TEACHERS LEARNING AND INNOVATING TOGETHER

Exploring collective learning and its relationship to individual learning, transformational leadership and team performance in higher vocational education

Nanda Lodders

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EXPLORING COLLECTIVE LEARNING AND ITS RELATIONSHIP TO INDIVIDUAL LEARNING, TRANSFORMATIONAL LEADERSHIP AND TEAM PERFORMANCE IN HIGHER VOCATIONAL EDUCATION

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Nanda Lodders,

Den Haag, december 2012

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1 Introduction: organizational change and learning in higher vocational education

> In the coming years, numerous transformations will be occurring in education. The implementation of these innovations will strongly call upon the innovative power of schools, and the prerequisite for such power and thus change appear to be increased autonomy, an innovative capacity, and a transformational leadership (Van den Berg, Vandenberghe & Sleegers, 1999, p. 327).

Higher vocation education in the Netherlands is challenged with the task of fulfilling the Dutch ambition that is part of the Lisbon strategy of the European Commission: to make The Netherlands one of the most competitive knowledge economies in the world[1]. In response to several mega-trends (see f.i., Korbijn, 2003[2]) The Netherlands, like many other countries, is developing from an industrial into a knowledge economy (Drucker, 1993). In this type of economy, an organization's competitive advantage depends on its ability to adapt to the changing environment through the continuous generation and application of new knowledge. Critical added value is no longer gained from maximizing the interactive potential of capital, labor and material (as it was in traditional economies), but "from the continuous application of knowledge to the enhancement and innovation of work processes, products and services" (Harrison & Kessels, 2004, p. 3). Consequently, to be successful in the knowledge economy, organizations need to strive for two types of innovation: they have to work continuously on improving their processes, products and services, and every now and then they have to radically renew themselves (Drucker, 1993; Nonaka & Takeuchi, 1995; Stam, 2011). Because education is one of the driving forces behind this trend towards the knowledge economy (Ministry of Education, Culture and Science, 2009) its importance for contributing to prosperity is increasing. This applies in particular to the higher vocational education sector, which trains more than 400.000 people each year[3]. By strengthening the quality of education and research, the government aims to strengthen the Dutch knowledge economy and improve its ability to compete internationally. At the same time Universities of Applied Sciences are faced with the fact that the labor market is in flux, there is a rise in student numbers, an increase in the diversity of the student population, and limited expediency of the educational system as well as a great uniformity in education. The current system is not sustainable into the future – in the words of Commissie Veerman (Veerman et al., 2010, p. 27) "if we go on like this, we won't make it".

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1 Http://www.europa-nu.nl/id/vh7dotpnvfze/lissabonstrategie en http://www.rijksoverheid.nl/onderwerpen/ ondernemersklimaat-en-innovatie/ruimte-om-teondernemen.

2 Korbijn identifies three factors: (1) the market is becoming increasingly demand-driven, (2) the speed of globalization is increasing, and (3) the world is becoming increasingly dynamic, because technology becomes obsolete more quickly and marketplace demands are changing rapidly. As a result, the market is changing continuously in an unpredictable way, the ability to innovate is becoming an increasingly important competitive factor and knowledge is becoming of key importance (Geurts & Meijers, 2009).

3 The number of enrollments per year (source: http://www.hbo-raad.nl/hbo-raad/feiten-en-cijfers/cat_view/60-feiten-en-cijfers/63-onderwijs/75-inschrijvingen). This number is above 400,000 since 2009 and shows an upward trend.

1.1 PROBLEM ORIENTATION: A NEW ROLE FOR HIGHER VOCATIONAL EDUCATION

The dominant, industrial educational system in higher vocational education is subject to the laws and shaped within a context of a stable, industrial society. The system has been optimized for just this context and has proved successful in past years; it has contributed to the social and economic development of our society. However, it seems this industrially-based educational system is no longer adequate in today's society (Van Aalst, 2002); it is insufficiently suited to train and certify young people for the knowledge economy (Van Aalst, 2001a; Kok, 2003). Knowledge becomes obsolete quickly and people have to stay up to date with the newest information (Bolhuis & Simons, 1999; Kessels, 2001a; Weggeman, 2000; Ministry of Education, Culture and Science, 2009). This has (at least) two important implications for Universities of Applied Sciences.

First they must offer more tailor-made programs and trajectories for students. Because of the increasing speed with which knowledge is becoming obsolete, the life cycle of products and processes has become shorter and the need for innovation has increased. Citizens, governments and in particular businesses have an increased need for directly accessible knowledge, therefore the demand for highly educated individuals is on the rise (Leijnse, 2000). And as a consequence of the ambition to be among the top five competitive knowledge economies by 2020, the goal to have 50% of the Dutch labor population between age 25 – 44 be highly educated by 2020 has been formulated[4]. In light of the increased differentiation of the student population and because the labor market is in constant flux, this goal requires delivering tailor-made programs and approaches (SER, 1996), which can be realized by bringing more flexibility and variety to the program-offerings and learning trajectories of individual students. A more tailor-made approach also makes it more possible to make use of the talents of individual students; an important aspect of the innovation power of a small country such as The Netherlands. However, a tailor-made focus which means an inquiry-based approach, is in direct opposition to the traditional, supply-oriented educational model in which students are collectively tested to determine whether they have completed the standard program at the end of the prescribed period (Meijers, 2006).

The second implication is that Universities of Applied Sciences should spend less time and energy on passing on passive knowledge; the core task which they have traditionally had (Leijnse, 2000). They will have to focus more on knowledge acquisition through research and application (Leijnse, 2010, Diekstra, 2012), and are increasingly seen in this light (Franssen, 2004) and judged (Mulders, 2010) as full knowledge institutions on this basis. An institution responsible for professional training acts as a knowledge institute and needs knowledge workers, for whom knowledge and staying current is crucial (Franssen, 2004). Teachers, as knowledge workers, must develop themselves continuously (Aliaga, 2000; Harris, 2000; Herling & Provo, 2000) and they do this by learning continuously (see for example Watkins & Marsick, 1993; Leithwood & Seashore Louis, 1998; Leithwood, Jantzi & Steinbach, 1998; Voogt, Lagerweij & Seashore Louis, 1998; Silins, Mulford & Zarins, 2002; Watkins, 2005; Collinson, Cook & Conley, 2006). Besides subject-content know-how, this also requires the development of new competencies amongst teachers (Franssen, 2004; Mulders, 2009), which includes the potential to grow, the cultivation of creativity, initiative-taking, an entre-

[4] Https://zoek.officielebekendmakingen.nl/dossier/29410/kst-2941041?resultIndex=11&sorttype=1& sortorder=4.

preneurial attitude, cooperation, continued involvement (Weggeman, 2007) and the ability to engage in continuous learning, in particular at work (Kessels, 2001a).

Achieving a shift in paradigm by means of learning

The development of an educational system which is supportive of the knowledge economy can be considered a radical change, or a paradigm shift (Van Aalst, 2001b; Kok, 2003; Van Emst, 2004; Geijsel & Meijers, 2005). Profound educational innovation is, however, difficult to accomplish; likely because people don't go forward with a paradigm shift. Recent research in the Dutch context about the effectiveness of career guidance interventions (Kuijpers & Meijers, 2012) confirms this idea. Leijnse (2000) says that radical change is rare in higher education and that it is consistently met with a "deafening wail" (p. 23-24). Keeping everything the way it is feels safe and teachers don't have the time or feel the inclination to innovate (Ministry of Education, Culture and Science, 2009). The specific nature of teachers plays an important role here. They are professionals, working in an organization of professionals (Wanrooy, 2001), who don't want to give up their independence or give up their particular nature (De Caluwé & Vermaak, 2006); they determine what, how and for whom something is done (Wierdsma & Swieringa, 2002). They also have difficulty agreeing on the quality of their work and favor their own judgment on it, therefore innovation rarely takes off.

Applying a top-down approach to change is not possible in such a situation. The relationship between teachers (as professionals) and management is tense (Wierdsma & Swieringa, 2002) and teachers maintain that they have the right to ignore decisions that management makes if these go against their principles (De Caluwé & Vermaak, 2006). Top-down approaches can lead to teachers having the feeling that their professionalism is being undermined (Miedema & Stam, 2008). As a result they can decide to use their 'pocket veto' (Hanson, 1996) and not take any action. Indeed the reason for the lack of success of large centrally-undertaken innovation projects by schools and educational organizations has to do with the fact that they were implemented from the top-down (Miedema & Stam, 2008). In such innovations the teacher's role is limited to carrying out the innovation (Lagerweij & Lagerweij-Voogt, 2004). And because the prescribed innovation often doesn't correspond with the practical knowledge teachers have about teacher-behavior that 'works' (Meijer, 1999); or because teachers find it difficult to integrate the new actions into their current work routine (Bergen & Van Veen, 2004) it is difficult to apply innovations that were envisioned by others and to develop the necessary competencies (Ghaith & Yaghi, 1997). Educational innovations have no chance of success without the support of teachers, because in the end, they are co-creators of the changes and help give it shape (Ministry of Education, Culture and Science, 2009). Geerlings, Mittendorff and Nieuwenhuis (2004) argue that the innovation of professional education requires the start of learning processes where teachers can envision a joint view of the current situation and the desired future. Miedema and Stam (2008) also maintain that the success of an innovation depends strongly on the teachers' willingness to learn and the schools' willingness to support that learning. But what kind of learning are we speaking about? Radical change requires higher forms of learning. The transition from an industrial educational system to one that fits within the knowledge economy requires third-order learning; the essential principles of educational organizations are called into question and questions are asked about what role they would like to take on within

their communities and which role they would like to fulfill within that (cf., Wierdsma & Swieringa, 2002). In addition, radical change demands organizational innovation.

Molenaar (2010) states that the subject of organizational innovation has been studied extensively in management and organizational research and that:

> *... in general, [it] has been defined as the development and use of new ideas, behaviors, or practices (Daft & Becker, 1978; Damanpour & Evan, 1984). In an organizational sense, innovation is not merely transmitting, diffusing, or recycling existing knowledge between members; it is also concerned with the transformation of prevailing knowledge and practices of actors as a means to facilitate organizational change Nonaka & Takeuchi, 1995). Organizational innovation often occurs in an iterative and cyclic process that is established and maintained through social interaction (Kanter, 1983). As such, innovation is regarded as a social process in which social interaction provides multiple opportunities for input and refinement (Calantone, Garcia & Droge, 2003; Nohari & Culati, 1996). Communication, sharing information and ideas, and opportunities to engage in discussion and decision-making are critical for an open orientation towards innovation (Frank, Zhao & Borman, 2004; Monge, Cozzens & Contractor, 1992). This suggests that a social learning process underlies the development of organizational innovation (Paavola, Lipponen & Hakkarainen, 2004), in which the combination of different people, knowledge, and resources triggers the generation of new ideas and practices (Kogut & Zander, 1992)* (p. 102).

Organizational innovation thus requires social learning, or learning processes based on social interaction, and so does the development and implementation of a new educational system.

