 12.8% of its second, 24.5% of goal interdependence's first, but the 10.1% explained variance of goal interdependence's second latent difference score was not significant. The model explained 29.8% of information sharing's first, and 20.8% of the variance of its second latent difference score.

We will elaborate on the most important findings from the parsimonious multivariate LDS model by first giving interpretations of the initial levels from each variable, and then we will interpret the parameters relating the variables, thus roughly following the order of the parameters in Table 5.1. As for all variables change was best described with proportional

where $\mu_{\Delta t}$ is the estimated intercept of the difference score at a certain occasion. To test whether measurement occasion scores significantly differ from occasion to occasion, measurement occasion scores are compared. Measurement occasion scores are calculated by adding an occasion's difference score and its previous measurement occasion score.

change models, this multivariate model is effectively a cross-lagged panel model with a mean structure (see autoregressions and difference factor intercepts in Table 5.1 and Appendix F.2).

The variables were related over time in the modified multivariate LDS model through four significant, and invariant, coupling parameters (see Figure 5.2, and γ 's in Table 5.1). The first two coupling parameters are from vision building to goal interdependence, and oppositely from goal interdependence to vision building. As we hypothesized, vision building and goal interdependence are thus reciprocally related (Hypotheses 2a & 2b). Intra-individual increases in a transformational leader's vision building practices lead to intra-individual increases in perceptions of the need to interact to attain goals, as well as vice versa. The third and fourth coupling parameters lead from vision building and goal interdependence to information sharing. Intra-individual increases in a transformational leader's vision building practices, and intra-individual increases in perceptions of the need to interact to attain goals, lead to intra-individual increases in engagement in information sharing activities. This supports Hypotheses 1a and 3a. Overall these results show reciprocity between vision building and goal interdependence, and a leading role of both variables on information sharing.

Table 5.1 Parameter estimates from the final multivariate latent proportional change score model

Parameter	Vision	Goal	Info
Proportion β_1	-.634*	-.431*	-.408*
Proportion β_2	-.314*	-.167†	==
Initial mean μ_1	3.238*	3.225*	4.167*
Difference factor1 intercept $\mu_{\Delta 1}$	1.510*	1.211*	1.113*
Difference factor2 intercept $\mu_{\Delta 2}$	.409	.256	1.117*
Coupling γ			
Goal[t- Δt] $\rightarrow \Delta$ Vision[t]	.195*		
Vision[t- Δt] $\rightarrow \Delta$ Goal[t]		.085†	
Vision[t- Δt] $\rightarrow \Delta$ Info[t]			.086*
Goal[t- Δt] $\rightarrow \Delta$ Info[t]			.233*
Initial variance ϕ_1	1.078*	.689*	.417*
Difference factor1 variance $\omega_{\Delta 1}$	.493*	.338*	.133*
Difference factor1 variance $\omega_{\Delta 2}$	.476*	.147*	.189*
Correlations ρ	I Vision	I Goal	I Info
I Vision	1		
I Goal	.353*	1	
I Info	.211*	.233*	1

* $p < .01$, † $p < .05$, double equality signs indicate that this parameter was held invariant. N = 655, # parameters = 67. Vision = transformational leadership vision building; Goal = goal interdependence; Info = information sharing. Factor loadings from the measurement occasion factors are not listed. See therefor Appendix B. Error variances are not listed. See for an approximation Appendix B. Error variances from the final structural model deviate from those in the measurement model with a maximum of .003, .009, and .002, for Vision, Goal, and Info respectively.

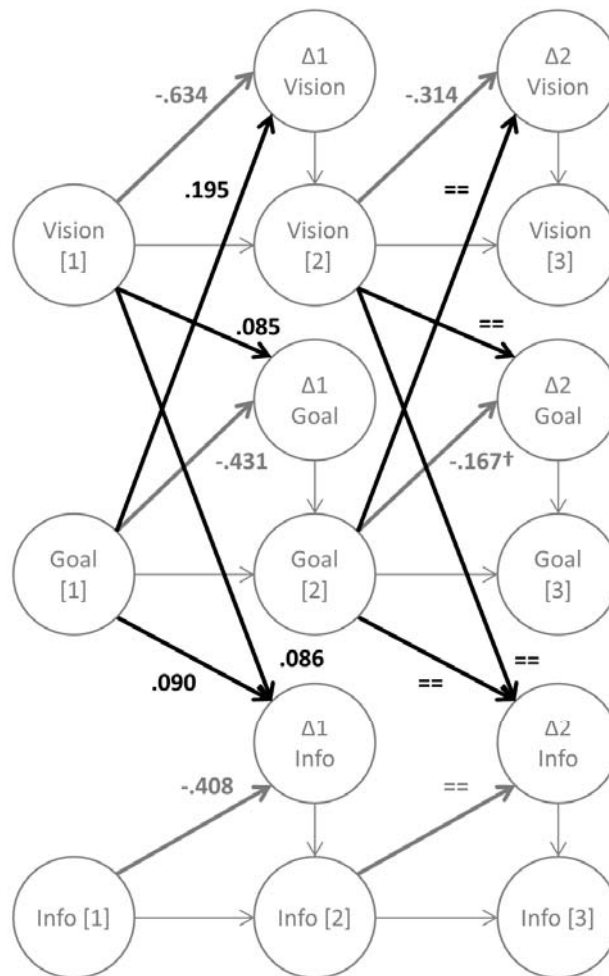


Figure 5.2

Simplified representation of the final multivariate proportional change LDS model

Vision = transformational leadership vision building; Goal = goal interdependence; Info = information sharing. Vision[t] represents vision's measurement occasion factor at time t. Δ[#]Vision represents vision's latent difference factors for subsequent occasions. The black single headed arrows are the invariant couplings from one variable to another (the γ's) with their values (the double equality sign represents invariance). The bold grey arrows are the autoregressions (β's) with their values. The grey arrows without values are fixed at 1. Vision and goal do not have invariant autoregressions, info does. The model is simplified to stress the influences over time and to ease interpretation.

Discussion

This investigation tested the longitudinal effects of the transformational leadership practice vision building, and perceptions of goal interdependence, on VET teachers' information sharing. The first aim of the investigation was to assess the relations as shown in Figure 5.1. The second aim was to explore possible reciprocal relations between these variables. Data of three measurement occasions with yearly intervals of a total of 655 participants were used for the analyses. Each variable was analyzed with univariate LDS models to assess its change. To assess the longitudinal relations between the variables, they were coupled with a multivariate LDS model. The results from the multivariate LDS analyses are elaborated on here.

None of the variables showed systematic constant change. Levels of information sharing were found to be very stable. The finding that initial levels of information sharing were high might indicate that teachers had already valued information sharing with colleagues at the onset of the study. The introduction of a policy of teaming might therefore have been welcomed, and may serve as a counter against a natural decline in teachers' engagements in social learning activities (Gabelica et al., 2014; Giles & Hargreaves, 2006; Schippers et al., 2003). Future research must assess whether high levels of information sharing lead to changes in teaching practices and, consequently, in increased student results (e.g., Desimone, 2009). Goal interdependence and vision building both increased between occasion 1 and 2, after which their levels did not increase further. Apparently, the initiation of teams can give a short boost in vision building practices of leaders, and perceptions of needing to interact to pursue common goals of teachers. Studies designed to capture more variation by measuring longer and denser will grant more insight into the dynamics of this process.

All three variables' initial factors were significantly and positively correlated. This suggests that those higher in any one variable tend to be also higher in the other variables at the onset of the study. This means that teachers who share information more also perceive more interaction with team members to pursue goals, and perceive their leader to engage more in vision building. Thus, higher levels of purposeful conditions and social reflective learning tend to go together.

Variables were sustained by the influence of other variables. We will elaborate on these couplings of variables in the reversed order of presentation of Figure 5.2. We found the assumed influence of goal interdependence on information sharing. Perceptions of needing to interact to attain goals positively influenced the generation and exchange of knowledge. This significant coupling parameter indicates a causal influence from goal interdependence to information sharing. This finding adds to the evidence about the beneficial role of collaboration and contact with team members in pursuing common goals in elevating levels of engagement in social reflective learning (Runhaar et al, 2010; Runhaar et al., 2014; Tjosvold, Tang & West, 2004; Tjosvold, Yu & Hui, 2004). The possibility of the reversed effect was not found. Apparently, perceptions of goal interdependence do not benefit from information sharing.

As we assumed, vision building positively influenced information sharing over time. Vision building thereby helped to sustain levels of information sharing. A leader who inspires to formulate shared goals and to commit effort to attain them more positively influences exchange of information and discussion of its adequacy. A transformational leader thus contributes to continued information sharing by repeatedly articulating a vision. This significant coupling parameter indicates a causal, and direct, influence from vision building to information sharing. This finding adds to the discussion about to what extent transformational leadership has its effects on team communication and critical reflective learning via perceptions of the workplace (e.g., Dionne et al., 2004). The reversed effect was not found. Leaders apparently do not change their vision building practices as a result of changes in teachers' social learning activities.

The assumed coupling from vision building to goal interdependence was also found. Intra-individual increases in vision building practices lead to intra-individual increases in perceptions of goal interdependence. A leader who inspires to formulate shared goals and to commit effort to attain them more positively influences teachers' perceptions of needing to interact to attain goals. This finding indicates a causal link, and corroborates studies showing

the effect of shared visions on goal interdependence (Wong et al., 2009), and, more generally, adds to the evidence for the positive influence of transformational leadership practices on collaboration and trust between teachers (Geijsel et al., 2009; Moolenaar et al., 2012; Thoonen et al., 2011). Exploration of couplings that would strengthen the model pointed also towards the reversed effect, and this coupling from goal interdependence to vision building was significant. Increased perceptions of a need to interact to pursue and attain common goals leads to increased vision building practices. Vision building and goal interdependence are therewith reciprocally related. It would thus seem that vision building practices are mostly meaningful when teachers are already trying to attain common goals. This indicates that only together can leaders and teachers co-create a purposeful environment that serves as an organic norm that may overcome the persistence of privacy and facilitate the establishment of teams in which teachers learn from each other by sharing information and pool their knowledge for educational improvement (Little, 1990; Mulford, 2010; Nemanich & Keller, 2007; Nielsen, Randall, Yarker, & Brenner, 2008; Rowan, 1990).

In sum, these longitudinal findings show that, at least in the interval in we measured, levels of information sharing were sustained. Moreover, the continuous interplay between a transformational leader's vision building practices and perceptions of goal interdependence seems to create a movement that helps to maintain those levels. These findings therefore extend current knowledge about the initiating role ascribed to transformational leadership in bringing about change by fostering learning (Leithwood et al., 1999; Thoonen et al., 2011). To this it adds that vision building practices are not one-way influences. When teachers take the responsibility to strive to attain common goals, they support their leader to remain inspirational (e.g., Mulford, 2010; Scribner, Hager, & Warne, 2002). Vision and goal interdependence therefore provide and (self-)generate direction so that teachers can sustain social learning and fruitfully adapt to the changes that face them (Giles & Hargreaves, 2006; Stoll et al., 2006).

Strengths and limitations of the present study

Data were gathered at VET colleges from teachers. In what way these teachers resemble employees in other organizations or industries was not part of this study. One way teachers are different from other employees is that they work daily with the transfer of knowledge, albeit to students. Future research must establish whether the dynamics found in this study can be replicated for other professions as well.

In this study we made use of a versatile model type for longitudinal data: the Latent Difference Score model (McArdle, 2009). It allowed to model change in a way similar to latent growth curve models but extended on them by adding proportional change to constant change. It therefore allowed to model dynamic relations between variables, reminiscent of relations in cross-lagged models. In this way, change is defined in a precise way, which makes interpretations of influences on change more robust. Despite this benefit, inferring causality must still be done with caution, as unmeasured variables may account for the found effects a lot better (Eschleman & LaHuis, 2013; McArdle, 2009). Inclusion of variables tapping into such concepts as self-reflection (as a prerequisite for making knowledge explicit so that it can be shared as information), identification with the school's goals, task interdependence, time for interaction, perceptions of actual collaboration, functional team conflict, individualized or distributed forms of leadership, teachers'

craftsmanship, and the establishment of shared meaning as well as student results would substantiates the validity of these findings (Fullan, 2007; Hallinger & Heck, 2011; Spillane et al., 2012; Thoonen et al, 2012).

Another caution for interpreting our findings is the fit of the model to the data. The RMSEA value was good, the SRMR value was acceptable, but the CFI value indicated a weak fit (Hu & Bentler, 1999). Thus, there remains some concern that other types of models may fit the data better, such as more simple cross-lagged models (Eschleman & LaHuis, 2013). Nevertheless, by modelling latent difference scores we were able to establish that some change occurred between the first and second measurement moment. Moreover, a series of ΔX^2 tests indicated that the modified multivariate proportional change model fitted the data best, and none of the variables was spurious. An additional analytic caution for interpreting our findings is that data were collected from teachers who were nested in teams. We were unable to correct for this possible dependency in the data, because we did not have enough power to do so: the amount of parameters vastly exceeded the amount of teams. Future research must establish to what extent being a member of a team changes the relation between information sharing and its antecedents or consequences.

One step further in unraveling how information sharing may be enhanced could be by using multilevel models to investigate the consistency of teachers' perceptions of social reflective learning in the team, and of the vision building activities of their leader, as a proxy for the shared perception of the content the leader shares. This would connect with the view that critical reflection constitutes both individual and shared sense making as well as collaboration and participating in communities of learners (McArdle & Coutts, 2010). Consequently, studies are needed that establish whether individually enacted learning activities and collaborative learning activities are conceptually the same, and it would be worthwhile to explore whether one would be predictive of the other (e.g., Lodders, 2013).

Additionally, information sharing did not grow. It could be that we measured it too soon after the implementation of a policy of teaming and that growth could have been modelled had we measured longer. However, its levels were already high at the onset of the study. Another explanation could therefore be that planned meetings were very regular. Because frequency of meetings is positively associated with exchanging information (Somech & Drach-Zahavy 2007) increasing meetings may lead to growth in information sharing. The regularity of the meetings would also explain the little variance of information sharing that the model explained. More variance may be explained with a different approach to the variables, such as with denser, and more contextualized, measurements, or more focus on the content that is actually exchanged in relation to the type and the duration of the goals that are pursued (e.g., Gabelica, Van den Bossche, Segers, & Gijssels, 2014).