Realizing continuous adaptation by means of learning

While social learning might help Universities of Applied Sciences to replace their educational systems, in a knowledge economy the replacement of one fixed situation (i.e., the educational model based on an industrial society) with another (i.e., a model based on a knowledge economy) is no longer considered sufficient. As mentioned above, rapid changes mean that knowledge quickly becomes obsolete. For people and organizations, this requires constant internal adaptation and a need to learn quickly (Prusak, 1997; Kessels, 2004; Kozlowski, Chao & Jensen, 2010). In a quickly-changing environment, organizations' proficiency is time- and situation related: when the situation changes, the criteria for proficiency change accordingly. In recent years, the literature on innovation has therefore also developed the perspective that schools are in an ongoing developmental process, whereby they are constantly being influenced by both internal as well as external stimuli (Lagerweij & Lagerweij-Voogt, 2004). As such, they need to develop their adaptive learning capabilities, or their capacity to learn and change simultaneously. This requires the ability of people "to work together in solving problems and innovating more accurately and more quickly" (De Laat & Simons, 2002, p. 15). Therefore, besides individual learning, collective forms of learning in organizations (e.g., team learning, collective learning and organizational learning) are being increasingly addressed (Cousins, 1998; Edmondson & Moingeon, 2004; Örtenblad, 2004; Popper & Lipshitz, 2004; Yang, Watkins & Marsick, 2004; Casey, 2005; Fenwick, 2008; Kozlowski et al., 2010). Seeing learning as connected with change is at the core of strategies

that see change as a learning process where people find solutions together for the problems they encounter (De Caluwé & Vermaak, 2006).

The assurance of this strategy lies within the learning organization. Fullan therefore states that schools must become learning organizations in order to survive (2001, p. xi). The archetype of a learning organization is seen as a promising response for schools to the demands made on them to learn continually (see for example Watkins, 2005), to adjust (see for example Schechter, 2008), and to restructure (see for example Leithwood & Seashore Louis, 1998; Silins et al., 2002; Collinson et al., 2006). In line with this archetype, ideas about organizational learning are being applied to educational settings (see for example De Laat & Simons, 2002; Verbiest, 2004; Kezar, 2005; Verbiest et al., 2005; White & Weathersby, 2005; Bowen, Rose & Waren, 2006; Collinson et al., 2004; Lick, 2006; Austin & Harkins, 2008; Tynjälä & Nikkanen, 2009; Veisi, 2010; Bui & Baruch, 2011). In this context there is also recognition for the fact that organizational development not only depends on individual learning, but also on processes of collective learning (Verbiest, 2004; Verbiest et al., 2005; Castelijns, Koster & Vermeulen, 2009). This type of learning can be seen as a necessary condition for organizational change (Wierdsma & Swieringa, 2002).

The development of a school's adaptive learning ability can be supported by a leader who has a transformational leadership style; an idea proposed first by Burns (1978) and subsequently extended in non-educational contexts by Bass (1985) and others (see f.i., Bass, 1999; Stewart, 2006). A leader with a transformational leadership style is particularly focused on the involvement, motivation and capabilities of teachers (and others in the school's organization), aiming to enlarge the potential of the school (as organization) to change and innovate (Geijsel, Sleegers & Van den Berg, 1999; Leithwood & Jantzi, 1999, 2000; Sleegers, 1999). He or she focuses on creating a collaborative work environment in which teachers strongly identify themselves with the commonly created goals of the school, fosters teacher development, and helps teachers solve problems together more effectively (Leithwood & Poplin, 1992). Through the strength of their vision and personality, transformational leaders are able to inspire teachers to change expectations, perceptions and motivations in order to work towards common goals. It is a leadership style which is considered supportive of organizational learning (Stewart, 2006) and 'collective learning' (see Verbiest, 2002), and which corresponds with the concept of the school as a learning organization (Van den Berg & Vandenberghe, 2005; Ten Bruggencate, 2009).

1.2 PROBLEM STATEMENT AND RESEARCH OBJECTIVE OF THIS STUDY

When organizational learning is considered a mechanism for organizational innovation and adaptation, practitioners might be interested in understanding and enhancing organizational learning in Universities of Applied Sciences. Because the concept of organizational learning has been studied from various perspectives, a rich theoretical base is available to them. The concept is, however, of a complex, multifaceted nature, and there is still a need for further research (Kozlowski et al., 2010). In studying group learning it is important to recognize that collective and organizational learning are not equal to the sum of individual learning (Garavan & McCarthy, 2008). Group learning might be more than the sum when a synergistic effect appears (King & Rowe, 1999; Gubbins & MacCurtain, 2008), but it might be less when

the lessons learned are not shared with others and therefore do not reach the level of the organization (Watkins & Marsick, 1993); or when the learning done by individuals is not focused in one and the same direction (Senge, 1990). Garavan and McCarthy (2006) therefore make a plea for taking the individual as well as the group and the organizational perspective into consideration. This corresponds to the notion that for continual organizational development to take place, both individual as well as collective learning is important. It is advantageous for Universities of Applied Sciences to have research done on learning from the perspective of organizational development that is applied in their own context: "research from organizational theory suggests that techniques and practices are more easily and successfully adopted within an institution when the approach has been tested within that particular setting and adjusted for that context..." (Kezar, 2005, p. 14). Moreover, universities have specific characteristics (see White and Weathersby, 2005) that should be taken into account when developing theories for this context. Assuming the premise is true that changes to higher vocational education can be achieved using a learning strategy, our study is focused on the value of 'organizational learning' in Universities of Applied Sciences. The key questions here are: what does this type of learning look like, which results are achieved, and what is the relationship to 'transformational leadership'. These questions will be specified in more detail in chapter 2.

1.3 RELEVANCE OF THE STUDY

Scientific relevance

Our study contributes to the field of HRD in which there is a growing interest in diverse forms of learning in the workplace (Kessels & Keursten, 2011). Specifically, it contributes to the theories on organizational learning and the learning organization, by studying in-depth the concept of organizational learning and the ways it manifests itself (i.e., as individual learning, collective learning and organizational learning). As such, we aim to increase the operational utility of the concept. Moreover, for the educational context, we study the relationship between 'organizational learning' and 'organizational results'. With that in mind, we aim to contribute to expanding the (yet limited) knowledge base that is available for this context, particularly with respect to the value of 'organizational learning' for educational institutions.

Practical relevance

Since a knowledge economy requires continuous adaptation via learning processes (Kessels, 2001a), organizations are in need of a systematic approach to 'manage' learning processes. Managing in this respect should not be taken too literally, for "the feasibility of managing such learning processes is questionable and they can hardly be imposed in the manner in which we are accustomed to running other industrial processes" (Kessels, 1998, p. 264). Managers are, however, able to contribute to a positive learning climate, stimulate cooperation between employees and equip the work environment with supportive resources (Kessels, 1996a). In this respect, Bolhuis and Simons (1999, p. 211) refer to an organization's 'learning policy', aimed at facilitating all forms of learning that contribute to the organization's development, goals and strategy. Kessels refers to a 'corporate curriculum', or the cre-

ation of "a rich landscape where personnel and teams find their way to construct knowledge" (1998, p. 264). As such, organizing the learning that takes place by individuals and groups becomes part and parcel of organizations' daily policies (Keursten, 2001). When educational practitioners try to create an environment in which learning and working collide, they are likely to benefit from an improved understanding of the learning processes taking place in their organizations and the results those processes generate.

Societal relevance

Given the fundamental changes that Universities of Applied Sciences face, they will need to redefine their identities and prove their own identities as these pertain to research universities (Diekstra, 2012). In this process, innovations should not be imposed top-down, but developed from 'within'; teams responsible for the universities' primary process should be actively involved in their design and implementation. Such an approach necessitates cultural changes and organizational learning. By studying this latter concept within the context of Universities of Applied Sciences, we aim to give suggestions for its development.

1.4 OUTLINE OF THIS DISSERTATION

In chapter 2 we examine what individual, collective and organizational learning is, based on the literature. Learning can be seen as a process as well as a result. Learning is conceptualized as work-related learning: a process where work and learning are interwoven. Within this we distinguish between learning by individuals and learning by the collective. A theoretical model for 'collective learning' is developed. From an organizational perspective learning is stimulated to support organizational change and to enlarge the adaptive potential of the organization. This perspective connects the learning of individuals and collectives with organizational behavior. We take time to consider the structural and cultural factors that are associated with a positive learning climate. In particular we pay attention to the concept of leadership. Subsequently a learning model is drawn up that connects the various forms of learning with one another and the organization. At the heart of this model are the social forms of learning in organizations, meaning 'social individual learning' and 'collective learning'. Based on the learning model the central questions are explicated. Several hypotheses are also drawn from the model. 'Social individual learning' is assumed to contribute positively to 'collective learning', which is then assumed to contribute positively to 'team performance' and 'team innovativeness'. 'Transformational leadership' is assumed to contribute positively to 'social individual learning' and 'collective learning'. These effects are hypothesized to remain that same even when teachers' gender, age, educational level, and employment status (part-time or full-time) are taken into account. The chapter ends with a summary of methods used in this study to answer the research questions and to test the hypotheses. The research contains three empirical studies: questionnaire-based research, a case study, and a game simulation.

Chapter 3 and 4 together form the first empirical study. Chapter 3 looks at the question of what collective learning processes look like within Universities of Applied Sciences. In this chapter a measurement instrument is developed to quantify the collective learning construct based on the perceptions of individual teachers about the daily activities within their pro-

grams. That instrument is subsequently optimized and the assumed factor structure of 'collective learning' is tested based on the results of a questionnaire research done with 495 teachers and 36 teacher teams at 8 Dutch Universities of Applied Sciences. This results in a revised model of 'collective learning'. The chapter ends with two alternate process models of 'collective learning', in which one of the factors is identified as a key factor and is assumed to influence the other factors. Chapter 4 is focused on how 'social individual learning', 'collective learning' and 'transformational leadership' are related. Based on the aforementioned questionnaire-based research, the assumed connections between learning and leadership are tested.

Chapter 5, based on a concrete innovation process in education, looks at which role 'social individual learning', 'collective learning' and 'transformational leadership' have played in the innovation process and what their contributions have been on the achieved results. Based on a large-scale quantitative study done earlier (Kuijpers & Meijers, 2012) three 'best-practice' cases are selected: Universities of Applied Sciences that were rated 'above average' in their successful efforts to develop and implement a career guidance program. Within this program, as a second empirical study, a case study is done. The results are primarily based on interviews done with those involved.

Chapter 6 is focused on testing the hypothesized positive relationship between 'collective learning' and 'team results' (i.e., their general and innovative performance). This chapter provides the results of the third empirical study, the game simulation that is held with five of the teams that took part in questionnaire research. Process observations by observers and reflection by the participants give insight into the degree to which elements of 'collective learning' contribute to 'team results'. In addition, we look at the relationship between the way teams and their members perceive collective learning processes.

Chapter 7 connects the various parts of the research in order to make a start at answering the question the study began with – what the value of organizational learning might be for changing higher vocational education. This reflection leads to the construction of a revised conceptual model. Subsequently the chapter provides a critical reflection on the conclusions drawn in previous chapters with regards to the value of the research and practice as well as the research methods that are at the foundation of these conclusions. This chapter ends with a number of reflections that emerged as the research came to a close.

2 Theoretical framework, research questions and hypotheses

> Given the importance of the concept of organizational learning for organizations that face ever changing, turbulent, and unpredictable environments, the domain - though rich in ideas - has a relatively limited empirical foundation, particularly with respect to human processes, and actionable knowledge (Koslowksi, Chao & Jensen, 2010, p. 368).