More conceptually, one could question what role collaborative learning activities play in maintaining and improving classroom practices. Teachers may not need to acquire more of some competence, and thus more information, but rather need to work with information that is relevant to keep adapting to changing policies and student populations. This means that the unit of analysis is not the amount of information shared in the team, but rather the content and the quality of the information. *That* information is shared is no indication for *which* information is shared. For instance, teachers may refrain from sharing feedback that might be valuable for a team member to develop in the long run, because they anticipate it may hurt the team member's feelings (Horn & Little, 2010; Little, 1990). Development, then, implies sudden shifts in the informational content that is relevant, for which steady levels of information sharing serve as a catalyst (Mulford, 2010; Weick, 1996). For social researchers

this poses a severe difficulty. Statistical possibilities do not allow for sudden changes in the meaning of variables (violation of assumption of equilibrium), nor are they fit to model emergence of new conversational topics or practices, as they are built on linear correlations. As such, although elaborate statistics have been developed, they constrain researchers working with quantitative data to developmental questions about variables that are already present, start small, and become bigger over time, but not about how innovations non-continuously (disruptively) emerge from a non-changing innovating process (see however Kunnen & Bosma, 2000, on how to model such a process). Research with methods that can address these issues could show the dynamics of the establishment and improvement of communities of learners for maintaining and improving instructional quality and student results.

Conclusion

All in all, an image rises from this longitudinal study that, in a Dutch VET context, levels of information sharing are driven by the reciprocity between a vision building transformational leader and perceptions of goal interdependence. The recurrent articulation of a vision continuously inspires teachers to formulate common goals and to interact to pursue them, and vice versa. As such, teachers and leaders co-construct a purposeful environment that sustains the generation and spreading of knowledge and discussing the adequacy thereof. This may in turn fuel the construction and maintenance of powerful teams for sustained improvement

Chapter 6

General discussion

Though enduring systematic theories about man in society are not likely to be achieved, systematic inquiry can realistically hope to make two contributions. One reasonable aspiration is to assess local events accurately, to improve short-run control (Glass, 1972). The other reasonable aspiration is to develop explanatory concepts, concepts that will help people use their heads. (Cronbach, 1975, p. 126)

The studies in this dissertation were aimed at contributing to theory about how teacher learning in the workplace can be facilitated. Therefore we investigated to what extent Vocational Education and Training (VET) teachers develop their engagement in learning activities after the introduction of working in multidisciplinary teams, and how the interplay between organizational and psychological factors facilitates learning. More specifically, engagement in learning activities was operationalized as individual (self-reflection, experimenting, keeping up to date) and social (information sharing, asking for feedback) professional learning, organizational conditions as transformational leadership practices (vision building, individualized consideration, and intellectual stimulation) and perceptions of interdependence (task and goal interdependence), and a psychological factor as self-efficacy beliefs. The first aim was the validation in a VET context of a model previously used in research on the enhancement of teacher learning in primary education (Geijsel, Sleegers, Stoel, & Kruger, 2009; Thoonen, Sleegers, Oort, Peetsma, & Geijsel, 2011) as well as by extending the model with more variables. The second aim was to examine co-development of the variables, that is, the extent to which the variables (reciprocally) influenced each other as they progressed over time.

Overall, results indicated that the structural relations as specified in the model these studies were based on partly held (Geijsel et al., 2009; Thoonen et al., 2011). As found in elementary school contexts, perceptions of the workplace mediated the effects of transformational leadership. However, self-efficacy beliefs did not affect engagement in learning activities over time. Rather, they were influenced by engagement in learning over time. Additionally, two reciprocal relations were found: between vision building and goal interdependence, and between task interdependence and self-reflection. The next paragraphs will elaborate more on the details of the findings from the four studies.

Summary of the results

Chapter 2 reported the study on the role of the interplay between transformational leadership practices (vision building, individualized consideration, and intellectual stimulation), perceptions of interdependence, and self-efficacy in enhancing the learning activities self-reflection and asking for feedback. A model was created and tested on the

data of 447 teachers from 66 teams using Structural Equation Modeling (SEM). The nested structure of the data (teachers within teams) was taken into account by means of testing the 'complex structure' in Mplus. The results from this study showed that self-reflection and asking for feedback were positively influenced by both self-efficacy and task interdependence. Asking for feedback was additionally enhanced by goal interdependence. Task and goal interdependence, in turn, fostered self-efficacy beliefs. Moreover, task interdependence was positively influenced by individualized consideration whereas goal interdependence was enhanced by vision building. Vision building also had a positive, and direct, effect on asking for feedback, as did intellectual stimulation. The findings contribute to previous research on the differentiated impact of transformational leadership practices on teachers' engagement in professional learning activities as mediated by perceptions of the work environment such as positive interdependence (Dionne, Yammarino, Atwater, & Sprangler, 2004; Jung & Sosik, 2002; Korek, Felfe & Zaepernick-Rothe, 2010; Staples & Webster, 2008; Tjosvold, 1986). The findings from this cross-sectional study also suggested a pivotal role of self-efficacy beliefs (Salanova, Bakker & Llorens, 2006; Schyns, 2004). The results therefore point towards the beneficial role of the interplay between organizational and psychological conditions in enhancing engagement in learning activities in the context of change (Korthagen & Vasalos, 2005; Kwakman, 2003; Leithwood, Jantzi, & Mascall, 2002; Stoll, Bolam, McMahon, Wallace & Thomas, 2006; van Woerkom, 2004). The model on the interplay of organizational and psychological factors for the enhancement of engagement in learning activities such as formed from research in elementary schools was therefore validated in a VET context.

Chapter 3 aimed to extend the findings from chapter 2 by introducing additional individual and social learning activities to the model. The individual learning activities, keeping up to date and experimentation, were added to self-reflection, while information sharing was added to asking for feedback as social learning activities. The data of 447 teachers from 66 teams were used in the analyses. Factor analyses showed two instead of three transformational leadership dimensions: individualized consideration and intellectual stimulation combined to transformational leadership practices concerned with attending to individual teachers' needs and challenging them individually to improve. Vision building, a transformational leadership practice that is more aimed towards the commitment of teachers to the common goals of the team, remained a separate dimension. Additionally, it was found that asking for feedback and information sharing should be combined into one social learning activity: information sharing and social reflection. Results from a SEM analysis, again with the nested structure of the data taken into account, showed positive direct effects of task interdependence and self-efficacy on enhancing engagement in both individual and social learning activities. Goal interdependence furthermore had a positive influence on social learning, but not on individual learning. Task and goal interdependence had a positive influence on self-efficacy, but the effect of goal interdependence was less than a third of the effect of task interdependence. In addition, the findings showed that vision building enhanced goal interdependence, while individual consideration and intellectual stimulation enhanced task interdependence. These results indicate that engagement in all learning activities was linked with self-efficacy beliefs, task interdependence, and the transformational leadership practices individualized consideration and intellectual stimulation. These links suggest that the *generation* of knowledge, ideas, and information through learning can be facilitated by empowering teachers. Moreover, engagement in social learning activities seems to be additionally linked to goal

interdependence and the transformational leadership practice vision building, suggesting that *exchanging* knowledge could be facilitated by the creation of a purposeful environment.

Building on the results from the cross-sectional studies, chapters 4 and 5 focused on the role of an empowering and purposeful environment for the enhancement of teacher learning by using a longitudinal design. A longitudinal design can make stronger claims about causality and mediation than cross-sectional models, and it allows investigation of possible reciprocal relations undetected by cross sectional models. Additionally, it allows assessing growth or decline.

Chapter 4 reported a longitudinal study into the role of individualized consideration and intellectual stimulation, task interdependence, and self-efficacy beliefs, in enhancing engagement in self-reflection over time. A Latent Difference Score (LDS) model was fitted to three waves of data of 655 teachers to test the dynamic, possibly reciprocal, influences between the variables, as well as to assess their change (McArdle, 2009). The results partly confirmed, partly contradicted, and partly extended the cross-sectional findings. Levels of all variables remained (relatively) stable over time. Task interdependence positively affected self-reflection over time. The transformational leadership practices individualized consideration and intellectual stimulation positively affected task interdependence over time. However, self-efficacy did not affect engagement in self-reflection over time. Instead, self-reflection positively affected self-efficacy over time, indicating that learning leads to competency beliefs. From this it seems that generating new knowledge to improve one's functioning fosters experiencing small successes, such as finding solutions to daily obstacles. It would thus appear that (reflective) learning leads to psychological empowerment for overcoming obstacles, rather than that an empowering environment leads to learning how to do so (Maynard, Mathieu, Gilson, O'Boyle, & Cigularov, 2012). Additionally, engagement in self-reflection was found to positively affect perceptions of task interdependence over time, and these two variables were therefore reciprocally related.

These findings suggest that while teachers are reflecting on how to interact with team members, they discover workable scripts for possible future interactions (e.g., Horn & Little, 2010; Spillane, Reiser, & Reimer, 2002; Weick, Sutcliffe, & Obstfeld, 2005). When enacting their newly developed scripts, teachers are able to discover that team members provide them with new information, given that they perceive these interactions with team members as supportive for choosing a course of action to complete the tasks at hand. In turn, they can then use this information to further reflect on how to improve (e.g., Clarke & Hollingsworth, 2002). Moreover, the findings also indicate that a transformational leader can help to sustain perceptions of the need for interaction to successfully complete tasks by serving as a positive role model and attending to teachers' individual needs and feelings, as well as challenging teachers to improve. Thus, through a continuous cycle of interaction with colleagues and knowledge *generation*, and while being supported by their leader, teachers co-construct a learning environment, through which they, in turn, feel empowered to overcome obstacles.

Chapter 5 focused on the benefits of a purposeful environment for sustained social learning. More specifically, it assessed the role of vision building and goal interdependence in fostering engagement in information sharing over time. Again, an LDS model was fitted to three waves of data of 655 teachers to test the dynamic, possibly reciprocal, influences between the variables, as well as to assess their change. The results confirmed and extended the cross-sectional findings. Levels of all variables remained (relatively) stable over time. Goal interdependence positively affected information sharing over time. Vision building, as a

transformational leadership practice, also affected information sharing positively over time. Individual teachers' engagement in information sharing is thus facilitated when teachers perceive the need to interact to formulate and share related team goals and to work together to achieve these goals. Moreover, information sharing seemed to be also facilitated by a leader who is perceived to initialize and build a vision from which teachers can derive more specific team goals. Thus, teachers engage in social learning when there is a purpose for which to do so. Additionally, vision building was found to positively affect goal interdependence over time, and goal interdependence positively affected vision building over time. These two variables were therefore reciprocally related.

After being organized into multi-disciplinary teams teachers face the task of pooling their knowledge in order to improve their curricula and integrate their courses. While formulating shared goals and deliberating how to reach them teachers create an infrastructure that specifies a course of action. A transformational leader contributes to this process by initiating and articulating a vision, inspiring teachers to formulate shared goals, connect to these, commit to them, and participate in interaction and coordination with team members in order to attain their goals. Reciprocally, when teachers take the responsibility to continue pursuing attainment of common goals, they support their leader to remain inspirational (e.g., Mulford, 2010; Scribner, Hager, & Warne, 2002). The collaboration between transformational leaders and teachers thereby co-creates a purposeful learning environment for sustained *exchange* of knowledge. Such a purposeful environment may therefore serve as a counter against a natural decline in teachers' engagement in making knowledge explicit and available for team members, as well as exchanging advice with team members to improve (Gabelica, Van den Bossche, De Maeyer, Segers, & Gijssels, 2014; Giles & Hargreaves, 2006; Schippers, den Hartog, Koopman, & Wienk, 2003).

In sum, the studies in this dissertation show that VET teacher learning is facilitated by the organizational conditions transformational leadership and interdependence, and these results are similar to findings from an elementary school context (Geijsel et al., 2009; Thoonen et al., 2011). In contrast, the psychological factor self-efficacy did not facilitate learning over time; rather, its levels were sustained by learning. Transformational leadership practices and perceptions of interdependence seem important elements for a supportive educational environment that sustains engagement in professional learning activities over time. More specifically, two transformational leadership practices, individualized consideration and intellectual stimulation, and task interdependence seem to drive knowledge generation (and possibly exchange), which subsequently leads to sustained levels of self-efficacy. Vision building and goal interdependence seem to, additionally, drive knowledge exchange. These two sets of links suggest that an environment that is both empowering and purposeful supports learning. It seems therefore likely that these sets of links can drive change in existing (instructional) practices (Slegers, Thoonen, Oort, & Peetsma, 2014; Thoonen, Slegers, Oort, & Peetsma, 2012).

The findings furthermore show that teachers play an active role in the construction of (their) purposeful and empowering workplaces. Reciprocity was found between task interdependence and self-reflection, indicating that teachers co-construct a learning environment through a continuous cycle of interaction and learning. This finding suggests that teacher learning is pivotal in building a school's change capacity (Stoll et al., 2006). Reciprocity was also found between vision building and goal interdependence, indicating that teachers and leaders inspire each other to work towards the formulation of,

commitment to, and pursuit of common goals. These findings suggest that working in multidisciplinary teams incites teachers to continuously make sense of what working in such a team implies, and, through interaction with team members, to find ways to strengthen their professional expertise and practice (Desimone, 2009; Weick et al., 2005). The co-creation of an empowering and purposeful workplace may therefore overcome the persistence of privacy (Little, 1990) and facilitate the establishment of a community of learners.

Limitations, future research, and practical implications

To view re-education as a task of acculturation is, we think, a basic and worthwhile insight. However, it is but a frame of reference. To provide for effective re-education, we need additional insight into the dynamics of the process, [and] the specific constellation of forces which have to be dealt with under varying conditions. (Lewin & Grabbe, 1945)

Limitations concerning the selection of organizational and psychological factors

The first aim of this dissertation was the validation of a model on the enhancement of teacher learning that was developed in an elementary school context (e.g., Geijsel et al., 2009). The cross-sectional studies found similar structural relations in a VET context to those in an elementary school context. The longitudinal studies strengthened claims about the positive causal influence of transformational leadership and perceptions of positive interdependence. The psychological factor self-efficacy, when assessed over time, was a consequence, rather than a factor, of individual, and possibly social, learning. However, these findings cannot lead to the conclusion that all organizational conditions will positively influence teacher learning, nor that psychological factors do not play a role in enhancing and sustaining levels of teacher learning. Inferring causality must still be done with caution, as unmeasured variables may account for the found effects a lot better (Eschleman & LaHuis, 2013; McArdle, 2009). Inclusion of team leadership or distributed forms of leadership in future research would allow the modeling of how leadership could transform from one to many sources, and would provide more insight in the daily practice of leadership that is embedded in the school setting (e.g., Day, Sammons, Leithwood, Hopkins, Harris, Gu, & Brown, 2010). Future research that includes variables that tap into different organizational conditions such as the degree of diversity and longevity, identification with the school's goals, functional team conflict, time for interaction, and perceptions of actual collaboration would substantiate the validity of the beneficial role of organizational conditions for teacher learning (Johnson & Johnson, 2009; Schippers, et al., 2003; Spillane et al., 2002; Thoonen et al., 2011; Yammarino, Dionne, Schriesheim, & Dansereau, 2008). Future research may also assess identification with school goals as a cognitive aspect of teachers' psychological states in addition to self-efficacy. Tolerance to uncertainty and trust would measure more affective aspects of teachers' psychological states that have also been found to motivate individual teachers to engage in professional learning activities (van Veen, Slegers, & van de Ven, 2005). Inclusion of these variables in future research would provide a more coherent understanding of how the interplay between psychological and organizational factors

promote, or are promoted by, teacher learning. Conducting these studies in different contexts, such as corporate, governmental, and non-governmental, as well as other educational contexts such as secondary education, would also add to the validity of the model on the interplay between organizational and psychological factors for the enhancement of learning of professionals in both educational and non-educational institutions.

In addition to the inclusion of more and different variables, future studies could also model variables on two levels, such as with Multilevel Structural Equation Models (MSEM), or multilevel latent growth curve models (Feldhoff, Radisch, & Bischof, *in press*; Heck & Hallinger, 2009; Preacher, Zyphur, & Zhang, 2010; Truijen, 2012). Multilevel modeling is needed to assess, for instance, whether all team members equally perceive the necessity of engagement in learning activities. Teams in which only a few teachers actively engage in learning may have underinformed team members. This could impede a team's capacity to adapt, such as when the informed team members leave. In contrast, the emergence of learning as a team phenomenon would consolidate an organically formed culture of learning that would be robust against changes in team composition, work conditions, and policy (e.g., Barab & Duffy, 2000; Giles & Hargreaves, 2006; Grossman, Wineburg & Woolworth, 2001; Wenger, 1998; Yost, 2006). Multilevel modeling would also contribute to conceptual clarity by testing whether variables are functionally similar at the individual level and the team level, thus indicating whether different concepts are needed for team and individual level phenomena, or not (e.g., Slegers, den Brok, Verbiest, Moolenaar, Daly, 2013). Such clarity would provide an understanding about whether interventions should target individuals or teams, in order to enhance learning and facilitate adaptation. Inclusion of team level outcomes, such as shared mental models or shared meaning, could, then, provide measures to assess the consequences of learning for the team. Multilevel models also allow assessment of upward and downward forms of cross-level interactions, thereby contributing to understanding how an environmental condition (such as a climate of trust) (e.g., Goddard, Tschannen-Moran, & Hoy, 2001), or a team characteristic (such as diversity) (e.g., van Knippenberg, de Dreu, & Homan, 2004) has differential effects on learning through individual perceptions, as well as how the behaviors of individuals align for the emergence of team level properties (such as collective efficacy beliefs) (Goddard, Hoy, & Woolfolk Hoy, 2004). Additionally, applying Latent Class Analysis (LCA) to growth curve models is a powerful tool to differentiate teacher learning into a few systematic patterns and to assess which pattern benefits most from which specific links between organizational and psychological factors. This would provide a more differentiated understanding of how schools within one sample improve (Hallinger & Heck, 2011).

Continuing this line of research on the interplay between organizational and psychological factors for the enhancement of teacher learning also has the benefit of coming to understand which different sets of linked factors can have a similar impact on teacher learning. Not all factors may be needed at once. Rather than an exhaustive combination of psychological and organizational conditions, it may be that the links between only a few factors can generate robust effects, due to their dynamic interplay. The studies in this dissertation already untangled two possible sets of linked factors, suggesting that more sets of linked factors that lead to learning might also be found. Future research must investigate whether the impact of these sets can be strengthened by the addition of a few other factors. The inclusion of several factors in future studies may therefore bring to light which sets of selected factors have robust effects on teacher learning and which factors are, relatively,

redundant in combination with others. When such sets of dynamically linked factors are known, schools may then promote those variables that best complement those that are already present as an effective way to strengthen their change capacities. When schools find, for instance, that teachers already generate a lot of knowledge and experiment with new instruction methods, but that teachers do not yet share their knowledge with team members, despite that teachers are willing to pursue common goals and monitor their collective progression, then schools may provide teachers more often with a vision about productive collaboration to initiate the enactment and pursuit of goals, thereby boosting exchange of information. As this would require thorough knowledge about which combinations of factors need to be strong, as well as a thorough assessment of the points on which a school's change capacity is already strong, which are weak, and which do not matter so much, it would be advisable for schools and teachers to collaborate with educational researchers to situate scientific insights in the context of the school. Future research should therefore continue to include more and different variables in order to increase understanding which factors matter in which combinations, and in which situations.

Limitations concerning change and development

The second aim of this dissertation was the modeling and testing of the dynamic interplay of the variables. Because engagement in learning activities remained stable over three measurement occasions, growth (or decline) could not be related to another variable. This dissertation cannot empirically answer therefore how engagement in learning activities could be increased. Consequently, our LDS models are equal to cross lagged panel models in which a mean structure is included (e.g., Delsing & Oud, 2012; Eschleman & LaHuis, 2013). Whereas we were able to address the question of reciprocity between variables, we were unable to assess the nature of these relations in terms of change, i.e., did a variable such as task interdependence merely counter decline, did it function as a catalyst, or could it co-develop together with another variable such as self-reflection?

One way to be able to model change is by using interventions (McArdle & Prindle, 2008; Sbarra & Allen, 2009). As the results showed that teachers did not perceive goal interdependence as high at the onset of the study, interventions could be designed to foster structured moments of contact to coordinate for the attainment of common goals and the exchange of knowledge to that end (e.g., Somech & Drach-Zahavy, 2007). These interventions may, for example, aim to build an open and trustful climate, or target learning from mistakes. Sharing information, discussing criteria for good functioning, and asking for feedback, are all activities that expose oneself to possible criticism of others, which teachers may want to evade to avoid interpersonal conflicts (Horn & Little, 2010; Little, 1990). Such doubts may be taken away when engagement in these sources of anticipated negative criticism are explicitly addressed, for instance during meetings, as sub-goals in attaining larger goals such as sustaining improvement of student results (e.g., Edmondson, 1999; Hattie & Timperley, 2007). This would allow teachers to discover that all team members can learn from the mistakes individual teachers make, as long as these can be identified and shared within an open and trustful climate. Interventions aimed at the creation of an open and trustful climate, as well as (collective) learning from mistakes, might therefore enhance perceptions of goal interdependence (Moolenaar, 2012; Stoll et al., 2006; Tjosvold, Yu, & Hui, 2004; Toole & Louis, 2002). An additional benefit of such interventions might be that

teachers would not only share more of the same information, for instance about students or the curriculum, but might also discuss a broader range of topics, such as one another's functioning in the team. Findings from such experimental studies will contribute to our understanding of how and when organizational conditions such as goal interdependence could be increased, rather than sustained.

A second way to model change is by including more measurement occasions (e.g., Feldhoff et al., *in press*). More measurement occasions could have allowed us to examine dynamic influences of self-efficacy, interdependence, and leadership on the change in levels of engagement in the learning activities, if they would have grown, or declined, at a later point in time. Findings from these studies could contribute to a deeper understanding of which factors may have to be manipulated in order to enhance engagement in learning activities. Such research may also be useful and helpful for increased understanding of the development of self-efficacy beliefs. In our study, self-efficacy did not grow (see also Thoonen et al., 2012). Teachers' beliefs of competence were stable and would thus appear to be robust to changes over the period, and with the intervals, we measured these beliefs. According to social learning theory, self-efficacy develops when people perceive to have found satisfying solutions to specific problematic or uncertain situations, or when they perceive others resolving such problems (Bandura, 1997). Self-efficacy beliefs are therefore situation specific (e.g., Schwarzer & Hallum, 2008), such as indicated by studies that show considerable between-context variability in teacher self-efficacy (Malmberg, Hagger, & Webster, 2014; Raudenbush Rowan, & Cheong, 1992; Ross, Cousins, & Gadalla, 1996). New challenges in specific situations may therefore cause temporal flows in teachers' levels of self-efficacy beliefs. Such flows may be assessed longitudinally when measured at the right interval. Measuring on too few occasions and with too large intervals would not be able to capture these micro-dynamics when these challenges are relatively quickly resolved. To better understand exactly how teachers' self-efficacy develops would therefore require studies that are more sensitive to the concrete situational challenges teachers are facing. Such studies should include more measurement occasions with shorter intervals and may chart challenges, for instance, by using open questions (Caprara, Fida, Vecchione, Del Bove, Vecchio, Barbaranelli, & Bandura, 2008). Moreover, other and more sensitive instruments than Likert-like interval scales may be needed to capture enough variability over time, such as analogue scales (e.g., Delignières, Fortes, & Ninot, 2004). This would help to understand the variability of self-efficacy, how and when it emerges in which contexts and from which experiences, and how it relates to interacting with colleagues and learning. Findings from these studies will increase our insights into how to conceptualize self-efficacy: as a trait or as a more transitory disposition.

Whereas modeling change in goal interdependence might be possible by using interventions, and modeling change in self-efficacy might be made possible by measuring more often and with other and more sensitive instruments, investigating situations in which change can be naturally expected would also allow modeling change (McArdle, Grimm, Hamagami, & Bowles, 2009; McArdle, Hamagami, Meredith, & Bradway, 2000). Future research might, for instance, investigate change in engagement in learning activities in low performing schools. In such a context one can expect variables to increase, which would allow researchers to model change. Alternatively, to understand more about change processes in a broader context, future research could investigate change in learning in teams that are relatively newer, such as beginning teams, or teams that are more temporary, such as virtual or cross-functional innovative teams, than existing functional work teams, like the

teacher teams we studied (e.g., Hoegl, Weinkauff, & Gemuenden, 2004; Staples & Webster, 2008).

Another explanation for the lack of growth (or decline) in engagement in learning activities could be that teachers may not need to acquire more information, but rather need to work with information that is relevant to keep adapting to changes they are confronted with. This means that the unit of analysis is not the amount of engagement in learning activities, but rather the content and the quality of the information. Development, then, implies sudden shifts in the informational content that is relevant, for which steady levels of knowledge generation and exchange serve as a catalyst (Mulford, 2010; Weick, 1996). Whereas professional learning is a core competence of teachers, their productivity lies in the instruction they use to teach students new knowledge and skills (e.g., Timperley & Alton-Lee 2008). Future longitudinal research might therefore measure which information teachers attend to and whether this changes over time, and additionally whether different learning activities are used at different times therefor. Such research would be able to illuminate which levels of engagement in which sequences of learning activities are sufficient for teachers to notice new information, which teachers may in turn use to change their instructional strategies (e.g., Endedijk, Hoekman, & Slegers, 2014; Endedijk, Brekelmans, Verloop, Slegers, & Vermunt, 2014; Slegers et al., 2014; Thoonen et al., 2012).

A closer look at the dynamics of teacher learning

Whereas the limitations so far already gave some indications for future research directions, in this section we will go a step further. Whether levels of engagement in learning are sustained or not, the generation and exchange of knowledge is a crucial activity to facilitate re-construction of teaching practices. These changed practices will, in turn, generate new information and knowledge that can be used for further accommodation of teaching practices to the circumstances at hand. Learning is therefore a cyclical process in which available environmental information, learning activities, and productive practices, are interconnected and co-develop (Barab, Cherkas-Julkowski, Swenson, Garrett, Shaw, & Young, 1999; Clarke & Hollingsworth, 2002). Such a micro-perspective on teacher learning would require concepts of human action and cognition, such as sense-making or transformative learning, that take daily experiences into account and explicitly incorporate continuous as well as sudden change in practices or frames of reference (Korthagen, 2010; Mezirow, 2006; Taylor, 2007; Weick et al., 2005).

This points to an additional limitation of the studies in this dissertation. Whereas interdependence was found to be highly influential in promoting engagement in learning activities over time, it addresses only *that* teachers perceive a necessity to interact to complete tasks and attain goals. It does not make explicit *how* or *for what* teachers interact. A better understanding of how perceptions of interdependence develop in teachers would require studies that are more sensitive to *what* specific type of environmental information teachers are attending to and *when* they do this. After all, teachers select only certain information from all that is potentially available in the (social) environment for their learning at a certain moment. As their learning progresses, teachers alter the potentially available information in the (social) environment through enacting what they have learned, and they may also need to select other information to continue learning (Weick et al., 2005). Such a micro-analysis of interaction and learning could also provide information about the local

challenges teachers face and the local solutions they find, which would reveal how teachers themselves interpret the changes that face them, and how they make use of their (social) environment to learn what is needed. This contributes to the ecological validity of such studies and their application in well performing schools and long lived teams. In-depth charting of this process would require measuring the content of the information teachers exchange or that is available to them when learning. In-depth studies that address the content teachers use is therefore needed to understand more about which affordances are used for adult learning (Barab & Roth, 2006; Gibson, 1979/1986; Greeno, 1994; Kulikowich & Young, 2001; Little, 1990; Maitlis, 2005).

Equally important is a better in-depth understanding of the dynamics of teacher learning, because the trajectories of teacher learning, as a process of progressively making sense of some of the information in one's environment, and the interval by which it can generate change, is largely unknown. In contrast to students who are educated to participate in society and whose learning consequently has a somewhat defined goal, teacher learning does not necessarily have a clear goal, and may resemble more the process of innovation of new services as found in other organizations and industries (Nonaka, 1994). The need for change may be situation specific, and only temporarily relevant. Liebig's law (van der Ploeg, Böhm, & Kirkham, 1999), stating that growth is optimal when *minimally* all resources are available (Lexence, 2014), would thus appear to apply only when an outcome is known, but not necessarily to the development of teachers. Moreover, teachers cannot constantly be at the edge of learning, for if they would, they may lose their grounds to teach in a consistent manner. They also need time to consolidate newly learned practices to be effective. Stated negatively, teachers need time to appear 'lazy' in teaching in order to learn, and teachers need time to appear 'lazy' in learning in order to teach (Mulford, 2010). Additionally, having learned something new, such as a new instructional skill, can constrain the acquisition of another, and may even hinder enactment of the skill it replaced. A trajectory of increasing knowledge and skills may therefore be misleading to assume, and it is left to future research to investigate by which pace learning processes generate change, if change is generated at all.