Educational institutions are operating in an environment where knowledge is increasingly acknowledged as being the main organizational driver (see Chapter 1). In such an environment, knowledge productivity (Kessels, 1995, 2001a), or "the ability to learn fast, adapt regularly to new challenges and acquire technical and interactive capabilities to continuously improve and innovate" (De Jong, 2010, p. 1, based on Harrison & Kessels, 2004) is crucial. This chapter focuses on creating a deeper understanding of the concept of learning in an organizational context. Organizational learning is increasingly studied from three, interrelated, perspectives: (1) the individual perspective, (2) the group or collective perspective, and (3) the organizational perspective (Cousins, 1998; Edmondson & Moingeon, 2004; Örtenblad, 2004; Popper & Lipshitz, 2004; Verbiest, 2004; Kozlowski et al., 2010). We explore the concept of learning from each of the three perspectives. For each perspective, we address the type of activities involved in the process of learning, as well as the outcomes associated with it. Subsequently, we synthesize results in a theoretical model. Using this model, we refine the general research question presented in Chapter 1 into a number of research questions and hypotheses that are of central interest to our study. Elaborating on the research questions and hypotheses, we discuss the variables central to our study and the study's research design.

2.1 INDIVIDUAL PERSPECTIVE ON LEARNING

Generally speaking there are four perspectives in the field of Human Resource Development (HRD) for studying learning processes: behaviorism, cognitivism, pragmatism and socially situated learning/ social constructivism. The social and economic context as well as the spirit of the age have an important influence on the dominant approach to knowledge and learning. Over time, in the field of HRD a development from behaviorism to respectively cognitivism, pragmatism and socially situated learning/ social constructivism can be noted (Keursten, 2006). Table 2.1 presents an overview of the four perspectives in terms of how they are embedded in societal developments, the perspective on the learner and the learning outcomes, as discussed by Keursten (2006).

For a long time, learning processes explored in research on learning in organizations (which can be positioned in the field of HRD) were conceptualized as "systems of information acquisition, storage, retrieval and transfer" (Richter, 2004, p. 133), focused on processing objective, explicit knowledge by individuals in the organization. Such a view can be placed within a cognitivistic perspective on learning, which aims to understand how learners process infor-

mation in their minds and how learning is concerned with the attainment of specific knowledge (Von Krogh & Roos, 1995). This idea is central to educational perspectives on learning, which are based on the assumption that learning can be planned and realized through formal training (Van Woerkom, 2003). Learning is then defined in terms of its outcomes, "whether these be knowledge in an accumulated storehouse of facts or habits representing behavioral responses to specific stimulus conditions" (Kolb, 1984, p. 26).

Table 2.1
Four main perspectives for studying learning processes identified in the field of Human Resource Development (HRD); source: Keursten (2006)

	Embedding within societal developments	**Perspectives on the learner**	**Learning outcomes**
Behaviorism	Was dominant in the post-war rebuilding phase and ongoing industrialization; manufacturing skills, productivity, loyalty and obedience were core principles.	The learner is treated from the same perspective as other company resources are managed; the focus is on efficiency and effective action with predictable results. The learner as a person is not part of the picture; he/she is a 'doer'.	Offers grip around questions whereby the situations are predictable and definable, and routine-based behavior is desired and where the connection between the situation and desired behavior remains stabile. A behavioristic approach provides routine, predictability, and standardization.
Cognitivism	Gained dominance along with the development of information and communication technology in a time when Western society was moving towards the information age. Dealing with a great deal of information became an important challenge.	The perspective of the learner as information worker is dominant; the processing of information is seen to be a process that should be optimized. This is seen as a rational process analogous to that of the computer.	Offers connections to questions where using more formal knowledge and the capacity to process information play a key role; where the focus is on making knowledge and information more accessible and whereby the cognitive processing of such information is considered the foundation for successful behavior at work. Cognitivism supports content-based professionalism and contributes to the using of existing formal knowledge and information.

Table 2.1 (continued)

	Embedding within societal developments	Perspectives on the learner	Learning outcomes
Pragmatism	Became more influential in the period where we began to dismantle ideologies and where instead the question 'does it work' began to be considered the measuring stick, whereby client-focused, continuous improvement and quality care became core goals and where we think in terms of resources (human resources; resource-based theories within organizations).	The perspective shifts to the learner as problem-solver who thinks and acts. It is about integrating thinking and doing in contexts where there is a problem and in this way being productive.	Fits very well with definable questions from practice whereby continuous improvement and independent problem-solving plays a key role and where the focus is on experiences and gaining knowledge through experience. Pragmatism contributes strongly to the building of experiences and the potential to solve problems based on the knowledge that has been gained through those experiences.
Socially situated learning/social constructivism	Is gaining ground in a time where more and more work has become knowledge-based; there is greater autonomy for professionals, who work within networks, and innovation is seen as increasingly important.	The focus shifts from the individual to the group and this learning group is the creator of new meaning, joint identity and a constantly renewing practice. Social constructivism contributes to the collective identity and creativity and offers solutions where 'more of the same' no longer works.	Corresponds with challenges where groups must jointly develop new solutions in complex situations where neither the goal, the context, nor the approach has been predetermined, but are under development. Think of: the development of new products; creation of new marketing and distribution systems.

Individual training, however, has often led to disappointing results: it is expensive (Rothwell, 1991), it only has impact if it occurs at the right time (Zemke, 1985; Jacobs & Jones, 1995; Herling, 2000), and the transfer of what has been learned to the daily work situation is poor (Baldwin & Ford, 1988). It is acknowledged that learning processes occurring at and around the workplace are often more powerful than learning processes taking place in formal training situations (Kessels, 1993; Kessels & Keursten, 2011).

In line with the general developments in the field of HRD, assumptions from the pragmatic and socially situated learning perspectives are increasingly adopted to reconceptualize knowledge and learning. More and more frequently, knowledge is considered to be based on unique, individual experiences and is therefore of a personal and subjective nature. This had led to an approach to learning, "in which people co-produce an insight as well as co-

producing their own understanding in an environment which fosters conversation and sensemaking" (Richter, 2004, p. 133). The conceptualization of knowledge and learning along the lines of the pragmatic and socially situated learning perspectives has at least two important implications, as will be discussed below.

First, it favors a shift away from an educational perspective on learning toward a perspective where work is considered an important source of learning (Kessels, 1996a; Bolhuis & Simons, 1999; Streumer & Van der Klink, 2004; Nijhof, 2006; Baert, Gielen, Lauwers & Van Bree, 2007). Learning is argued to take place at and around the workplace and is therefore situated close to, or as part of the primary working process (Kessels & Grotendorst, 2011). Van Woerkom (2003) refers to work-related learning as "the natural learning process that is interwoven in the daily work process, which is not explicitly organized by external actors and which, dependent on the degree of consciousness of the learner, can be more intentional or implicit" (Van Woerkom, 2003, p. 2)[5]. Work-related learning may result in changes in skill levels, knowledge, attitudes and learning abilities, or in changes in work processes or work outcomes. According to the views of Simons and Ruijters (2001), changes in skill levels, knowledge, attitudes and learning abilities might be referred to as 'learning in the restricted sense', long-term changes in these areas might be referred to as 'development', and deep and enduring new ways and new outcomes of work might be referred to as 'change'. Professionals are involved in work-related learning for various reasons (Kwakman, 2011).

A first reason is that, since many changes are going on both in professions and in labor organizations, professionals are confronted with new tasks and changing demands. In order to adequately address those changes, they will need to learn new things. Kwakman refers to such learning as "learning in the context of improvement and change" (2011, p. 305). This idea is closely related to the concept of knowledge productivity (Kessels, 1995, 2001a), which represents a process in which new knowledge is developed with the intention to contribute to innovation in the work environment (Verdonschot, 2011). Work-related learning is specifically relevant, because it is more powerful than learning processes embodied in formal training settings (Kessels, 1993, 1998). This type of work-related learning is consistent with a socially situated perspective on learning (see Table 2.1). Moreover, it is in line with the notion presented in Chapter 1, that organizations, to be successful in the knowledge economy, need to strive continuously to improve their processes, products and services, and occasionally embark on radical renewal (Stam, 2011). In such an economy, learning with the intention of innovating becomes increasingly important (Verdonschot, 2009).

A second reason for professionals to be involved in learning is because the nature of their work requires them to do so. Work confronts them time and again with new problems and unique situations, asking for idiosyncratic solutions. As such, professionals are continuously involved in processes aimed at improving the quality of their own work (Kwakman, 2011; Verdonschot, 2011). This type of work-related learning is based on experience and refers to the process in which individuals make sense of their experiences. As such it is consistent with a pragmatic perspective on learning, of which Kolb's (1984) learning cycle is an influential example (Keursten, 2006). While knowledge is gained as a naturally occurring process inher-

[5] The fact that learning is considered a side product of working or problem solving, does not imply that from an organizational perspective it should be left to random opportunity (Bolhuis & Simons, 1999; Kessels & Keursten, 2011).

ent to work, Kolb argues that genuine learning requires the learner not only to be actively involved in an experience, but also to reflect on it, to conceptualize it and to formulate new action plans that guide future experiences. A specific characteristic of work-related learning is that the process and its results often remain implicit (Simons & Ruijters, 2001; Van Woerkom, 2003). Implicit learning processes are merely happening as a byproduct of working or problem solving and take place quite independently of conscious learning attempts (van Woerkom, 2003). It is important for practitioners to develop more awareness of work-related learning processes and outcomes for various reasons (Simons & Ruijters, 2001): (1) when people realize what they have learned implicitly, they come to understand that learning at work can take place at any moment and they can develop a sense of pride accordingly, (2) people can only share the outcomes of their learning when they actually realize them, and (3) people can only improve their *ways* of learning when they know what and how they learn. Social interaction contributes to making implicit knowledge explicit (Van Woerkom, 2003) and facilitates knowledge sharing (Boer, Van Balen & Kumar, 2004). A third reason for professionals to be involved in learning is because it is a means to accomplish personal goals; it is in their own interest.

Another important consequence of the changing perspective on learning is that people are no longer considered passive media for storage; they are seen as active, meaning-oriented designers of their own knowledge, steering their own learning processes. They are intentional actors, who give meaning to their environments, while at the same time being influenced by them (Fox, 2001). An interactive understanding of knowledge is proposed, based on continuous interaction of people with their environments (Simons, van der Linden & Duffy, 2000). Such understanding favors a socially situated perspective on learning, where learning is situated in the social and relational aspects of work (Lave & Wenger, 1991). Learning is conceptualized as taking place in a specific social context, and the activities in this context determine both the form and the content of the learning. Relationships are emphasized as the context-bound nature of learning (De Jong, 2010). As a result, learning in social interaction, or with and from others, has gained a central place in theory development (Bolhuis & Simons, 2001; Collinson et al., 2006). Because of the social nature of learning, the quality of interactions among people is assumed to have an important effect on learning. As such, learning demands an open atmosphere and open communication (Von Krogh, 2000, in De Jong, 2010), and conversation is considered "the central medium for creating individual meaning and organizational change" (Leithwood & Seashore Louis, 1998, p. 3). This is compatible with a postmodern vision on organizations, in which they are perceived as "processes and relationships rather than as structures and rules" (Mitchell, Sackney & Walker, 1996, p. 52) and as a social construction or a network of meanings (Leithwood & Seashore Louis, 1998).