The process of 'being busy' learning does not necessarily lead to 'having learned' something in terms of sustainable change in cognition or behavior. Because learning processes have a dynamic nature, input and output of learning constantly change, while at the same time dramatic improvements may suddenly, or not at all, be observed (e.g., Hollenstein, Lichtwarck-Aschoff, & Potworowski, 2013; Kunnen & Bosma, 2000). Change may or may not occur. Recurrent enactment of certain actions creates a temporal organization which makes continued enactment of, for instance, instructional actions quite robust, even in the face of changes in the saliency of affordances (e.g., Schöner & Dineva, 2007; Thelen, Schöner, Scheier, & Smith, 2001), that is, they become routine and thereby difficult to change (e.g., Spillane et al., 2002). Providing more information, about for instance a desirable and new instruction strategy, may not quicken mastering such a new competence if a teacher's history with the current instruction strategy is too strong an attractor. Nevertheless, accumulation of experiences can give rise to new insights, because the interpretation of, and acting in, the same situation is never exactly alike twice (e.g., Stephen, Dixon, & Isenhower, 2009; Weick et al., 2005). Additionally, the experience of a critical event may disrupt routines and frames of reference, and this could be facilitated by continued critical reflection (Cope, 2003; Dirkx, Mezirow, & Cranton, 2006; van Woerkom, 2004). Thus, change resides in the dynamic pattern of (chosen) actions. Consequently, change may reside

less in organizational or environmental forces than is commonly assumed. Research into dynamic patterns of making sense of one's environment is therefore needed to understand how routines might be manipulated to allow change. It might be speculated that change can more easily occur when a temporal organization of certain actions is less strong, for instance after a holiday, or through meditation. A different approach would be to disrupt the dynamic pattern by presenting teachers regularly with unexpected situations or ideas (see also the transformational leadership practice intellectual stimulation), or when teachers would allow themselves to behave more inconsistently (and thus less predictable for themselves, but also for their colleagues). Understanding more about the learning trajectories of teachers, or adults in general, would thus seem necessary in order to understand which affordances and which dynamics foster teacher learning (e.g., Coburn, 2004; Losada, 1999; Losada & Heaphy, 2004).

To understand more about the dynamics of teacher learning and the affordances therein, researchers should not only develop theories about teacher learning processes, but should also test these theories (e.g., Howie & Bagnall, 2013). This would require, in addition to instruments that can capture the content of teacher learning, analytic techniques that derive their power first and foremost from frequent measurements, rather than a large sample of participants. For LDS models, like any form of SEM, a number of participants greater than 200 is recommended (Eschleman and LaHuis, 2013; see however Sbarra & Allen, 2009). Consequently these models allow generalization of findings to the population. Gathering many repeated measurements from all these participants however is difficult and expensive. This restrains empirical investigation of micro-level intra-individual change processes, such as the accumulation of daily experiences that lead to sudden change in insights, meaning, or accommodation of teaching practices. In contrast, analyses that derive their power from repeated measures, such as State Space Grids analysis or Recurrent Quantification Analysis (RQA), give measures about the stability or flexibility of a process and can already be applied to the data of a single person (Dale & Spivey, 2005; Granic, & Dishion, 2003; Lewis, Lamey, & Doulas, 1999; Mainhard, Pennings, Wubbels, & Brekelmans, 2012; see also Wijnants, Bosman, Hasselman, Cox, & Van Orden, 2009). Whereas the application of these analyses would allow for detailed descriptions of micro-level intra-individual change processes, the generalization of the findings of these analyses is restraint by available sample size and the motivation to participate for a sufficient and longer period of time. Nevertheless, a great benefit of such methods and analyses is that it allows for tailored advice to individual teachers (or teams). Consequently, this approach to professional learning would allow teachers and policy makers alike to formulate situated expectations about the pace of adaptation, the rate of innovations in a certain time, and delays in proficiency. Future research that would measure, quantify, and dynamically model (Lichtwarck-Aschoff, Kunnen, & van Geert, 2009; Vleioras, van Geert, & Bosma, 2008), affordances in teachers' sense making processes would test the metaphor to understand the minutiae of workplace learning (Howie & Bagnall, 2013). This situated and systematic approach would greatly contribute to theory development, which would in turn facilitate the design and establishment of powerful professional learning communities (Barab & Duffy, 2000; Kulikowich & Young, 2001; Sleegers et al., 2013; Stoll et al., 2006; Taylor, 2007; Weick et al., 2005).

In sum, the limitations of the studies in this dissertation point out that continuing research on the interplay between organizational and psychological factors and engagement

in learning activities is needed to understand which sets of linked variables would best benefit a certain organizational context in order to strengthen its change capacity. In future research, scholars should include more measurement occasions with shorter intervals in their designs and use more sensitive instruments to better understand the dynamic influences between variables. Such studies could also include outcome variables such as changed practices to understand more about the consequences of these dynamics. Additionally, more in-depth investigations would grant a deeper understanding of both the affordances teachers use in their daily practices to overcome challenges and the temporal patterns of the micro-process of learning in the workplace.

Conclusion

This dissertation showed that engagement in learning activities of Dutch VET teachers working in multidisciplinary teams is facilitated by transformational leadership practices and perceptions of interdependence over time, and, in turn, facilitates self-efficacy beliefs over time. Through a continuous cycle of interaction with team members and learning, teachers co-construct a learning environment that empowers them to overcome obstacles. A transformational leader seems to be able to motivate teachers to exert extra effort in this endeavor. Teacher learning has thus been shown to play a pivotal role in building change capacity. Additionally, teachers and leaders inspire each other to work towards the formulation of, commitment to, and pursuit of common goals in a continuous cycle, thereby co-creating a purposeful environment that fosters social learning. The findings therefore showed that, while a leader may guide, support, and challenge, teachers drive the establishment of conditions for learning and improvement. And that is certainly not an easy task.

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Samenvatting (Dutch summary)

Dit proefschrift is gericht op de verdere ontwikkeling van theorie over hoe het leren van leraren op de werkplek bevorderd kan worden. Individueel en sociaal leren van docenten is belangrijk voor aanpassing aan veranderende omstandigheden zoals veranderende studentenpopulaties of veranderingen in inzicht in effectief pedagogisch en didactisch handelen, voor het bouwen aan de verandercapaciteit van scholen, en voor het in stand houden van verbeteringen (Sleegers, Thoonen, Oort, & Peetsma, 2014; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006; Stoll, 2009). Om de mechanismen te begrijpen hoe professioneel leren van docenten bevorderd kan worden, hebben onderzoekers gekeken naar de vervlochten invloed van organisatie- (waaronder leiderschap) en motivatiekenmerken (Geijssel, Sleegers, Stoel, & Kruger, 2009; Leithwood, Jantzi, & Mascall, 2002; Thoonen, Sleegers, Oort, Peetsma, & Geijssel, 2011). Uit deze onderzoeken blijkt dat organisatie- en psychologische kenmerken de positieve effecten van leiderschap op professioneel leren mediëren. Echter, veel van deze onderzoeken zijn gedaan in het primair onderwijs, en met cross-sectioneel onderzoek. Het is daarmee onduidelijk in hoeverre de vervlechting van leiderschap, en organisatie- en motivatiekenmerken ook het leren van docenten buiten de context van het primair onderwijs kan beïnvloeden. Daarnaast is het ook nog onduidelijk wat de dynamiek van de variabelen over tijd is, en of het leren van docenten niet ook juist een centrale rol kan spelen in het bevorderen van de organisatie- en psychologische factoren. Onderzoek in een andere context, en longitudinaal, was daarom nodig om meer te begrijpen van de aard en de dynamiek van deze relaties en hoe verandering plaats vindt in scholen over tijd.

De onderzoeken in dit proefschrift zijn gedaan in het Middelbaar Beroepsonderwijs (MBO). Gedurende de laatste decennia zijn Regionale Opleidingscentra (ROC's) door vele fusies geworden tot gigantische onderwijsinstututen, en zijn zij betrokken geweest bij grootschalige onderwijsvernieuwingen die gericht waren op het stimuleren van het zelfsturend en competentiegericht leren van studenten. Ook werden ervaren professionals uit het werkveld als docent aangetrokken, wat leidde tot een grote diversiteit aan ervaring en verwachtingen onder docenten. Eén prominente uitdaging bij de implementatie van deze hervormingen is de organisatie van de werkcondities van docenten naar multidisciplinaire teams. Docenten met een verscheidenheid aan achtergronden en vakbekwaamheden werden verzocht samen te werken om studenten de competenties aan te leren die zij nodig hebben om sterke professionals te worden en daarmee beter voorbereid te zijn deel te nemen aan een continu in beweging zijnde arbeidsmarkt (Kwakman, 2003; Poortman, 2007; Truijen, 2012). Dientengevolge zien MBO docenten zich uitgedaagd om te leren hoe zij effectief samen kunnen werken in teams die gericht zijn op het versterken van de professionele expertise, en als gevolg daarvan het leren van studenten bevorderen.

Wij hebben daarom in vier onderzoeken en met vragenlijsten onderzocht in hoeverre docenten van het MBO leeractiviteiten ondernemen na de implementatie van multidisciplinaire teams, en hoe de wisselwerking tussen organisatorische en psychologische factoren hun leren bevordert. Meer specifiek was 'leeractiviteiten ondernemen' geoperationaliseerd als individueel (zelfreflectie, experimenteren, en bijblijven) en sociaal

(informatie delen, en feedback vragen) professioneel leren, organisatiecondities als transformationele leiderschapspraktijken (visie bouwen, individuele steun, en intellectuele stimulatie) en waarneming van wederzijdse afhankelijkheid (taak- en doelafhankelijkheid), en een psychologische factor als self-efficacy (of zelfwerkzaamheids-) overtuigingen. Het eerste doel was de validering in een MBO context van een eerder, in het primair onderwijs, ontwikkeld model over het bevorderen van het leren van docenten (hoofdstuk 2)(Geijssel et al., 2009; Thoonen et al., 2011), evenals het uitbreiden van het model met meer variabelen (hoofdstuk 3). Het tweede doel was het onderzoeken van co-ontwikkeling tussen de variabelen (hoofdstuk 4 en 5), dat wil zeggen, de mate waarin variabelen elkaar (wederzijds) beïnvloeden terwijl zij voortschrijden in de tijd (zie Figuur 1.1, p. 16).

De resultaten lieten zien dat de structurele relaties zoals gespecificeerd in het model ten dele in stand bleven (Geijssel et al., 2009; Thoonen et al., 2011). Zoals eerder gevonden in het primair onderwijs medieerde de waarneming van de werkplek de effecten van transformationeel leiderschap. Self-efficacy overtuigingen beïnvloedden het ondernemen van leeractiviteiten echter niet over tijd: zij werden beïnvloed door het ondernemen van leeractiviteiten over tijd. Daarnaast vonden we twee wederzijdse relaties, namelijk, die tussen visie bouwen en doelafhankelijkheid, en tussen taakafhankelijkheid en zelfreflectie. In de volgende paragrafen zullen we de details van de bevindingen van de vier onderzoeken nader toelichten.

De bevindingen

Het aanmoedigen van het leren van docenten in het MBO

In *hoofdstuk 2* rapporteerden wij het onderzoek naar de rol van de wisselwerking tussen transformationele leiderschapspraktijken (visie bouwen, individuele steun, en intellectuele stimulatie), waarneming van wederzijdse afhankelijkheid, en self-efficacy overtuigingen in het verbeteren van de leeractiviteiten zelfreflectie en feedback vragen. Het bijbehorende model werd getest op data vergaard met digitale vragenlijsten van 447 docenten van 66 teams door middel van Structural Equation Modeling (SEM). Er is rekening gehouden met de geneste structuur van de data (docenten binnen teams) door op de 'complexe structuur' te testen in Mplus. De resultaten van dit onderzoek laten zien dat zelfreflectie en feedback vragen positief beïnvloed werden door zowel self-efficacy overtuigingen en taakafhankelijkheid (zie Figuur 2.2, p.30). Feedback vragen werd ook nog positief beïnvloed door doelafhankelijkheid. Taak- en doelafhankelijkheid bevorderden bovendien self-efficacy overtuigingen. Verder werd taakafhankelijkheid positief beïnvloed door individuele steun, terwijl doelafhankelijkheid positief werd beïnvloed door visie bouwen. Visie bouwen had ook een positieve, en directe, invloed op feedback vragen, evenals intellectuele stimulatie. Deze bevindingen dragen bij aan vorig onderzoek naar de gedifferentieerde invloed van transformationele leiderschapspraktijken op het ondernemen van professionele leeractiviteiten van docenten zoals gemedieerd door de waarneming van de werkomgeving (Dionne, Yammarino, Atwater, & Sprangler, 2004; Jung & Sosik, 2002; Korek, Felfe & Zaepernick-Rothe, 2010; Staples & Webster, 2008; Tjosvold, 1986). De bevindingen van dit cross-sectionele onderzoek suggereren ook een centrale rol van self-efficacy overtuigingen (Salanova, Bakker & Llorens, 2006; Schyns, 2004). De resultaten wijzen daarom naar de bevorderlijke rol van de verweven invloed van organisatorische en

psychologische factoren in het verbeteren van het ondernemen van leeractiviteiten onder veranderende omstandigheden (Korthagen & Vasalos, 2005; Kwakman, 2003; Leithwood, Jantzi, & Mascall, 2002; Stoll, Bolam, McMahon, Wallace & Thomas, 2006; van Woerkom, 2004). Het model over de verwevenheid van organisatorische en psychologische factoren voor het bevorderen van het ondernemen van leeractiviteiten zoals ontwikkeld in het primair onderwijs is daarmee gevalideerd in het MBO.

Het bevorderen van individuele en sociale leeractiviteiten van MBO docenten

Hoofdstuk 3 was erop gericht de bevindingen van hoofdstuk 2 uit te breiden door aanvullende individuele en sociale leeractiviteiten aan het model toe te voegen. Wij hebben individuele leeractiviteiten, blijven en experimenteren, aan zelfreflectie toegevoegd, en de sociale leeractiviteit informatie delen aan feedback vragen toegevoegd. De data van de 447 docenten van 66 teams werden gebruikt in de analyses. Factoranalyse liet twee in plaats van drie transformationele leiderschapsdimensies zien: individuele steun en intellectuele stimulatie combineerden tot transformationele praktijken die betrekking hebben op het aandacht schenken aan de professionele behoeften van individuele docenten en op het hen individueel uitdagen tot verbetering. Visie bouwen, de transformationele leiderschapspraktijk die meer gericht is op de betrokkenheid van docenten bij een gemeenschappelijk doel, bleef een losstaande dimensie. Daarnaast vonden we dat feedback vragen en informatie delen gecombineerd zou moeten worden tot één sociale leeractiviteit: informatie delen en sociale reflectie. De resultaten van een SEM analyse, rekening houdend met de geneste structuur van de data, lieten positieve directe effecten zien van taakafhankelijkheid en self-efficacy overtuigingen op het ondernemen van zowel individuele als sociale leeractiviteiten (zie Figuur 3.2, p. 49). Doelafhankelijkheid had bovendien een positieve invloed op sociaal leren, maar niet op individueel leren. Taak- en doelafhankelijkheid hadden ook een positieve invloed op self-efficacy overtuigingen, maar het effect van doelafhankelijkheid was minder dan een derde van het effect van taakafhankelijkheid. Daarenboven lieten de bevindingen zien dat visie bouwen doelafhankelijkheid bevorderde, terwijl individuele steun en intellectuele stimulatie taakafhankelijkheid bevorderden. Deze resultaten geven aan dat het ondernemen van alle leeractiviteiten gekoppeld is met self-efficacy overtuigingen, taakafhankelijkheid, en de transformationele leiderschapspraktijken individuele steun en intellectuele stimulatie. Deze koppelingen suggereren dat het genereren van kennis en ideeën door leren kan worden bevorderd door docenten in hun kracht te laten staan ('to empower'). Daarnaast lijkt het ondernemen van sociale leeractiviteiten aanvullend gekoppeld te zijn aan doelafhankelijkheid en de transformationele leiderschapspraktijk visie bouwen. Dit suggereert dat kennis uitwisselen, door het creëren van een omgeving die rijk is aan doelen ('purposeful'), kan worden gefaciliteerd.

Voortbouwend op de resultaten van de cross-sectionele onderzoeken richtten wij ons in hoofdstuk 4 en 5 op de rol van een omgeving die leraren in hun kracht laat staan (een 'bekrachtigende' omgeving) en rijk is aan doelen (een 'betekenisvolle' omgeving), en die daardoor het leren van docenten kan bevorderen. Hiervoor maakten wij gebruik van een longitudinaal design. Een longitudinaal design kan sterkere uitspraken over causaliteit en mediatie doen dan een cross-sectioneel design, en het maakt het mogelijk om wederkerige

relaties te onderzoeken die onontdekt blijven in cross-sectioneel onderzoek. Daarbij maakt een longitudinaal design het vaststellen van groei en krimp mogelijk.

Naar het in stand houden van niveaus van reflectief leren

In *hoofdstuk 4* rapporteerde een longitudinaal onderzoek naar de rol van individuele steun en intellectuele stimulatie, taakafhankelijkheid en self-efficacy overtuigingen in het bevorderen van het ondernemen van zelfreflectie over tijd. Een Latent Veranderingsscore (LVS) model werd gepast op de data van drie meetmomenten van 655 docenten om de dynamische en mogelijk wederkerige invloeden tussen variabelen te testen, en eveneens om hun verandering vast te stellen (McArdle, 2009). Voorgaande cross-sectionele bevindingen werden door de resultaten ten dele bevestigd, ten dele tegengesproken, en ten dele uitgebreid (zie Figuur 4.2, p. 69). Niveaus van alle variabelen bleven (relatief) stabiel over tijd. Taakafhankelijkheid had een positieve invloed op zelfreflectie over tijd. De transformationele leiderschapspraktijken individuele steun en intellectuele stimulatie hadden een positieve invloed op taakafhankelijkheid over tijd. Echter, self-efficacy overtuigingen hadden geen effect op het ondernemen van zelfreflectie over tijd. Integendeel, zelfreflectie had een positieve invloed op self-efficacy overtuigingen over tijd. Dit duidt erop dat leren tot competentie-overtuigingen leidt. Hieruit valt af te leiden dat het genereren van nieuwe kennis voor het verbeteren van iemands self-efficacy overtuigingen aangemoedigd wordt door het beleven van kleine successen, zoals het vinden van oplossingen voor dagelijkse problemen. Het lijkt er dus op dat (reflectief) leren leidt tot psychologische bekrachtiging voor het overwinnen van obstakels, en niet zo zeer dat een bekrachtigende omgeving leidt tot het leren hoe dat te doen (Maynard, Mathieu, Gilson, O'Boyle, & Cigularov, 2012). Bovendien bleek het ondernemen van zelfreflectie een positieve invloed te hebben op de waarneming van taakafhankelijkheid over tijd, waarmee deze variabelen een wederzijdse relatie hebben.

Deze bevindingen suggereren dat, gedurende dat docenten reflecteren over hoe met elkaar om te gaan, zij werkbare mogelijkheden voor toekomstige interacties ontdekken (e.g., Horn & Little, 2010; Spillane, Reiser, & Reimer, 2002; Weick, Sutcliffe, & Obstfeld, 2005). Als zij dan hun nieuw ontwikkelde omgangsvormen ten uitvoer brengen, kunnen docenten ontdekken dat hun teamleden hen kunnen voorzien van nieuwe informatie, gegeven dat zij de interacties met hun teamleden als ondersteunend beschouwen voor het kiezen van een werkwijze die geschikt is voor het volbrengen van de voorliggende taken. Vervolgens kunnen zij deze informatie weer gebruiken om verder te reflecteren over hoe verder te verbeteren (e.g., Clarke & Hollingsworth, 2002). Bovendien geven de resultaten aan dat een transformationeel leider kan helpen bij het onderhouden van de waarneming van de noodzaak van interactie met teamleden om taken succesvol af te ronden door een positief rolmodel te zijn en aandacht te hebben voor de professionele behoeften van individuele docenten, alsmede door docenten uit te dagen zich te verbeteren. Hoofdstuk 4 laat dus zien dat, door een continue cyclus van interacteren met collega's en het genereren van kennis, en met ondersteuning van de leider, docenten een leeromgeving co-construeren, waardoor zij zich vervolgens gesterkt voelen om obstakels te overwinnen.

Doorgaan met leren voor een doel

Hoofdstuk 5 richtte zich op de voordelen van een betekenisvolle omgeving voor het onderhouden van sociaal leren. Meer specifiek gingen wij in dit hoofdstuk in op de rol van visie bouwen en doelafhankelijkheid voor het bevorderen van het ondernemen van informatie delen over tijd. Wederom werd een LVS model op data van drie meetmomenten van 655 docenten gelegd om de dynamische, en mogelijk wederkerige, invloeden tussen de variabelen te testen, en eveneens om hun verandering vast te stellen. De voorgaande bevindingen uit cross-sectioneel onderzoek werden door de resultaten bevestigd en uitgebreid (zie Figuur 5.2, p. 89). Het niveau van alle variabelen bleef (relatief) stabiel over tijd. Doelafhankelijkheid had een positief effect op informatie delen over tijd. De transformationele leiderschapspraktijk visie bouwen had ook een positieve invloed op informatie delen over tijd. Het ondernemen van informatie delen door individuele docenten wordt dus gefaciliteerd als docenten een noodzaak waarnemen om te interacteren om doelen te kunnen formuleren en te delen, en om samen te werken om deze doelen te bereiken. Bovendien werd informatie delen bevorderd door een leider die gezien wordt als iemand die een visie initieert en daaraan bouwt, van waaruit docenten meer specifieke teamdoelen kunnen afleiden. Docenten ondernemen dus sociale leeractiviteiten als dat een doel dient. Daarnaast lieten de resultaten zien dat visie bouwen een positief effect had op doelafhankelijkheid over tijd, en dat doelafhankelijkheid ook weer een positief effect had op visie bouwen over tijd. Deze twee variabelen zijn daarmee wederkerig gerelateerd.

Nadat docenten in multidisciplinaire teams georganiseerd zijn zien zij zich voor de taak gesteld om hun kennis te bundelen zodat zij hun curricula kunnen verbeteren en hun vakken kunnen integreren. Als zij dan gezamenlijke doelen formuleren en beraadslagen over hoe die te bereiken, creëren docenten een infrastructuur voor een bepaalde werkwijze. Een transformationeel leider draagt aan dit proces bij door een visie te verwoorden en te initiëren, waardoor docenten geïnspireerd worden om gedeelde doelen te formuleren, zich daaraan te verplichten, en om bij te dragen aan overleg en coördinatie om hun doelen te verwezenlijken. Als docenten de verantwoordelijkheid nemen om door te gaan met het proberen te bereiken van hun doelen, zijn zij ook wederkerig ondersteunend om hun leider inspirerend te laten blijven zijn (e.g., Mulford, 2010; Scribner, Hager, & Warne, 2002). De samenwerking tussen de transformationele leider en docenten co-creëert daarmee een betekenisvolle leeromgeving voor de duurzame uitwisseling van kennis. Een dergelijk betekenisvolle omgeving kan daarom dienen als een tegengewicht tegen het (als een natuurlijk proces) minder worden van het expliciet maken van kennis en het beschikbaar maken van kennis voor teamleden, evenals het uitwisselen van advies met teamleden ten dienste van onderwijsverbeteringen (Gabelica, Van den Bossche, De Maeyer, Segers, & Gijselaers, 2014; Giles & Hargreaves, 2006; Schippers, den Hartog, Koopman, & Wienk, 2003).

Conclusie

De onderzoeken in dit proefschrift laten zien dat het leren van MBO-docenten gefaciliteerd wordt door de organisatiecondities transformationeel leiderschap en wederzijdse afhankelijkheid, en deze resultaten zijn vergelijkbaar met bevindingen uit onderzoek in het primair onderwijs (Geijssels et al., 2009; Thoonen et al., 2011). In

tegenstelling daarmee faciliteerde de psychologische factor self-efficacy overtuigingen leren niet over tijd; in tegendeel, de niveaus van self-efficacy overtuigingen werden ondersteund door het ondernemen van leeractiviteiten. Transformationele leiderschapspraktijken en de waarneming van wederzijdse afhankelijkheid waren in dit onderzoek belangrijke elementen voor een ondersteunende onderwijsomgeving die professioneel leren over tijd in stand houdt. Meer specifiek blijken in dit onderzoek twee transformationele leiderschapspraktijken, individuele steun en intellectuele stimulatie, en taakafhankelijkheid het genereren van kennis (en het uitwisselen daarvan) aan te drijven, wat vervolgens leidt tot het in stand houden van de mate waarin docenten ervan overtuigd zijn dat zij toekomstige problemen goed kunnen oplossen. Visie bouwen en doelafhankelijkheid blijken in dit onderzoek het uitwisselen van kennis daar bovenop ook aan te drijven. Deze koppelingen suggereren dat een omgeving die zowel bekrachtigend als ook betekenisvol is, ondersteunend is voor leren. Het lijkt dan ook waarschijnlijk dat deze koppelingen docenten kunnen faciliteren in het veranderen van bestaande instructiewijzen (Sleegers, Thoonen, Oort, & Peetsma, 2014; Thoonen, Sleegers, Oort, & Peetsma, 2012).

De bevindingen laten bovendien zien dat docenten een actieve rol spelen in de constructie van (hun) betekenisvolle en bekrachtigende werkplekken. Wederkerigheid was gevonden tussen taakafhankelijkheid en zelfreflectie, wat aangeeft dat docenten een leeromgeving co-construeren door een continue cyclus van interactie en leren. Deze bevinding suggereert dat het leren van docenten een centrale rol speelt in het bouwen aan de veranderingscapaciteit van scholen (Stoll et al., 2006). Wederkerigheid was ook gevonden tussen visie bouwen en doelafhankelijkheid, wat aangeeft dat docenten en leiders elkaar inspireren om te werken aan het formuleren van, zich verplichten aan, en het volbrengen van gemeenschappelijke doelen. Deze bevindingen suggereren dat het werken in multidisciplinaire teams docenten kan aanzetten om continu betekenis te verlenen aan wat werken in teams inhoudt, en om, door interactie met teamleden, manieren te vinden om hun expertise en onderwijspraktijken te versterken (Desimone, 2009; Weick et al., 2005). De co-constructie van een bekrachtigende en betekenisvolle werkplek kan daarmee bijdragen aan de vestiging van leergemeenschappen en aan het versterken van de verandercapaciteit van scholen.

Appendices

Appendix A Response rates & sample descriptives

Appendix A.1 – Response rates of measurement occasion 1

Response rates per VET college and the manner in which teams were contacted

VET College	lowest response from one team within a VET college	mean response from VET college	highest response from one team within a VET college	# teams approached	manner of contact
1	50%	70%	92%	7	team leader
2	28%	50%	100%	23	Directly
3	11%	71%	94%	7	team leader
4	0%	32%	100%	14	Directly
5	50%	75%	100%	8	team leader
6	54%	74%	100%	8	team leader

Note: percentages are rounded.

Appendix A.2 – Response rates of measurement occasions 1, 2, and 3

Questionnaires:	t1	t2	t3
Send	853	857	822
Returned	454	449	389
Response rate	53%	52%	47%
Dropped	-16	-87	-65

Unique responses on measurement occasions:

Occasions 1&2&3		144	
Occasions 1&2 or 1&3 or 2&3	82	45	54
Occasion 1 or 2 or 3	167	82	81
Total unique responses in the data set		655	

Note: cases could be dropped, for instance, because not all returned questionnaires were filled out completely.