The socially situated perspective on learning is focused on *groups* of people, who are assumed to learn and, as such, create new meanings, a shared identity and innovative practice (Keursten, 2006). As a result, there is a growing interest in how individuals learn through participation and interaction in groups. Nowadays, there is a common understanding that learning is not only an individual challenge and necessity, but also a collective one (Van Lakerveld, 2011). The question that follows from this idea is: is the 'unit' of learning the individual or the group? Though this question cannot be addressed in a straightforward way, the framework presented by De Laat and Simons (2002) helps us to understand learning by indi-

viduals and groups. They distinguish four forms of learning: 'individual learning', 'individual learning processes with collective outcomes', 'learning in social interaction', and 'collective learning'. 'Individual learning' is the most individualistic form, for it entails an individual process with individual outcomes. An example is a professional reading a book in order to update his or her knowledge. The second form of learning is characterized by an individual process and collective outcomes. Such learning might occur, for example, when professionals that participated in a conference afterwards compile lessons learned. The third form, 'learning in social interaction' relates to individuals who achieve individual outcomes in interaction with others. An example is a professional asking a colleague for feedback on his or her own performance. This type of learning will hence forth be referred to as 'social individual learning', for this term emphasizes the individual orientation of the learning process and can therefore be more sharply contrasted from the term 'collective learning'; the fourth type of learning in the framework of De Laat and Simons (2002). 'Collective learning' refers to a group of people consciously striving for common learning and/or working outcomes. This type of learning will be elaborated upon in the section 'Collective perspective on learning'.

In summary, literature on learning by professionals reflects a tendency that in the HRD-literature is referred to as 'from educating to learning' (Bolhuis & Simons, 1999; Buskermolen, De la Parra & Slotman, 1999). Work-related learning is considered an important source of learning for professionals (Kwakman, 2011), which is more powerful than learning processes embodied in formal training settings (Kessels, 1993, 1998). Professionals are involved in work-related learning in order to continuously improve the quality of their work, to realize change, and to accomplish personal goals (Kwakman, 2011). Since the 1990s, research on learning in organizations is increasingly based on socially situated perspectives on learning, resulting in a growing interest in 'social individual learning' and 'collective learning'. In the present study we will focus on work-related learning, which we will conceptualize from a socially situated perspective. In terms of the framework presented by De Laat and Simons (2002), our interest goes out to 'social individual learning' (current section) and 'collective learning' (see subsequent section). While work-related learning processes can be more or less implicit, with respect to 'social individual learning' we limit our focus to learning processes characterized by the fact that people intentionally interact with others (implying a shared process), in order to improve their own performance with respect to work (and therefore this learning primarily leads to individual outcomes). In the present study, 'social individual learning' is defined as follows.

> *'Social individual learning' refers to the work-related learning processes that arise when an individual interacts with others to improve the quality of his or her work, to realize change, and/or to accomplish personal goals. Such learning may result in long-term changes in skills, knowledge, attitudes and learning abilities, or in changes in work processes or work outcomes, signifying development and change respectively'.*

Examples of concrete activities associated with 'social individual learning' are 'asking for feedback', 'exchanging knowledge' and 'collaborating'. We choose to focus on *intentional* processes of 'social individual learning', because they resemble an active learning orientation for individuals and we hypothesize a positive relationship between such an orientation and the way these individuals perceive group-based learning processes.

2.2 COLLECTIVE PERSPECTIVE ON LEARNING

Definition

Although 'social individual learning' implies a shared process, it may not simply be labeled 'collective learning'. As Marsick & Neaman (1996, p. 99) put it: "individuals learn in a social context [and] in addition, they can act as agents for collective learning that leads to change". Therefore, individual learning can be distinguished from 'collective learning'. Processes of collective learning are characterized by the fact that members of the collective consciously strive for common learning and/or working outcomes (De Laat, Poell, Simons & Van Krogt, 2001; Simons & Ruijters, 2001; De Laat & Simons, 2002), such as a balanced primary process, collective quality standards, gained and shared new insights, and collective visions, innovations and action plans for the team and/or the organization (Simons & Ruijters, 2001). In line with the ideas presented above, collective learning processes are assumed to be interwoven with daily work processes, based in experience and founded upon shared constructions (Seashore Louis & Kruse, 1998). Moreover, they may result in the development of skills, knowledge, attitudes and learning abilities, and in changes in work processes or work outcomes, or, respectively in 'learning in the restricted sense', 'development', and 'change' (Simons & Ruijters, 2001). Since 'collective learning' is conceptualized as a form of work-related learning, work processes are at its core, and the learning process and its outcomes might be implicit. Consequently, in the present study 'working teams', as opposed to 'learning teams', are central to 'collective learning' (De Laat & Simons, 2002). In processes of collective learning, people work from "shared mental representations or understandings of the organization and how it operates" (Cousins, 1998, p. 128), including a shared sense of direction for the organization (Leithwood, Jantzi & Steinbach, 1998). In line with these ideas, 'collective learning' in the present study, is defined as follows.

> *'Collective learning' refers to the work-related learning processes that arise when the members of a collective collaborate and consciously strive for common learning and/or working outcomes. Such learning may result in long-term changes in skills, knowledge, attitudes and learning abilities, or in changes in work processes or work outcomes, signifying development and change respectively'.*

In this definition, the term 'collective' refers to "any interdependent and goal directed combination of individuals, groups, departments, organizations, or institutions" (Morgeson & Hofmann, 1999, p. 251) that collaborate to realize shared ambitions with respect to work. The focus in the present study is specifically on groups of teachers that work within one and the same educational team, for they are most likely to be mutually involved in daily work situations.

Phases of the collective learning process

While 'collective learning' is conceived of as a process, a plea is often made for the closely related (overarching) construct 'organizational learning' (see subsequent section) because of its outcome: the organization's adaptability (Edmondson & Moingeon, 2004; Kozlowski et al., 2010). In experiential learning, processes and outcomes are, however, interwoven, because the learning process itself is a process of adaptation (Kolb, 1984). It is a continuous process

in which ideas are formed, tested and reformed through experiences in a transactional relationship between the learner and his or her environment. In line with these ideas, Dixon (1999) describes 'collective learning' as a cyclical process consisting of four phases: generating information all over the organization, integration of information within the organizational context, collective interpretation of information, and being authorized to act based on the interpreted significance. In this process, joint reflection on professional experiences leads to the construction of a "shared, communal wisdom of practice" (Ben-Peretz & Shonmann, 1998, p. 51).

Castelijns and colleagues (Castelijns et al., 2009; Castelijns, Geldens, Kools, Koster & Vermeulen, 2010) expand the cycle by adding a phase of ambition development. As Kessels (2004, p. 170) points out: "learning cannot be enforced on the basis of power, control or contract, [but] requires a shared ambition that is attractive, comprehensible and meaningful for both employees and the organization". This phase of ambition development seems to contribute to the realization that a shared sense of direction is central to the collective learning process (Senge, 1990). It stimulates the integration and coordination of individual actions that are required if 'collective learning' is to exceed the sum of all individual learning by the collective (Morgeson & Hofmann, 1999). Recently, in her study of team learning, Savelsbergh (2010) found the development of a shared vision to be an important aspect of team learning.

Dixon's final phase, the action phase, can be divided into three parts: action, evaluation, and reflection. Evaluation of results provides learners with feedback on the effects of their actions and is therefore an important source of learning, especially because of the implicit nature of work-related learning as mentioned before. Reflection is crucial for developing learning abilities (Keursten, 2001). Savelsbergh (2010) found reflection on team processes and results to be an important aspect of team learning. In Dixon's model, evaluation and reflection are not recognized as a separate phase, but are included in the information-generation phase that directly follows the action phase. By expanding Dixon's model with a phase of ambition development and a evaluation and reflection phase, a six-phase cycle for the process of collective learning is created. Based on additional literature, as discussed below, we rename these phases as: 'shared vision', 'information generation', 'information distribution', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'.

Shared vision. Many authors consider a shared vision – a mental image of a future the members of the collective want to create together (Senge, Cabron-McCabe, Lucas, Smith, Dutton & Kleiner, 2000) – a highly important feature of 'collective learning' (Heraty & Morley, 2008), because it underlies the required unity in the form of "collective intent and shared meaning" (Heraty & Morley, 2008, p. 480). A vision imposed by authority is not sustainable (Senge et al., 2000), for it lacks the buy in of members of the collective (García-Morales, Lopez-Marín & Llamas-Sánchez, 2006). The vision does not result from "unilateral ideological visioning", but it is based on "the development of collective intent and shared meaning" (Heraty & Morley, 2008, p. 480), which itself results from prior collective learning processes. Since work-related learning is characterized by implicit learning processes that largely take place independently of conscious attempts at learning (Van Woerkom, 2010), the vision will primarily be related to work.

Information generation. Important for 'collective learning' is that primary users in particular (i.e., teachers) collect information and ideas about processes, that information is gathered by means of hypothetical questions (what will happen if we… I… the pupils…the methods…didactics…?) and that information is collected about complaints and errors (Verbiest et al., 2005). In order for the process of information generation to result in teachers' ability to repeatedly improve and innovate, information should be drawn from many external as well as internal sources (Kessels, 2004). Information from external sources prevents the organization from becoming a closed system that increasingly develops an homogeneous view lacking diversity and dialogue (Dixon, 1999). Information from internal sources provides feedback on the actions of the organization and the results achieved, thereby creating opportunities to adjust processes along the way and evaluate them after completion (Dixon, 1999). Potential sources for internal and external information generation are: learning from personal experience, learning by observing, copying what others are doing, grafting carriers of new knowledge, and acquisition by carrying out focused and wide-ranging sensing of the external environment (Huber, 1996).

Information distribution. The information generated in the previous phase can only be fully understood in the context of the entire organization (Dixon, 1999). Therefore, 'collective learning' requires that everyone is informed about the others' data and the transfer of information is timely, complete, and accurate (Verbiest et al., 2005), and spread over all the areas of expertise (Dixon, 1999). A collective information base forms the input for the dialogue phase, discussed below, in which the information is jointly interpreted. Because of its personal and context-specific nature, communication of implicit knowledge is difficult (Mittendorff, Geijsel, Hoeve, De Laat & Nieuwenhuis, 2006) and requires social interaction (Brown & Duguid, 1996). Moreover, members of the collective might be disinclined to share things that might cause them embarrassment, thereby providing insufficient information to relevant others (Dixon, 1999). Openly sharing information therefore requires an organizational culture focused on learning, not on blaming (Lipshitz, Friedman & Popper, 2007).

Dialogue and inquiry. As multiple interpretations of the information generated and distributed may exist, 'collective learning' requires insight into the different interpretations by different people, as well as dialogue (Chiva, Alegre & Lapiedra, 2007; Collinson et al, 2006; Fenwick, 2008; Garavan & McCarthy, 2008; Rowe, 2008) aimed at constructing shared meaning. In this type of dialogue people mutually explore ideas, questions, and potential actions (Watkins & Marsick, 1993; Savelsbergh, 2010). It involves inquiry into alternative interpretations and views (Rait, 1995), via "questioning that simultaneously challenges assumptions and yet does not attack the individual" (Watkins & Marsick, 1993, p. 14). Such an approach increases the chances that all relevant information will be taken into account and that the collective's knowledge base will grow (Rait, 1995). Dialogue and inquiry are based on pluralism (Easterby-Smith, Crossan & Nicolini, 2000) and even conflict (Chiva et al., 2007). Conflict is resolved when people consider their knowledge as hypotheses to be tested through action (Lipshitz et al., 2007). Dialogue does not necessarily lead to similar interpretations (Dixon, 1999; Verbiest et al., 2005), but to a sufficiently shared understanding on which the organization can base its subsequent actions (Dixon, 1999). The process of dialogue is a difficult one that requires dialogical skills (Dixon, 1999; Verbiest et al., 2005) for which people should be explicitly trained (Senge, 1990). Furthermore, it requires conditions, such as quality of

relationships, trust, psychological safety (Lipshitz et al., 2007), and equality in the dialogue (Dixon, 1999, Verbiest et al., 2005, Lipshitz et al., 2007).

Collective action. The act of organizing is essentially the process of imposing a shared reality – resulting from processes of dialogue and inquiry in the previous phase – on the environment through actions by a group of people (Weick, 1979, Lipshitz et al., 2007). Experiential learning entails action, for it allows the group to evaluate the results of its learning processes and to adjust theories of action (Argyris & Schön, 1978) accordingly. From the perspective of the learning organization, action can be considered an essential element of the learning process, for it translates the mental learning results into changes in organizational behavior. Assuming a positive relationship with economic output (Van Woerkom, 2003), knowledge is not an end in itself, but is created to enlarge the adaptive ability of the organization (Garavan & McCarthy, 2008). Therefore, to be effective, learning has to lead to changes in work (Mittendorff et al., 2006). As "all learning involves the level of the individual at some point" (Mittendorff et al., 2006, p. 299-300), members of the collective should develop an understanding of what should be done individually to contribute to the 'collective learning' of the group (Leithwood, 1998; Verbiest et al., 2005). This understanding might result from a discussion with colleagues, as well as from collegial collaboration and consultation.

Evaluation and reflection. Acting on shared beliefs enables a collective to evaluate the results of its actions and to adjust its theories of action (Argyris & Schön, 1978). Explicit evaluation of both the process and the results are essential for experiential learning: they close the learning cycle and provide input for subsequent learning cycles by providing insight into the efficacy of the collective members' behaviors and actions. Evaluations can be performed by measuring against various standards: expected or desired results, internal benchmarks (e.g., past performance of the collective), and external benchmarks (other collectives, e.g., best practices, competitors). Due to the implicit nature of work-related learning, it is important to explicitly evaluate the learning processes and outcomes, for these are difficult to detect and evaluate (Mittendorff et al., 2006). Also, collective reflection on interaction between the members of the collective (Van Woerkom, 2003) is required. Reflection can be considered a form of externalization (Nonaka & Takeuchi, 1995) that stimulates 'collective learning' (Heraty & Morley, 2008; Mittendorff et al., 2006).

2.3 ORGANIZATIONAL PERSPECTIVE ON LEARNING

Besides the individual and collective perspective on learning, the organizational perspective can be distinguished as well. Different descriptions of what exactly makes up organizational learning can be found in the literature. Contributions have been made by authors from a variety of fields and the abundance of perspectives has resulted in confusion and fragmentation (Edmondson & Moingeon, 2004). Different authors have focused on creating clarity by providing ordering frames or typologies. An imperative ordering distinguishes between literature on organizational learning and literature on the learning organization (Argyris & Schön, 1996; Örtenblad, 2004; Heraty & Morley, 2008). Based on contributions of others, Örtenblad (2004) provides an overview of the main differences between both perspectives.

> *DiBella (1995) claims that the 'learning organization' is a form of organization, while "organizational learning" is the process of learning in organizations. Finger and Bürgin Brand (1999) see the 'learning organization' as an ideal organization form and 'organizational learning' as an activity and process by which organizations reach this ideal. Easterby-Smith and Araujo (1999) describe the organizational learning literature as dealing with observation and analysis of processes involved in learning in organizations. They describe the learning organization literature as action oriented, focusing of finding tools that can help to increase the quality of the learning processes* (p. 54).

Theory and research from the perspective of organizational learning is concerned with processes of learning in the organization, theory and research from the perspective of the learning organization is concerned with the form of the organization itself (Örtenblad, 2004). While both perspectives have a different theoretical foundation, the concepts are often used interchangeably, thereby creating confusion (Örtenblad, 2004) and a lack of consistency in the overarching research field. Using studies by Edmondson and Moingeon (2004) and Örtenblad (2004), an overview of both perspectives will be given shortly in order to explore their contributions to understanding the multi-level construct of organizational learning. Subsequently, the relationship between organizational learning and organizational change is addressed.

Research from the perspective of organizational learning

Theory and research from the perspective of organizational learning is commonly of a descriptive nature (Edmondson & Moingeon, 2004; Örtenblad, 2004). It focuses primarily on different types of learning processes that manifest themselves within organizations – both desirable and non-desirable ones – and on the implications for the organization. In describing the process of organizational learning, authors address both the individual and the collective level of learning (e.g., DiBella, 1995; Easterby-Smith & Araujo, 1999, Finger & Bürgin Brand, 1999). Many authors agree about the idea that organizational learning refers to the way in which members of the organization learn individually and collectively in order to respond to the demand of improving the activities of that organization (Mitchell en Sackney, 1998). Illustrative in this respect, is the work of Edmondson and Moingeon, who define organizational learning as "a process in which an organization's members actively use data to guide behavior in such a way as to promote the ongoing adaptation of the organization" (2004, p. 28). The organizational level is addressed by authors focusing on how knowledge resulting from these learning processes is stored in the organizational mind (Örtenblad, 2004). The heightened interest in the social aspect of learning is also present at this level of analysis: "Fundamental to conceptions of organizational learning is the development among organizational members of shared mental representations or understandings of the organization and how it operates. … shared interpretations of events and collective representations of knowledge are constructed through social interaction" (Cousins, 1998, p. 128). The importance of the social aspect of learning is shown in the typologies provided by Edmondson and Moingeon, and Örtenblad.

Based on the individual and organizational level of analysis, Edmondson and Moingeon discern two types of research contributions that can be placed within the perspective of organizational learning: 'residues' (organizational level) and 'communities' (individual level). The

term *residues* relates to contributions around the question of how knowledge is represented at the organizational level. While internally organizational knowledge is represented by shared interpretations and mental maps, externally it is said to be embodied in organizational routines, policies and procedures (Cousins, 1998). Questions that are addressed are, among others, how routines shape organizational behavior, how knowledge is acquired and distributed and how interpretative processes prevent rational adaptation (Edmondson & Moingeon, 2004). The role of communication as a medium for transferring and distributing information within the organization and between organizations has caught the attention of several researchers (Cousins, 1998). Based on Daft and Huber (1987), Cousins delineates the 'system-structural perspective' and the 'interpretative perspective'. In the former the organization is conceptualized as a system for transmitting data, in the latter the organization is considered a system that gives meaning to data. "The interpretative perspective raises to prominence the equivocality of data and the environment and the importance of context in sensemaking. Learning is a consequence of discussion, shared interpretation, changing assumptions and trial-and-error activities" (Cousins, 1998, p. 225). The term *communities*, on the other hand, relates to the contributions that conceptualize organizations as collections of individuals who can learn and develop. This concept includes descriptions of individual learning, models specifying conditions that enable learning and models that describe beneficial outcomes (e.g., an organization's ability to change) of individuals engaging in learning. Social influences are acknowledged: "New interpersonal challenges encountered in less hierarchical, team-based organizations encourage individuals to engage in developing communication and other interpersonal skills, which creates a kind of institutionalized learning" (Edmondson en Moingeon, 2004, p. 25).

Örtenblad also makes a distinction between two types of research contributions that can be placed within the perspective of organizational learning: 'organizational learning' and 'learning at work'. The term *organizational learning* relates to research where employees are considered to learn as agents for the organization. Organizational knowledge results when knowledge is stored in the organizational memory, consisting of routines, dialogues, and symbols. Important questions are how knowledge can actually be stored in the organizational mind and how stored knowledge is used in practice. Learning is mostly described as having different levels, such as single-loop, double-loop (Argyris & Schön, 1978), and even triple-loop (see f.i., Boonstra, 2004). Örtenblad distinguishes between 'old organizational learning' and 'new organizational learning'. The new organizational learning perspective rejects cognitive learning by individuals, emphasizing that it is the collective that learns (i.e., individuals learn by participation in groups). Moreover, from this perspective learning is considered to be situated and related to work, which is also the basic assumption in contributions from the perspective of *learning at work*.

The residues perspective and the (old and new) organizational learning both relate to the organizational level. They focus on the question that relates to how the outcomes of individuals' learning, both independently and in interaction with others, are stored in (the memory of) the organization. The communities perspective and the learning at work perspective relate to the individual level. They focus on the learning processes that individuals, again both independently and in interaction with others, go through and on the conditions that enable learning. The typologies provided by Edmondson and Moingeon and Örtenblad show that organizational learning is commonly conceptualized as 'individual learning' and 'collective

learning', where the conditions of learning and the effects of that learning for the organization are ascertained. Increasingly, learning is considered a social process and social and group forms of learning are addressed.

Research from the perspective of the learning organization

Contributions from the perspective of the learning organization describe from a normative perspective which requirements an organization must satisfy in order to stimulate intentional learning that in turn contributes to realization of the organizational goals (Örtenblad, 2004), specifically the ongoing adaptation of the organization (Edmondson & Moingeon, 2004). The learning organization is considered "an outcome that can be brought about through intervention" (Edmondson & Moingeon, 2004, p. 21). In the literature little agreement can be found on the description and characteristics of a learning organization (Bolhuis & Simons, 1999). Many authors have tried to conceptualize the learning organization in a homogenous way, but no one seems to have succeeded as yet (Örtenblad, 2004). Different authors have emphasized how difficult it is to describe what a complete learning organization might look like (e.g., Watkins & Marsick, 1993; Marquard & Reynolds, 1994; Pedler & Aspinwall, 1998). Despite the heterogeneity, the learning organization is often considered a necessity and implicitly or explicitly the assumption is made that this organizational form is appropriate for each type of organization, irrespective of its culture or branch (Örtenblad, 2004). Again, a review of the typologies by Örtenblad (2004) and Edmondson and Moingeon (2004) helps to comprehend how the perspective of the learning organization contributes to understanding learning in and by organizations.

Based on the individual and organizational level of analysis, Edmondson and Moingeon discern two types of research that can be placed within the perspective of the learning organization: participation and accountability. *Participation* refers to organizational-level intervention research aimed at achieving organizational improvement (in terms of a creative and flexible response) by means of the intelligent activities of individuals. The organization is assumed to learn when these individuals solve problems through full participation and when they communicate about essential subjects. *Accountability* refers to individual-level intervention research aimed at exploring and developing the way individuals think about the organization. The organization is said to learn when individuals undertake action to adjust or develop their cognitive or mental models and are thus able to take more effective decisions. While the normative character of both types of research, as well as their focus on organizational outcomes, places them within the perspective of the learning organization, they both draw heavily on individual and group level (learning) processes. As Edmondson and Moingeon's typology shows, the perspective of the learning organization enriches the perspectives of 'individual learning' and 'collective learning' by emphasizing that organization-level interventions can be made to steer individual and group learning processes.