Appendix A.3 – Sample descriptives of measurement occasions 1, 2, and 3

		t1	t2	t3
gender (men)		66%	68%	60%
age (years)	Mean	48	48	48
	Sd	9	10	10
	Min	22	20	21
	Max	62	63	65
Job size	> 32 hours	61%	62%	58%
Tenure	> 20 years	33%	32%	32%
	10 years	20%	22%	22%
	< ½ year	4%	2%	0%
Education	Master	16%	16%	14%
	Bachelor	72%	74%	79%
	2 nd education	12%	10%	7%

Note: Years and percentages have been rounded.

Appendix B

Item formulations, and cross-sectional and longitudinal assessment of the scales' factor structures

All scales were responded to as follows: (1) disagree much, (2) partially disagree, (3) do not disagree, do not agree, (4) partially agree, (5) agree much.

Transformational leadership: vision building

Refers to the development of shared vision, goals and priorities (Geijsel et al., 2009)

	Chapter 2		Chapter 3		Chapter 5			
	Factor loadings	Residual variances	Factor loadings	Residual variances	Invariant factor loadings	Residual variances		
My leader...						t1	t2	t3
...uses all possible occasions to share the vision of the department to the team, students, parents and others	0.797	0.430	1.000	0.432	1.000	0.464	0.399	0.376
...refers during decision making processes explicitly to the goals of the department	0.859	0.312	1.029	0.314	0.997	0.296	0.342	0.267
...clarifies for the team the relation between the vision of the department and initiatives from the board of directors	0.885	0.279	1.094	0.280	0.947	0.275	0.308	0.274
...clearly describes current problems in light of a vision of the future of the department	0.909	0.260	1.203	0.259	0.989	0.291	0.310	0.208
...sketches the consequences of a vision for the department's current ins and outs during meetings	0.917	0.237	1.177	0.234	1.000	0.245	0.290	0.248
<i>Cronbach's α</i>		.94		.942		.941	.914	.939

Transformational leadership: individual consideration and intellectual stimulation

Includes attending to the needs and feelings of individual teachers, support of professional development of teachers and challenging teachers to constantly evaluate their current knowledge and daily practices (Geijsel et al., 2009)

My leader...	Chapter 2		Chapter 3		Chapter 4			
	Factor loadings	Residual variances	Factor loadings	Residual variances	Invariant factor loadings	Residual variances		
						t1	t2	t3
...takes the opinions of individual teachers seriously	0.872	0.335	1.000	0.525	1.000	0.507	0.325	0.418
...shows appreciation when a teacher takes the initiative for educational improvement	0.845	0.355	1.004	0.464	0.998	0.443	0.386	0.436
...listens carefully to the ideas of team members	0.900	0.259	1.001	0.455	0.955	0.434	0.362	0.383
...has an eye and an ear for problems being experienced by teachers with policy implementation	0.892	0.269	1.121	0.410	0.930	0.387	0.349	0.325
...helps teachers to express their emotions	0.772	0.517	1.000	0.552	0.839	0.548	0.475	0.542
...encourages teachers to try new things in line with their own interests	0.868	0.309	1.104	0.321	0.940	0.335	0.369	0.332
...stimulates teachers to reflect on how to improve in the department	0.921	0.201	1.110	0.266	0.949	0.298	0.328	0.275
...encourages teachers to seek and discuss new information and ideas which are relevant to the direction in which the department is developing	0.923	0.194	1.152	0.254	0.914	0.303	0.279	0.321
...engages individual teachers in discussion of personal and professional goals	0.860	0.280	1.023	0.302	0.847	0.325	0.331	0.393
...encourages teachers to experiment with new teaching methods	0.807	0.459	1.012	0.504	0.833	0.532	0.596	0.614
...creates sufficient opportunities for teachers to work on their professional development	0.711	0.617	0.912	0.622	0.913	0.646	0.474	0.545
<i>Cronbach's α</i>	<i>.93/.94</i>		<i>.956</i>		<i>.956</i>	<i>.947</i>	<i>.943</i>	

The first five items are the individualized consideration scale, and the last six items are the intellectual stimulation scale. Cronbach's α 's in the chapter 2 column represent the α 's for individualized consideration and intellectual stimulation, respectively.

Goal interdependence

Refers to the degree to which coordination and interaction is required to reach a team member's own goals as well as the goals of other team members (Runhaar, 2008; van der Vegt et al., 2000)

	Chapter 2		Chapter 3		Chapter 5	
	Factor loadings	Residual variances	Factor loadings	Residual variances	Invariant factor loadings	Invariant residual variances
In our team we all want to reach the same	0.678	0.595	1.000	0.585	1.000	0.484
We agree on what quality is for our team	0.897	0.292	1.240	0.321	1.028	0.401
If work does not satisfy quality requirements, the responsible team member is asked about this by other team members	0.616	0.765	1.007	0.749	0.904	0.669
<i>Cronbach's α</i>		.77		.768		.768/.768/.770

Cronbach's α 's in the chapter 5 column represent the scales on the first, second, and third measurement occasions, respectively.

Task interdependence

Refers to the degree to which interaction and coordination of team members are required to complete tasks (Runhaar, 2008; van der Vegt et al., 2000)

	Chapter 2		Chapter 3		Chapter 4	
	Factor loadings	Residual variances	Factor loadings	Residual variances	Invariant factor loadings	Invariant residual variances
For the conduct of our jobs, the members of my team need information from each other	0.785	0.136	1.000	0.143	1.000	0.128
To do our jobs well, we have to work together as a team	0.864	0.092	1.086	0.109	1.012	0.087
The work of one team member influences the conduct of the tasks of other team members	0.447	0.628	0.922	0.607	0.880	0.623
To do our work well, we have to coordinate our work as a team	0.809	0.160	1.232	0.141	0.987	0.169
If team members reach their goals, it becomes easier for other team members to reach their goals*			0.924	0.453		
<i>Cronbach's α</i>		.79		.800		.783/.779/.823

* Whereas this item initially belonged to the goal interdependence scale, it did not fit well in that scale, and better in the task interdependence scale, but only on the first measurement occasion. Cronbach's α 's in the chapter 4 column represent the scales on the first, second, and third measurement occasions, respectively.

Occupational Self-efficacy

A future-oriented belief about the level of competence a person expects to display in a given situation (Runhaar, 2008; Schyns & Von Collani 2002)

	Chapter 2		Chapter 3		Chapter 4			
	Factor loadings	Residual variances	Factor loadings	Residual variances	Invariant factor loadings	Residual variances		
						t1	t2	t3
I can remain calm when confronted with difficulties in my work because I know that I can fall back on my competences	0.547	0.442	1.000	0.439	1.000	0.421	0.363	0.299
When I am confronted with a problem in my work, I can usually find different solutions	0.552	0.369	0.962	0.361	0.999	0.352	0.242	0.243
Whatever happens in my work, I can usually manage	0.819	0.223	1.404	0.224	1.005	0.277	0.292	0.220
My past experiences have prepared me well for my current work	0.580	0.407	1.041	0.415	1.024	0.411	0.315	0.391
In my work, I achieve the goals which I have set for myself	0.605	0.407	1.122	0.406	0.937	0.413	0.321	0.283
I am adequately equipped to face the demands of my work	0.711	0.309	1.237	0.312	0.966	0.330	0.287	0.265
<i>Cronbach's α</i>		<i>.80</i>		<i>.802</i>		<i>.801</i>	<i>.800</i>	<i>.850</i>

Asking for feedback / Information sharing (and social reflection)

Refers to the seeking of information and advice from each other in addition to efforts to maintain the stream of information sharing going in a team (Geijsel et al., 2009; Runhaar, 2008; van Woerkom, 2003)

	Chapter 2		Chapter 3		Chapter 5	
	Factor loadings	Residual variances	Factor loadings	Residual variances	Invariant factor loadings	Invariant residual variances
If I think that I have not done my work well, I discuss this with my team members	0.511	0.536	1.089	0.410	0.892	0.414
I regularly ask my team members for feedback	0.479	0.561	0.987	0.470	0.925	0.417
I observe colleagues' lessons to learn from them	0.553	0.926				
If I think that I have done my work badly, I discuss this with my leader	0.774	0.543				
I regularly ask my leader for feedback	0.775	0.580				
I regularly share knowledge and experiences with team members			1.000	0.288	1.000	0.262
I discuss what I find important in my work with team members			1.174	0.248	0.973	0.227
I discuss our criteria for good functioning with team members			1.221	0.477	0.884	0.458
I discuss problems encountered in my teaching practice with others in order to learn from their responses			1.158	0.302	0.974	0.295
I discuss how I have developed with my team members			1.174	0.538	0.805	0.560
<i>Cronbach's α</i>		.77		.869		.868/.858/.867

The first five items were the original asking for feedback scale, and the last five items were the original information asking scale. The information sharing scale was not included in the study reported in chapter 2. The factor analysis reported in chapter 3 showed that the first two items from the asking for feedback scale fitted well with the information sharing scale, and that the other three items from the asking for feedback scale should be discarded. Cronbach's α 's in the chapter 5 column represent the scales on the first, second, and third measurement occasions, respectively.

Self-reflection

An individual learning activity aimed at making implicit knowledge explicit (Runhaar, 2008; van Woerkom, 2003)

	Chapter 2		Chapter 3		Chapter 4			
	Factor loadings	Residual variances	Factor loadings	Residual variances	Invariant factor loadings	Residual variances		
						t1	t2	t3
I ponder what I find important in my work	0.746	0.146	1.000	0.137	1.000	0.140	0.181	0.141
I monitor progress with regard to the goals of my work	0.760	0.220	1.254	0.224	0.935	0.255	0.210	0.219
I reflect on the manner in which I do my work	0.796	0.146	1.060	0.156	0.985	0.147	0.197	0.180
I compare my performance with how I performed one year ago	0.614	0.495	1.260	0.503	0.921	0.526	0.501	0.425
I think about my communication with colleagues	0.615	0.286	1.016	0.280	0.976	0.277	0.256	0.212
<i>Cronbach's α</i>		.82		.821		.823	.815	.854

Experimentation

An individual learning activity that makes implicit behavior explicit and is aimed at finding better teaching practices (Geijssel et al., 2009)

	Chapter 3	
	Factor loadings	Residual variances
I seek out new methods of working, techniques and instruments	1.000	.323
I show creativity in my work when I have an opportunity to do so	0.688	.303
In my lessons, I experiment with new instructional methods	1.093	.335
I make my own teaching materials	1.086	.570
<i>Cronbach's α</i>		.718

This scale was only included in the study reported in chapter 3.

Keeping up to date

Refers to an individual activity through which knowledge, insights and skills can be learned from external sources (Geijssel et al., 2001; Geijssel et al., 2009)

	Chapter 3	
	Factor loadings	Residual variances
I keep myself informed of developments within the field	1.000	.312
I take part in further training and in-service training even when it is not compulsory	1.111	.548
I read professional literature	1.210	.392
I study textbooks and lesson material thoroughly and on a regular basis	1.086	.320
<i>Cronbach's α</i>		.757

This scale was only included in the study reported in chapter 3.

Appendix C

Correlation tables

Appendix C.1 – Correlation table for chapter 2

Means, Standard Errors, Intraclass Correlations, Correlations

Variables	mean	S.E.	ICC	1	2	3	4	5	6	7
1. TL-Vision	3.18	.049	.307							
2. TL-Consideration	3.54	.048	.280	.69*						
3. TL-Stimulation	3.30	.047	.280	.77*	.80*					
4. Task interdependence	4.41	.026	.076	.07*	.11*	.08*				
5. Goal interdependence	3.12	.043	.139	.34*	.25*	.22*	.08*			
6. Self-efficacy	4.09	.026	.042	.12*	.11*	.10*	.08*	.10*		
7. Asking for feedback	3.26	.026	.096	.33*	.29*	.32*	.12*	.23*	.10*	
8. Reflection	4.17	.035	.133	.08*	.06†	.05†	.10*	.07*	.13*	.15*

* p<.01; † p<.05; TL = Transformational Leadership

Appendix C.2 – Correlation table for chapter 3

Means, Standard Errors and Correlations from the measurement model

Variables	Mean	S.E.	ICC	1	2	3	4	5	6	7	8
1. TL: Vision	3.177	.049	.305								
2. TL: Consideration & stimulation	3.410	.045	.290	.731*							
3. Task interdependence	4.323	.026	.086	.073*	.091*						
4. Goal interdependence	3.116	.043	.141	.336*	.234*	.096*					
5. Self-efficacy	4.093	.026	.041	.121*	.106*	.094*	.102*				
6. Knowledge sharing & social reflection	3.819	.031	.132	.195*	.148*	.149*	.230*	.149*			
7. Self-reflection	4.167	.026	.136	.075*	.056†	.110*	.065*	.125*	.200*		
8. Experimentation	4.074	.028	.053	.043	.039	.089*	.025	.120*	.153*	.149*	
9. Keeping up to date	4.051	.030	.022	.041	.062†	.071	.058†	.097*	.154*	.155*	.166*

* p<.01; † p<.05; TL = Transformational Leadership

Appendix C.3 – Correlation table for chapter 4

Means, Standard Errors of the means, and Correlations from the measurement model

Variables	Mean	S.E.	1	2	3	4	5	6	7	8	9	10	11
1. TLcs [1]	3.680	.051											
2. TLcs [2]	3.804	.047	.415*										
3. TLcs [3]	3.884	.048	.471*	.574*									
4. Task [1]	4.556	.027	.116*	.064†	.034								
5. Task [2]	4.505	.029	.107*	.113*	.083*	.113*							
6. Task [3]	4.467	.032	.118*	.106*	.106*	.100*	.139*						
7. SE [1]	4.088	.031	.115*	.002	.034	.085*	.059*	.060*					
8. SE [2]	4.147	.030	.071†	.032	.004	.046*	.080*	.026	.164*				
9. SE [3]	4.126	.034	.076	.032	.037	-.025	.053*	.047†	.132*	.155*			
10. Refl [1]	4.350	.026	.049	.055	.015	.094*	.080*	.046†	.116*	.080*	.056*		
11. Refl [2]	4.271	.029	.055	.067*	.055	.080	.111	.047†	.072*	.109*	.078*	.140*	
12. Refl [3]	4.261	.030	.132*	.108*	.097*	.091*	.092*	.105*	.112*	.084*	.100*	.151*	.188*

* p<.01; † p<.05; TLcs = Transformational Leadership consideration and stimulation; Task = task interdependence; SE = self-efficacy; Refl = self-reflection; [1], [2], [3] indicate measurement occasions 1, 2, 3, respectively