Örtenblad also distinguishes between two types of research that can be placed within the perspective of the learning organization: 'learning climate' and 'learning structure'. The term *learning climate* refers to research that considers the learning organization as one that facilitates learning by individuals and provides them with freedom to learn. Such organizations are characterized by a better learning climate than organizations that do not facilitate this type of learning. In such a climate, "learning is encouraged, rewarded and allowed to flow

freely around the organisation" (Garratt, 1990, p. 24), and people are stimulated to talk to each other (Pedler & Aspinwall, 1998). In this type of research the focus on the organization is combined with a focus on the learning process. The term *learning structure* refers to research conceptualizing the learning organization as a flexible organization. In this type of research, organic structures are preferred over bureaucratic structures, because decentralized structures allow organizations to learn continuously from their environments. As Örtenblad's typology shows, the perspective of the learning organization enriches the perspectives of 'individual learning' and 'collective learning' by emphasizing the significance of the organization as the learning context. In the literature, a wide variety of factors can be found that, taken together, form this context (see for example the overview by Lipshitz et al., 2007).

A factor of which the importance is repeatedly emphasized for the educational sector is 'transformational leadership' (e.g., Leithwood, Jantzi & Steinbach, 1998; Leithwood, Leonard & Sharratt, 1998; Van den Berg, Vandenberghe & Sleegers, 1999; Silins et al., 2002; Verbiest, 2002; Meijers, 2004; Van den Berg & Vandenberghe, 2005; Geijsel, Sleegers, Stoel & Krüger, 2009; Ten Bruggencate, 2009). Transformational leaders focus on realizing a change of culture by creating a working environment in which teachers work together optimally, and in which they strongly identify themselves with the commonly created goals of the school. They 'seduce' teachers to learn (Meijers, 2004), aiming to build the school's capacity to change and innovate (Ten Bruggencate, 2009). It is a leadership style which is associated with large-scale innovations that lead to complex transformations in the culture of organizations (Van den Berg et al., 1999). While 'transformational leadership' is interwoven with the structure and the culture of the organization, leadership can be considered a separate factor influencing learning processes within the organization (Lipshitz et al., 2007). As Örtenblad's typology shows, the perspective of the learning organization enriches the perspectives of 'individual learning' and 'collective learning' by emphasizing that organizations can facilitate individuals' and teams' learning by providing a structure, a culture, and a leadership style supportive of such learning.

The relationship between organizational learning and change

To be successful in the knowledge economy, organizations need to strive for two types of innovation. First, they have to work continuously on improving their processes, products and services, and second, every now and then they have to be able to radically renew (Drucker, 1993; Nonaka & Takeuchi, 1995; Stam, 2011). In the previous sections it became clear that learning in organizations relates to (the development of) individuals' and groups' skills, knowledge, attitude and learning abilities, and that it might result in changes in work processes or outcomes at an individual, team and organizational level. From the perspectives of 'organizational learning' and 'the learning organization', such learning is intended to increase organizations' creative and flexible response and thereby provide an answer to the demands of improvement and renewal. Learning in organizations is then closely tied to organizational change. Simons and Ruijters (2004) explicitly distinguish between 'learning' (in the restricted sense), 'development' and 'change' as three types of learning outcomes (see Table 2.2). Organizational change occurs when (the development of) individuals', teams', and organizations' skills, knowledge, attitudes and learning abilities lead to changes in work processes or

outcomes at each of these levels. The increase of organizations' creative and flexible response might be considered such a change.

Table 2.2
The various ways and levels of learning and their outcomes (within the cells), source; Simons & Ruijters (2004)

Levels of learning **Ways of learning (broad sense)**	**Individual**	**Team**	**Organization**
Learning (restricted sense)	Skills, knowledge, attitudes, learning abilities of individual	Skills, knowledge, attitudes, learning abilities of group	Skills, knowledge, attitudes, learning abilities of organization
Development	Long term skills, knowledge, attitudes, learning abilities of individual	Long term skills, knowledge, attitudes, learning abilities of group	Long term skills, knowledge, attitudes, learning abilities of organization
Change	Work processes or outcomes of individuals	Work processes or outcomes of group	Work processes or outcomes of organization

Organizational change is associated with different types of learning (see Wierdsma & Swieringa, 2002; Boonstra, 2004; Wierdsma, 2004). Several scholars distinguish between first-, second- and third-order learning (Boonstra, 2004, De Caluwé & Vermaak, 2006*). First-order (or single-loop) learning* focuses on changing rules, practices and competencies and leads to improvement. It takes the form of learning by conditioning, imitation or teaching. Organizational challenges are addressed by behavior which might be typified as 'more of the same', leading the organization's status quo to be maintained. *Second-order (or double-loop) learning* focuses on changing rules and insights and leads to renewal. While the learning process is basically individual, it takes place in a social contexts and affects social organization through the exchange of new insights. Examples are experimental learning and action learning. Organizational challenges are addressed by exploring different perspectives on problems and issues and linking the exploration to the organization's development, relationships, and people's reflection on their own insights and assumptions. Double-loop learning requires double-loop inquiry: "continuous practice of examining assumptions, surfacing and challenging mental models, and acting on what is learned" (Boyce, 2003, p. 128). *Third-order (or deutero) learning* focuses on changing principles and leads to development. Learners question the validity of activities, relationships, and meanings posed by the context in which they operate and the interactions in which they are involved. Here, organizing, changing and learning are interrelated. Contexts and principles are inquired about, deconstructed and reconstructed together, and relationships and activities are re-ordered to take into account the external variety. Wierdsma refers this as an organization's capacity to change (2004, p. 240). In third-order learning, knowing and learning are basically social processes aimed at creating a shared meaning around issues and creating new possibilities. Meanings are socially constructed in a dialogue that makes room for multiple voices and multiple social realities.

An organization's capacity to change therefore requires processes of collective competence or collective learning alongside individual competence (Wierdsma & Swieringa, 2002; Wierdsma, 2004). Third-order learning is closely associated with the concept of the learning organization. An organization that functions as a learning organization is proficient, and knows how to remain proficient. Proficiency is time- and situation related: when the situation changes, the criteria for proficiency change accordingly. Therefore, continuous development is required. Wierdsma and Swieringa (2002) use the term 'organizing while learning', a way of organizing that requires third-order learning, specifically 'collective learning'.

A learning organization stimulates conscious learning, which requires a collective will, courage and ability to inquire about what others do, why they do it, and how they do it. People in such an organization are able to learn at the level of rules, insights and principles, or to demonstrate first-, second- and third-order learning. Important to the organization's development is use of the variety of ideas present within the organization (internal variety). Learning requires dialogue in which differences are constructively addressed in order to cope with the variety imposed by the organization's environment (external variety). Since it is essential that the operational unit (i.e., the group of people working together) is able to independently and as frequently as possible, meet the external variety, the shared understanding that results from such dialogue forms the basis of collective action. In other words, organizational learning refers, for the most part, to the development of an organization's 'collective competence'. In an organization which possesses collective competence, people are able to question the existing rules, insights and principles together and in the context of problems they are confronted by. As such, Wierdsma and Swieringa (2002) explicitly relate 'collective learning' to an organization's capacity to change. Finally, reflecting on the (higher vocational) educational context, Wierdsma and Swieringa point out that learning in educational organizations is predominantly individual, that third-order learning is rare, and that the organizations' capacity to learn collectively is not well developed. However, as was discussed earlier, the educational sector is confronted with changes that do require third-order learning (see Chapter 1), indicating the need to develop 'collective learning' in this context.

2.4 A MODEL DESCRIBING TYPES OF LEARNING IN ORGANIZATIONS

Results of the literature study, as presented in the previous sections, are summarized in Figure 2.1. Organizational learning is conceptualized as the interactive, individual and collective learning processes that manifest itself within the organization as a side–product of work. Such processes are interwoven with work, founded on experience and based on social interaction. Genuine learning at the individual and collective level requires that learners complete the experiential learning cycle. Learning is the primary mechanism for continuous adaptation of individuals and collectives to their environment. Individual learning is comprised of three basic forms: 'individual learning' (individual process and outcomes), 'social individual learning' (collective process, individual outcomes) and 'individual learning processes with collective outcomes'.

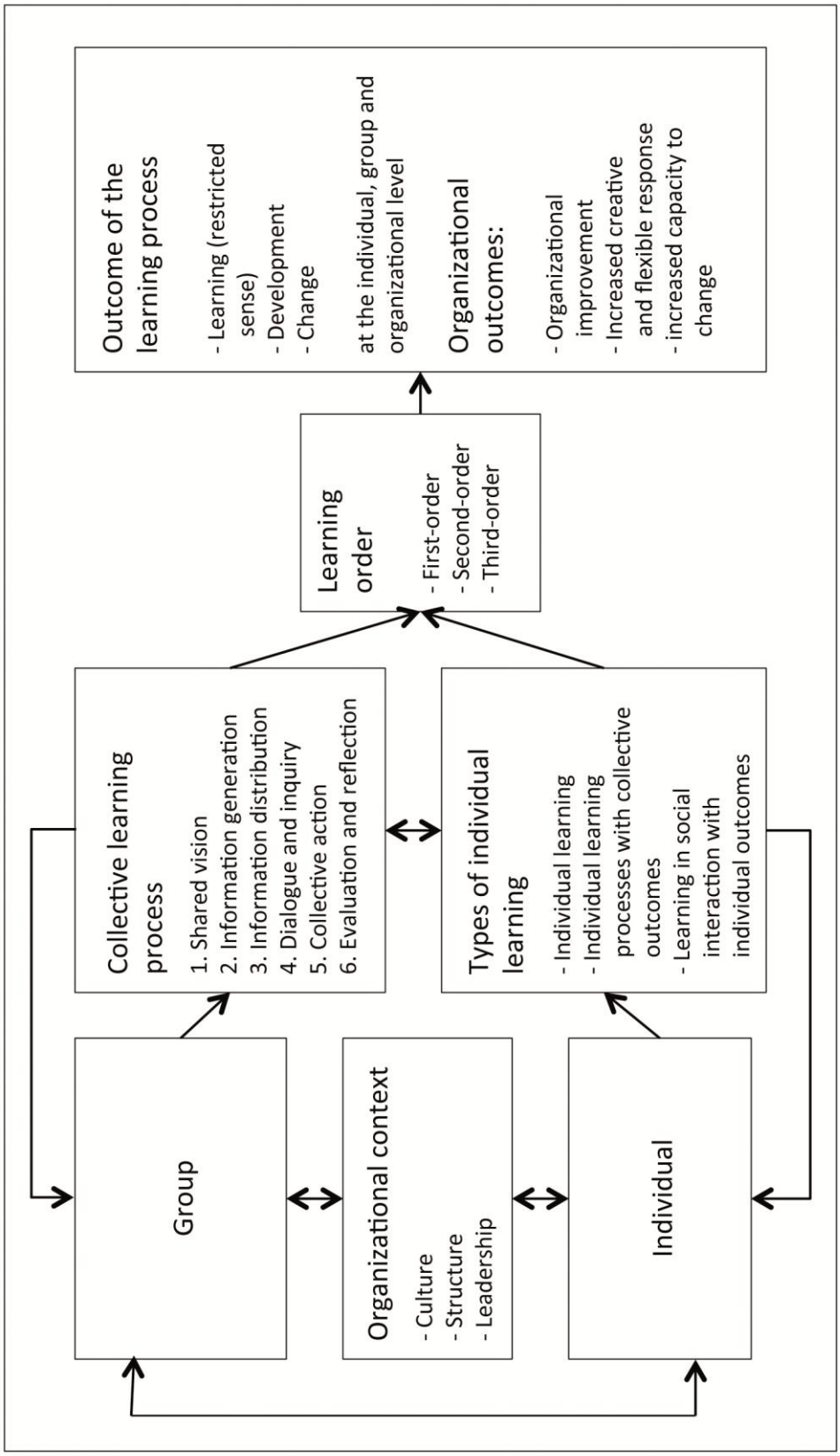

Figure 2.1. Delineating organizational learning.