Appendix C.4 – Correlation table for chapter 5

Means, Standard Errors and Correlations from the measurement model

Variables	Mean	S.E.	1	2	3	4	5	6	7	8
1. Vision [1]	3.226	.052								
2. Vision [2]	3.327	.047	.430*							
3. Vision [3]	3.339	.052	.487*	.513*						
4. Goal [1]	3.222	.045	.345*	.257*	.213*					
5. Goal [2]	3.324	.026	.249*	.233*	.186*	.389*				
6. Goal [3]	3.305	.048	.227*	.256*	.287*	.408*	.497*			
7. Info [1]	4.159	.034	.201*	.096*	.080	.229*	.111	.080†		
8. Info [2]	4.152	.033	.249*	.169*	.131*	.181*	.188*	.123*	.259*	
9. Info [3]	4.155	.036	.204*	.134*	.167*	.158*	.162*	.201*	.260*	.235*

* p<.01; † p<.05; Vision = transformational leadership vision building; Goal = goal interdependence; Info = information sharing; [1], [2], [3] indicate measurement occasions 1, 2, 3, respectively

Appendix D

Chi-square difference (ΔX^2) tests of invariance and stability, and model selection and optimization

Appendix D.1 – Chi-square difference (ΔX^2) tests of invariance and stability for chapter 4

		TLcs	Task	SE	Refl
factor loadings λ 's	equal – unequal	24.143(20)	8.061(6)	9.658(10)	4.758(8)
residual variances ψ 's	equal – unequal	36.889(22) [†]	4.380(8)	55.265(12)*	23.961(10)*
autoregressions β 's	absent – free	183.144(2)*	88.125(2)*	154.481(2)*	163.616(2)*

* $p < .01$; [†] $p < .05$; degrees of freedom (df) in parentheses; TLcs = transformational leadership consideration and stimulation; task = task interdependence; SE = self-efficacy; Refl = self-reflection. ΔX^2 tests of the autoregressions include the assumption of measurement error with a mean of 0, and TLcs, SE, and Refl had variant residual variances, Task had invariant residual variance. A significant ΔX^2 test indicates a worsening through restraint. The more restraint model is listed first in the second column. Thus, significance indicates to select the second listed model, and vice versa.

Appendix D.2 – Model selection and optimization Chi-square difference (ΔX^2) tests for chapter 4

		TLcs	Task	SE	Refl
Change model	dual – proportional	461.382(2)*	269.723(2)*	71.610(2)*	109.127(2)*
Change model	constant – dual	348.621(1)*	1.351(1)	2.249(1)	17.969(1)*
Change model	constant – proportional	810.003(3)*	271.074(3)*	73.859(3)*	127.096(3)*

Proportional change model optimization

autoregressions β 's	equal – unequal	20.688(1)*	.606(1)	1.123(1)	2.026(1)
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* $p < .01$; degrees of freedom (df) in parentheses; TLcs = transformational leadership consideration and stimulation; task = task interdependence; SE = self-efficacy; Refl = self-reflection. TLcs, SE, and Refl had variant residual variances, Task had invariant residual variance. A significant ΔX^2 test indicates a worsening through restraint. The more restraint model is listed first in the second column. Thus, significance indicates to select the second listed model, and vice versa.

Appendix D.3 – Chi-square difference (ΔX^2) tests of invariance and stability for chapter 5

		Vision	Goal	Info
factor loadings λ 's	equal – unequal	4.511(8)	5.100(4)	11.551(12)
residual variances ψ 's	equal – unequal	23.715(10)*	8.852(6)	19.794(14)
autoregressions β 's	absent – free	155.336(2)*	169.145(2)*	202.044(2)*

* $p < .01$; [†] $p < .05$; degrees of freedom (df) in parentheses; Vision = transformational leadership vision building; Goal = goal interdependence; Info = information sharing. ΔX^2 tests of the autoregressions include the assumption of measurement error with a mean of 0, and Vision had variant residual variances, Goal and Info had invariant residual variance. A significant ΔX^2 test indicates a worsening through restraint. The more restraint model is listed first in the second column. Thus, significance indicates to select the second listed model, and vice versa.

Appendix D.4 – Model selection and optimization Chi-square difference (ΔX^2) tests for chapter 5

		Vision	Goal	Info
Change model	dual – proportional	808.566(2)*	20.403(2)*	137.743(2)*
Change model	constant – dual	68.991(1)*	41.727(1)*	0.322(1)
Change model	constant – proportional	877.557(3)*	62.130(3)*	138.065(3)*

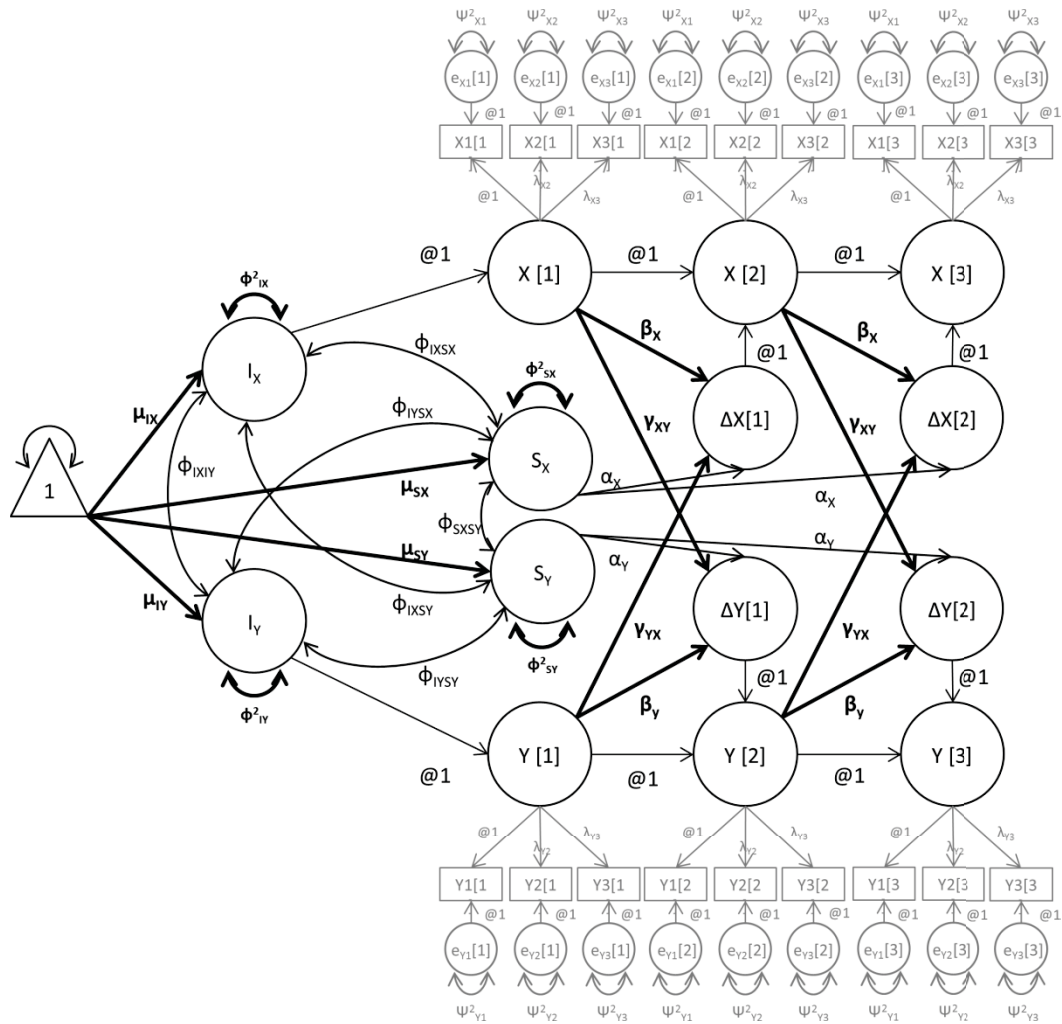
Proportional change model optimization

autoregressions β 's	equal – unequal	16.057(1)*	6.645(1)*	0.438(1)
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* $p < .01$, degrees of freedom (df) in parentheses; Vision = transformational leadership vision building; Goal = goal interdependence; Info = information sharing. Vision had variant residual variances, Goal and Info had invariant residual variance. A significant ΔX^2 test indicates a worsening through restraint. The more restraint model is listed first in the second column. Thus, significance indicates to select the second listed model, and vice versa.

Appendix E

Latent Difference Score model



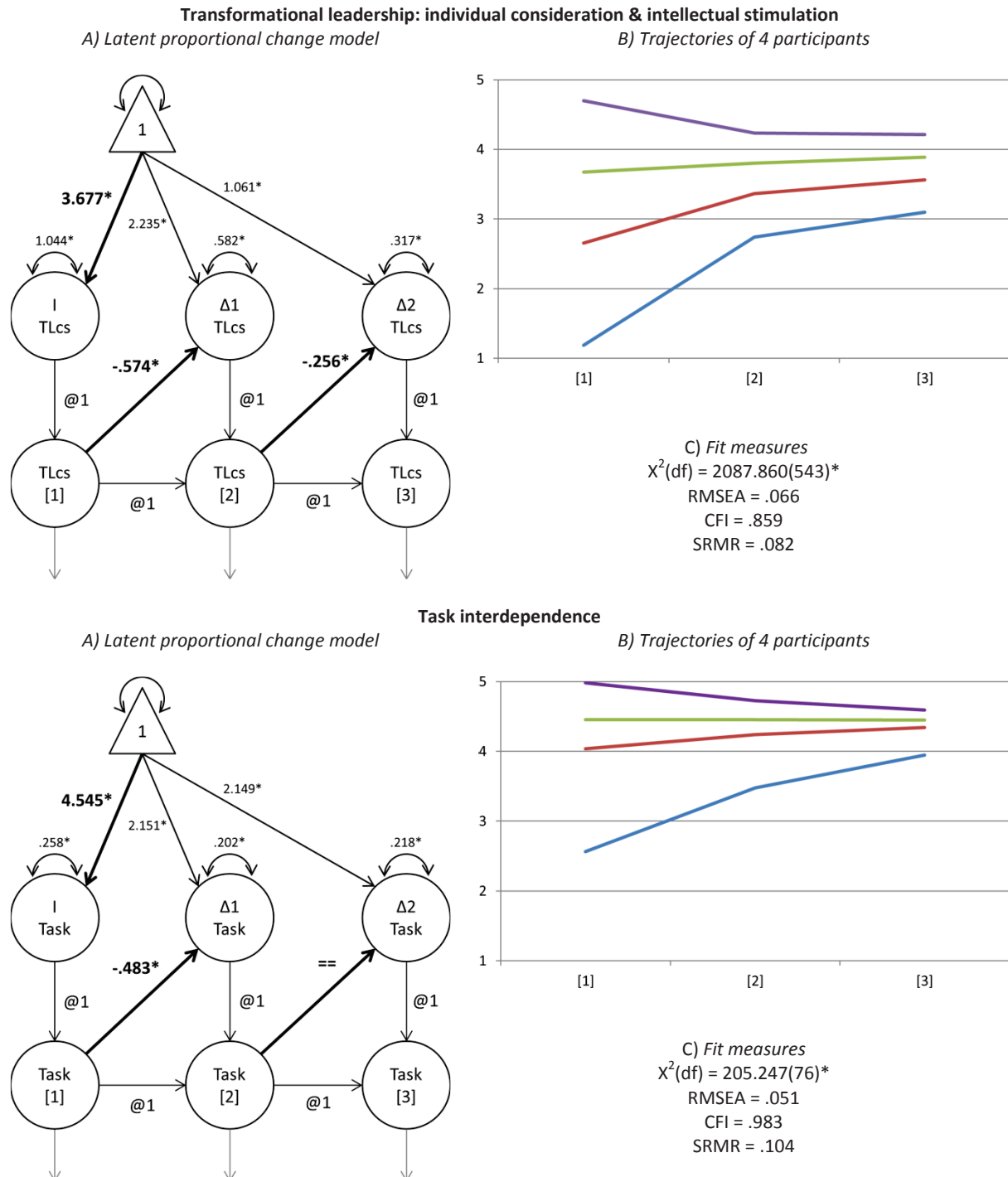
Bivariate dual change Latent Difference Score model.

This model may appear complicated, but because a number of constraints are typically applied there are few parameters that are estimated. Roughly from middle left to bottom right: Bold and grey are used to create contrast to make the graph easier to read. The triangle represents a constant with a mean of 1 and variance of 1, circles represent factors, squares represent observations. Y and X represent variables. I represents an initial factor with a mean μ_I and variance ϕ_I^2 . S stands for slope and represents a systematic constant change factor (or intra-individual constant growth), also with a mean and variance. ϕ 's represent co-variances between initial and slope factors. Δ stands for difference. [1–3] indicate measurement occasions. $\Delta Y[1]$ represents thus the first latent difference score of variable Y, and is the most important parameter; hence the name of the model. It represents intra-individual change proportional to the levels of its influences on the previous time point. The Δ values are a function of slope factor loadings (α 's), autoregressive effects (β 's), and regressions on other variables (γ 's, or couplings). α 's are typically set at one when measurement occasions are equidistant. The values of Δ 's may differ over time, even when their influences are invariant (which they are in the figure, which is indicated by equal labels). They are created from measurement occasion factors (e.g., $Y[2]$), by fixing their factor loading at one (@1). Furthermore, $Y[1]$ represents the factor of measurement occasion 1 of variable Y, $Y1[1]$ represents the first item of variable Y on the first measurement occasion, $e_{Y1}[1]$ represent the measurement error of the first item, and ψ^2 is its variance. Measurement occasion factor loadings (λ 's) must be held invariant. Measurement error variance can be held invariant (and it is in the figure). The model in the figure is termed a dual change model because change stems from both a constant change factor (S), and autoregressions (β 's). The model can be changed into a constant change model by fixing the autoregressions at zero, and into a proportional change model by removing the slope factor and freeing the autoregressions.