'Collective learning' differs from individual learning in that the members of the collective learn in interaction with one another, while striving for unity in the form of common outcomes of their actions. The underlying unity is central to continuous adaptation at the level of the organization. Social interaction is considered a prominent mechanism for integrating and coordinating individuals' actions. 'Collective learning' is considered an experiential learning cycle consisting of six phases: 'shared vision', 'information generation', 'information distribution', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'. 'Individual learning' and 'collective learning' are assumed to develop in a mutual relationship (Castelijns et al., 2009). As noted by Morgeson and Hofmann (1999, p. 253): "it is the individuals (or collective) who determine the collective construct, and, through their actions, influence the behavior of others in the collective".

Learning, both individually and collectively, is intended to increase organizations' creative and flexible response and their capacity to change and is therefore closely tied to organizational change. Developing organizations' capacity to change demands third-order learning, a highly social process in which contexts and principles are inquired about, deconstructed and reconstructed. Such learning requires collective competence, or the ability of people in an organization to question existing rules, insights and principles together and do so in the context of the problems they are confronted by in actual work situations. 'Collective learning' might therefore be considered a mechanism that underlies organizations' capacity to change. Finally, individual and collective learning manifest themselves in the organizational context, which shapes the learning environment and therefore influences learning processes and their outcomes. Based on their specific structures, cultures and leadership characteristics, organizations more or less facilitate learning done by individuals and collectives and provides them with the freedom to learn.

2.5 FOCUS OF THE STUDY: RESEARCH QUESTIONS AND HYPOTHESES

Research questions

In contemporary research, a plea is often made for social forms of learning, specifically 'collective learning', because of their potential to build the organization’s capacity to manage change. However, we did not find that the collective learning concept was consistently defined (see also Kozlowski et al., 2010). In the present study, 'collective learning' is conceptualized as an experiential learning cycle that consists of six aspects: 'shared vision', 'information generation', 'information distribution', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'. We aim to contribute to theory development by designing, optimizing and testing a measurement instrument for 'collective learning' for quantitative research. The aspects of 'collective learning' will be operationalized as sub-constructs of the collective learning construct. Both the hypothesized structure of 'collective learning' and its measurement instrument will be optimized and tested in the context of higher vocational education. As a result, insight will be gained in how processes of collective learning manifest themselves within teacher teams in Universities of Applied Sciences. The following research question will be addressed.

Research question 1: How can the hypothesized factor structure and the (newly designed) measurement instrument for Collective Learning be improved? What is the quality of the resulting model when tested in the context of higher vocational education (i.e. is the hypothesized construct structure adequate)?

While Dixon (1999) describes 'collective learning' as a form of experiential learning with phases that ideally happen one after the other, the hypothesized factor structure does not imply such a sequential relationship. A process approach to 'collective learning' would be interesting though, as incomplete learning cycles might hinder an organization's ability to learn from the accrued experience (Rait, 1995). Elaborating on the factor model of 'collective learning' found in the present study, various models of (causal) interrelationships between the factors of 'collective learning' can be deduced from theory and tested for their fit to empirical data. In further exploring the collective learning construct, a limited number of theoretically–logical models will be sought and their fit to our survey data on 'collective learning' will be tested. This leads us to the following research questions.

Research question 2: Starting from the optimized factor structure for Collective Learning, what process models would represent theoretically-logical process models? Do these process models show an adequate fit to the data we collected on Collective Learning?

In the present study, the collective learning concept will be considered in relationship to other concepts (also see the subsequent sections). First, we will take into account the concept of social individual learning, because individual and collective learning are assumed to be interdependent and to develop in a mutual relationship (Castelijns et al., 2009). Both 'social individual learning' and 'collective learning' imply a shared process – and can therefore be considered social forms of learning – but only the latter is primarily associated with shared results. We are interested in the way these social forms of learning interact. The organization provides the context in which individual and collective learning emerge. While a variety of factors – related to culture, structure and leadership – make up this context, 'transformational leadership' is specifically associated with teacher learning (individual and collective) and organizational change in the educational context (e.g., Leithwood, Jantzi & Steinbach, 1998; Van den Berg et al., 1999; Leithwood, Leonard & Sharratt, 1998; Silins et al., 2002; Verbiest, 2002; Meijers, 2004; Van den Berg & Vandenberghe, 2005; Geijsel et al., 2009; Ten Bruggencate, 2009). We will therefore also include the concept of transformational leadership in our study. Finally, we will take into account the concept of team results, encompassing teams' general and innovative performance, because learning in organizations will often be directed at improving their performance. Overall, we are interested in the interaction between 'collective learning', 'social individual learning', 'transformational leadership' and 'team results'; as such, we explore a particular set of the relationships presented in Figure 2.1. We will study these relationships in the context of an innovation process, where teacher teams successfully developed and implemented a career guidance program (which will be described in greater detail in Chapter 5). This leads us to the following research question.

Research question 3: What connections can be found between Collective Learning, Social Individual Learning, Transformational Leadership and Team Results in daily practice, specifically in educational innovation processes where teams have successfully developed and implemented a career guidance program?

Using this context we also try to create a better understanding of the concepts of collective learning and social individual learning (and their mutual differences), and transformational leadership. We will study the way they manifest themselves in the innovation projects referred to above, and map the concepts' variety and richness. This leads us to the following research question.

Research question 4: What forms of Social Individual Learning, Collective Learning and Transformational Leadership can be identified in the educational innovation processes described above?

In exploring the relationship between 'collective learning' and 'team results' further, a game simulation is held, where teacher teams from a University of Applied Sciences compete in producing existing products and designing new products. In this simulation we study the relationship between 'collective learning' and the teams' financial and innovative performance (i.e., 'team results'). As will be argued in the subsequent section, we expect a positive relationship between the level of 'collective learning' and teams' results. We will try to answer the following research question.

Research question 5: How are Collective Learning and Team Results (i.e., Team Performance and Innovativeness) related in the context of a game simulation where teacher teams compete in producing and designing products?

The experimental setting created in the game simulation gives us the opportunity to study the extent to which teachers in a team equally assess the level of 'collective learning' demonstrated by the team when undertaking a fixed set of activities within a restricted time period. In order to better understand the nature of 'collective learning', we study the relationship between teachers' individual perceptions of the process, as well as the relationship between those perceptions and teams' overall perceptions. As such, we strive to find an answer to the following research question.

Research question 6: How are team members' perceptions and teams' perceptions of the collective learning process related in the context of the game simulation described above?

Hypotheses

'Social individual learning' both influences 'collective learning' and is influenced by it (Bolhuis & Simons, 1999; Morgeson & Hofmann, 1999). While “[o]rganizational learning has its roots in individual learning” (Jerez-Goméz, Céspedes-Lorente & Valle-Cabrera, 2005, p. 716), "team learning and organizational learning provide the context for individual knowing" (Kessels, 2004, p. 174). As such, their interrelationship is very likely a matter of circular causality, and they are assumed to develop in a mutual relationship (Castelijns et al., 2009). However, the present study is restricted to the influence of 'social individual learning' on 'collective learning'. This choice is based on the notion that the collective "learns through its individual members and is therefore directly or indirectly influenced by individual learning" (Romme & Dillen, 1997, p. 69). This idea is supported by Leithwood, Leonard and Sharratt (1998), who consider individual learning a necessary part of 'collective learning'.

In the educational context 'collective learning' might be hindered by the dominant culture, which is characterized by norms of privacy, isolation and autonomy, limited interaction between teachers (Rait, 1995; Ben-Peretz & Shonmann, 1998; Verbiest et al., 2005) and laborious processes of knowledge sharing, even when the organization is designed to facilitate these (Seashore Louis & Kruse, 1998). The collegiality that lays the foundation for collaboration and social learning is uncommon in schools and teachers' daily work context is not compatible with it (Ben-Peretz & Shonmann, 1998). 'Collective learning', however, requires a sincere form of openness that is based on de-privatization of the work performed by individual teachers and on the unity that results from shared norms and values (Seashore Louis & Leithwood, 1998). Teachers who are used to 'social individual learning' (e.g., learning by means of knowledge sharing, giving and receiving feedback, and collaboration) are accustomed to sharing thoughts with colleagues, to involving them in their own working methods and to inviting them to critically reflect on their performance and development. Each of these actions is associated with being vulnerable, for it implies revealing to and discussing with others theories-in-use and espoused theories (Argyris & Schön, 1978) in a context where this is uncommon. Possibly, teachers used to 'social individual learning' are more inclined to participate in processes of collective learning, for they are less likely to be hindered by a dysfunctional resistance to being vulnerable. Moreover, these teachers are also assumed to be better equipped to 'collective learning', because they have experience with processes of learning through social interaction. This leads us to the following hypothesis.

Hypothesis 1: Social Individual Learning has a positive effect on Collective Learning.

The learning of individual teachers and teacher teams can be more or less supported by organizational conditions, such as the leadership style. Transformational leaders facilitate opportunities for teachers to learn from each other and they model continual learning in their own practice (Mulford, Silins & Leithwood, 2004). They strive to create a culture of working and learning together, stimulate teachers' professional development, teach their teams to signal problems and to solve those as a team, and create organizational conditions that promote all of the afore mentioned (Verbiest, 2009). In the present study, a positive effect of 'transformational leadership' on 'social individual learning' and 'collective learning' is expected (cf. Leithwood, Jantzi & Steinbach, 1998), which leads us to the following hypotheses.

Hypothesis 2: Transformational Leadership has a positive effect on Collective Learning.

Hypothesis 3: Transformational Leadership has a positive effect on Social Individual Learning.

Due to the fact that learning is considered a process of meaning construction in which the learner is an active, meaning–oriented designer of his or her own knowledge, personal and situational characteristics of the learner influence the learning process. We assume, however, that the hypothesized effects among 'social individual learning', 'collective learning' and 'transformational leadership', if found, will still be present even when controlling for a number of personal and situational characteristics. Relevant characteristics of a learner are his or her age and gender, as well as his or her educational level and current profession, for they are part of the learner's frame of reference (Bolhuis & Simons, 1999). Each of these variables is included in the preset study, in order to assess their relationship to learning. Current profession is further specified as 'current function', for this study is solely focused on one profession (teaching), in which there are different functions. Additionally, a variable is included that represents the learner's employment status in terms of having a full- or a part-time contract. The employment status might influence teachers' willingness to spend time on learning processes that are not explicitly part of their work tasks (work-related learning is often implicit). This leads us to the following hypothesis.

Hypothesis 4: The positive effects of Transformational Leadership on Social Individual Learning and Collective Learning, as well as the positive effect of Social Individual Learning on Collective Learning, if found, will still be present when the variables teachers' gender, age, educational level, and employment status (part-time or full-time) are taken into account.