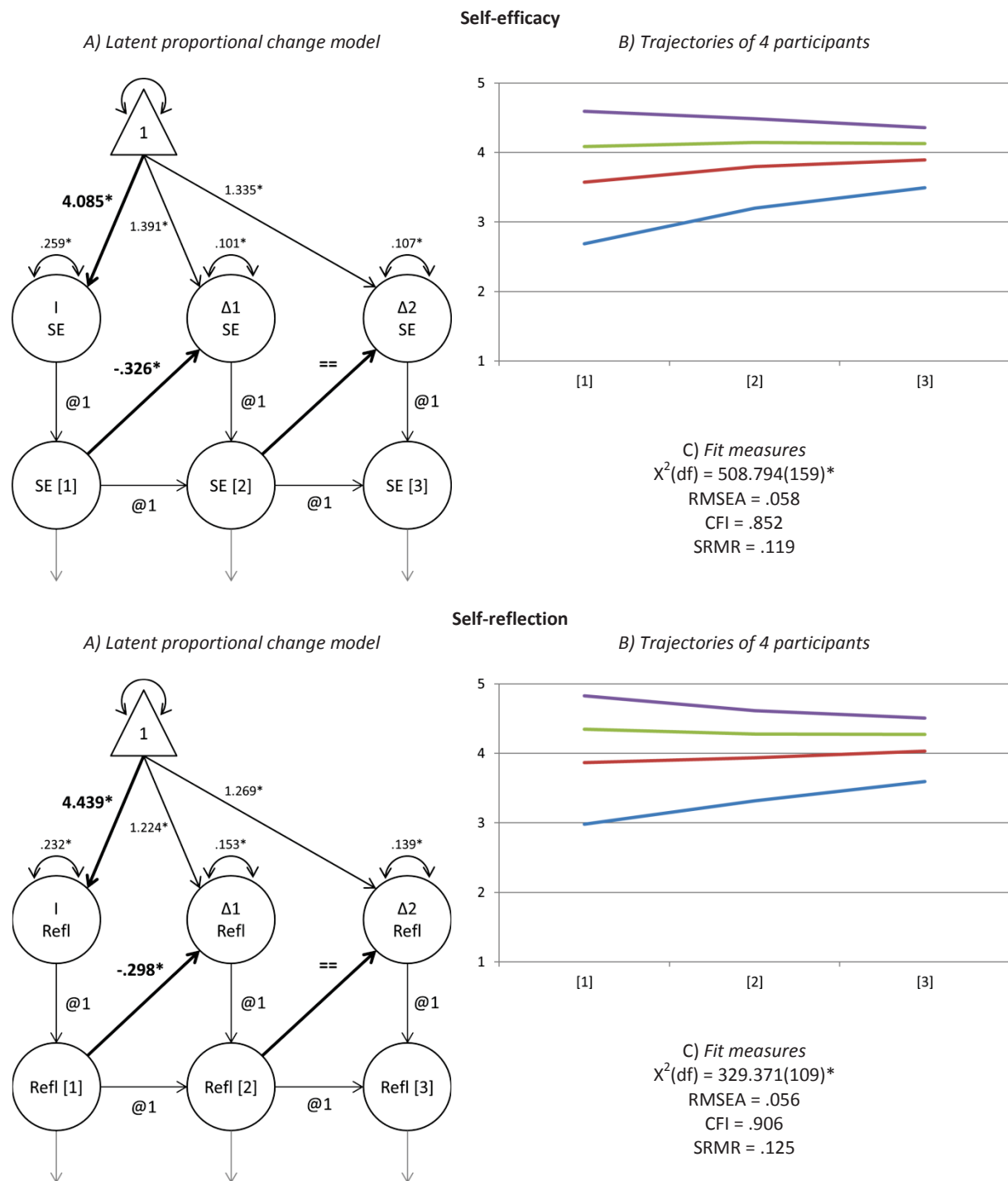
Appendix F

Univariate latent proportional change models, their trajectories, and their fit measures

Appendix F.1 – Univariate latent proportional change models from chapter 4



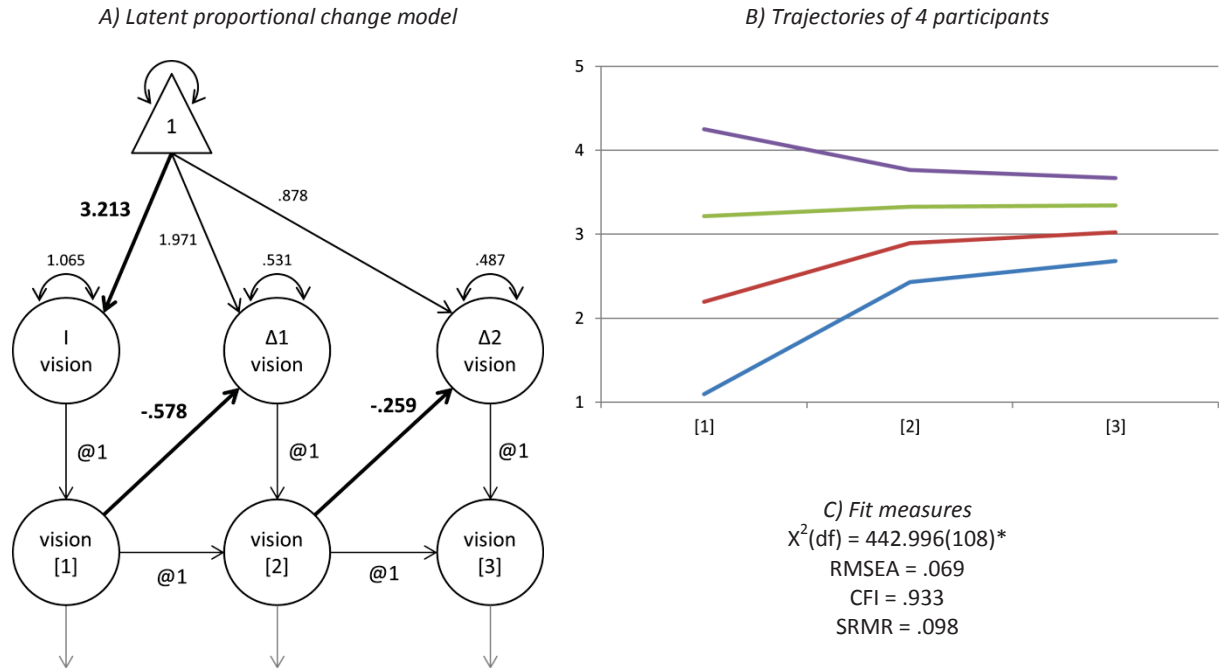
Appendix F.1 continued...



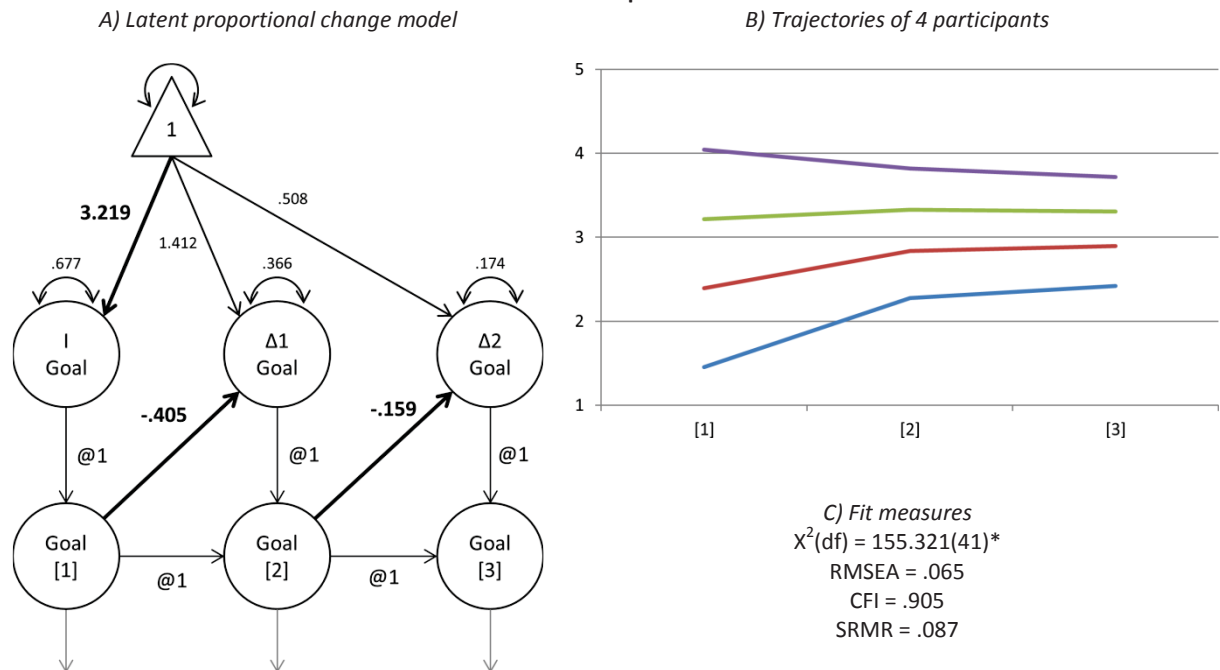
* $p < .01$; A)'s: Double equality signs indicate that this parameter is constraint to be equal over time. Observations, measurement occasion factor loadings, and measurement errors are not shown, but their inclusion is referred to by the gray arrows. B)'s: Trajectories per variable are based on model estimated values, derived from initial values of 4 randomly selected participants.

Appendix F.2 – Univariate latent proportional change models from chapter 5

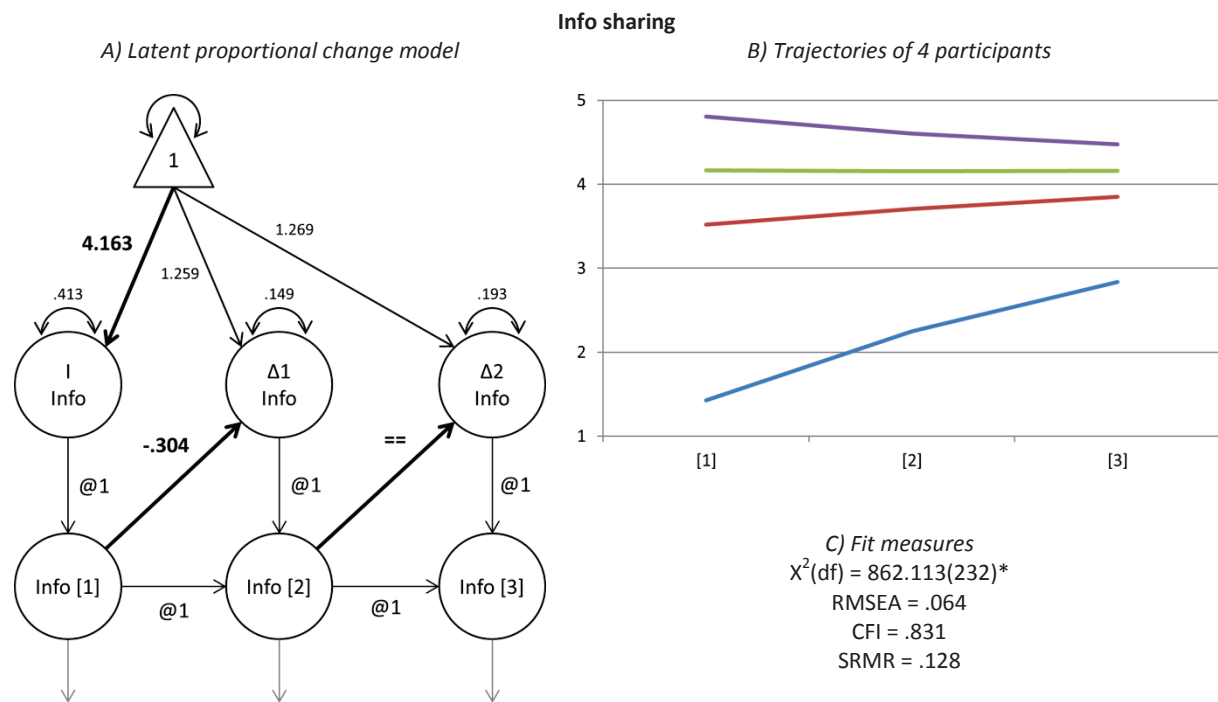
Transformational leadership: vision building



Goal interdependence



Appendix F.2 continued...



* $p < .01$; A)'s: Double equality signs indicate that this parameter is constraint to be equal over time. Observations, measurement occasion factor loadings, and measurement errors are not shown, but their inclusion is referred to by the gray arrows. B)'s: Trajectories per variable are based on model estimated values, derived from initial values of 4 randomly selected participants.

About the author

Arnoud Oude Groote Beverborg was born on February 4th, 1981, in Oldenzaal, the Netherlands. After finishing secondary education at the Staring College in Lochem in 1999, he started studying Health Sciences at the Maastricht University, where he frequently got lost. After one year, he decided to study Psychology the Radboud University Nijmegen, and it was there that he was positively surprised to find that store employees genuinely enjoyed to take his money. Having a taste for good food and an aversion to sloppy organizations, he went to work in an autonomous vegan restaurant that was run by volunteers, where he grew into the man that he is today. He graduated in 2008 from the Research Master Behavioral Science on the role of task information in goal and mean selection in young children's imitation, although secretly he thought he was participating in a project that was bringing a revolution to behavioral science.

The deadline of the revolution having past, in March 2009 he started working as a PhD student under supervision of Peter Sleegers and Klaas van Veen. He enjoyed having the opportunity to observe real people doing real work during his PhD project. One part of his own work is realized in his dissertation entitled "Fostering sustained teacher learning", about the dynamic interplay between organizational conditions, psychological factors, and learning activities. His other interest is in understanding the role of banal experiences in the facilitation of the development of meaning adults have of themselves and the situations they find themselves in.

Publications

International peer reviewed articles

- Oude Groote Beverborg, A.**, Slegers, P.J.C., & van Veen, K. (2015). Promoting VET teachers' individual and social learning activities: the empowering and purposeful role of transformational leadership, interdependence, and self-efficacy. *Empirical Research in Vocational Education and Training*, 7(5).
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“What you got there, boy?” mister Gadling asked Jim.

“It’s my lucky stone. I was given it in Singapore. It’s meant to stop you being drowned.”

“A lump of chalcedony won’t stop you drowning. But I’ll tell you how not to drown, if you like.”

“Really? Honest?”

“Sure. Don’t drown.”

“Huh?”

“You just don’t drown. I’ve done it half a dozen times. It’s easy, once you get the hang of it. Don’t drown.”

(Gaiman, 1993/2012)