For organizational learning to be worth continuing attention "it must result in something consequential for schools" (Leithwood, Jantzi & Steinbach, 1998, p. 70). The literature suggests a positive relationship between organizational learning, innovation and performance, However, to date little research analyzes those relationships empirically, together in a single model (Jiménez-Jiménez & Sanz-Valle, 2011; Tohidi & Jabbari, 2012). Because 'collective learning' can be considered a strong mechanism for organizational learning (Mittendorff et al., 2006), we hypothesize that it is positively related to universities' general and innovative performance. Because in the present study the term 'collective' refers to teacher teams, the team level is the relevant level to take into account when assessing results; the focus is therefore on team-level results. The subsequent hypothesis follows from this.

Hypothesis 5: Collective Learning has a positive effect on Team Results (i.e., Team Performance and Innovativeness).

An overview of the hypotheses that will be tested in the present study is presented in Figure 2.2.

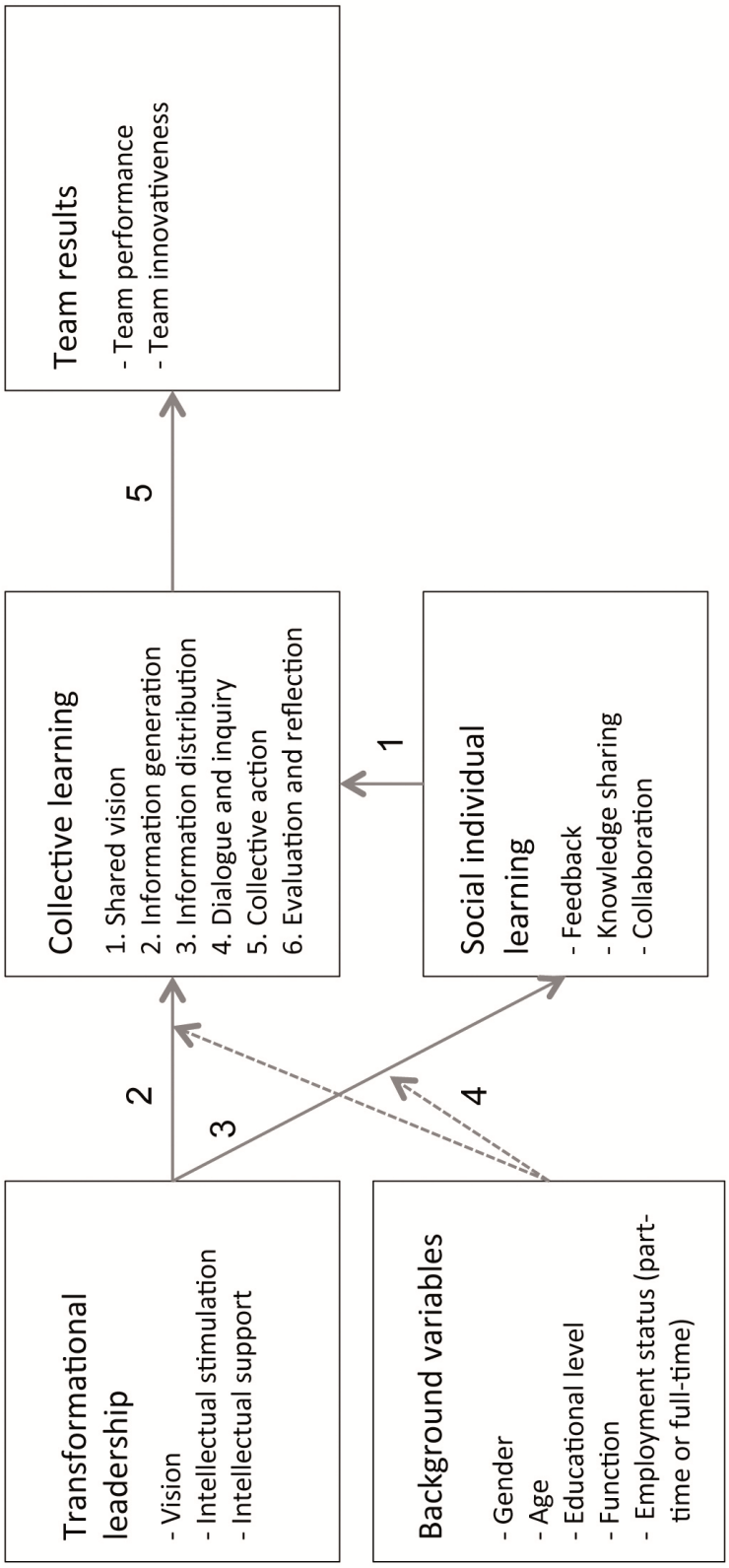

Figure 2.2. Hypotheses to be tested in the present study.

2.6 RESEARCH DESIGN AND METHODS

The research questions will be answered and the hypotheses tested by means of three interrelated empirical studies, as discussed below.

Study 1: survey research

In the first study (further referred to as Study 1) we use a survey to measure each of the variables in the conceptual model, in teacher teams from Universities of Applied Sciences. It consists of two parts: Study 1a and 1b. In Study 1a we focus on designing, optimizing and testing an instrument that allows for measuring each of the theoretically identified factors of 'collective learning' (research question 1). Based on a literature study, we select items that are indicative of the respective factors. Next, we collect empirical data, by inviting a group of teachers from Universities of Applied Sciences to assess their personal situation and the situation within their team with regards to learning and leadership. Analyzing these data by means of multilevel covariance structure analysis (see Muthén, 1994), we test, optimize and retest the hypothesized factor structure of 'collective learning' until we obtain a satisfactory fit to the data in an explorative as well as in a validation (sub)sample. In further exploring the collective learning construct, three alternative models – a second-order factor model and two process models – are formulated and tested (research question 2). The second-order factor model solely shows the correlations among the factors by means of an underlying factor (i.e., 'collective learning'). The process models, on the other hand, provide a more tentative description of the process of collective learning. They describe the pattern of interrelationships among the factors in the form of a process.

In Study 1b we test the hypothesized interrelationships among the concepts of collective learning, social individual learning, transformational leadership, and team results. In our survey research, we ask teachers to share their perception of each of these concepts. We relate scores of 'social individual learning' and 'collective learning' in a structural model, to test, by means of multilevel covariance structure analysis, the hypothesis that the former has a positive effect on the latter (Hypothesis 1). Likewise, we test the hypothesized positive effect of 'transformational leadership' on 'collective learning' (Hypothesis 2), and on 'social individual learning' (Hypothesis 3), respectively. Third, the survey includes questions on a number of teachers' personal and situational variables (e.g., age, gender, function). We include these questions in order to be able to study their potential effects on the interrelationships between 'social individual learning', 'collective learning', and 'transformational leadership' (Hypothesis 4). Finally, we include measures in the survey to look at 'team performance and innovativeness'. This allows for testing, in a structural model, the hypothesized positive effect of 'collective learning' on 'team results' (Hypothesis 5).

Study 2: case study

The second study (hereafter referred to as Study 2) is a case study, where we aim to create a deeper understanding of the relationships between 'collective learning', 'social individual learning', 'transformational leadership' and 'team results' (research question 3). Moreover, we aim to create a deeper understanding of the concepts of collective learning and social individual learning (and their mutual differences), and transformational leadership (research

question 4). The case study is used with three teacher teams in three different Universities of Applied Sciences. These teams are selected because previous large-scale, quantitative research (Kuijpers & Meijers, 2012) showed that they successfully implemented a comparable, large-scale organizational innovation. We collected information on the innovation itself, the implementation process and the results via interviews and a document study.

Study 3: game simulation

The third study (further referred to as Study 3) is a game simulation in which we explore the relationship between 'collective learning' and 'team results' (i.e., their general and innovative performance) further (research question 5). In the simulation, representations of existing teacher teams participate in a market simulation where teams are to design products according to market specifications or their own ideas and sell them to the market. The level of 'collective learning' that manifests itself in the teams is assessed, and we compare it to teams' financial and innovative performance. We use results to explore the relationship between 'collective learning' and teams' financial and innovative performance (i.e., 'team results'). Furthermore, in order to better understand the nature of the collective learning concept, we study the relationship between teachers' individual perceptions of the collective learning processes occurring during the game simulation, as well as the relationship between those perceptions and teams' overall perceptions (research question 6).

2.7 SUMMARY

The present study is based on the premise that it is worthwhile for organizations to support and facilitate organizational learning (i.e., work-related learning of employees at the individual and the collective level), because learning in an educational context has proven to be insufficient to cope with the fast changes and increasing complexity of the current work environment (Casey, 2005). In line with social-constructivist perspectives, learning is conceptualized as an interactive process, based on experience and often founded in social interaction. Genuine learning requires learners to go through each of the phases of the experiential learning cycle. Due to the implicit and social nature of work-related learning, social forms of learning facilitate individuals' attempts to make sense of their experiences. Moreover, social interaction provides a mechanism for making explicit and sharing what has been learned. 'Social individual learning' and 'collective learning' are presented here as two main forms of social learning. In the present study, 'social individual learning' refers to the (implicit) learning processes that arise when an individual interacts with others to improve his or her own performance with respect to work, and 'collective learning' refers to the (implicit) learning processes that arise when members of a collective collaborate to realize shared ambitions with respect to work. 'Collective learning' differs from 'social individual learning' in that the members of the collective strive for unity in the form of common outcomes. Collective learning processes are interwoven in the process of daily work and are based on experience and shared constructions (Seashore Louis & Kruse, 1998). Realization of this unity requires integration and coordination of individuals' actions, and therefore 'collective learning' is driven by interaction, integration, interdependencies and coordination mechanisms (Morgeson and Hofmann, 1999). Social interaction is considered a prominent mechanism for realizing unity and therefore for an organization's capacity to manage change (Cousins, 1998; Wierdsma &

Swieringa, 2002; Seashore Louis & Kruse, 2004). The collective learning process is regarded as an experiential learning cycle, that consists of six phases: 'shared vision', 'information generation', 'information distribution', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'.

The present study aims to contribute to the development of theory on organizational learning and the learning organization by exploring the multi-level construct of organizational learning in three interrelated empirical studies. Organizational learning is assumed to reflect 'individual learning' and 'collective learning' within the organization, processes that are influenced by the learning environment which is shaped by the organizational context. The importance of social forms of individual learning is increasingly emphasized by various theoretical perspectives, and, in the present study, individual learning is therefore delineated as 'social individual learning'. The way 'collective learning' is defined in the present study, is that it is inherently a social process. In the first part of the present study (Studies 1a and 1b), survey research is conducted among teachers from Universities of Applied Sciences in order to optimize and test a newly designed measurement model for 'collective learning' (research question 1), and to explore two alternative models for relating the factors of 'collective learning' (research question 2). Next, the hypothesized positive effect of 'social individual learning' on 'collective learning' is tested (Hypothesis 1), as well as the hypothesized positive effect of 'transformational leadership' on 'collective learning' (Hypothesis 2) and on 'social individual learning' (Hypothesis 3). In addition, the hypothesis that these effects will still be found, even when controlling for the following variables: teachers' gender, age, educational level, and employment status (part-time or full-time) (Hypothesis 4) is tested. Finally, the hypothesized positive effect of 'collective learning' on 'team results' is tested (Hypothesis 5). In the second part of the present study (Study 2), a case study is conducted among three teacher teams from different Universities of Applied Sciences that successfully implemented a comparable, large scale organizational innovation project. With the case study we aim to create a deeper understanding of the relationships between 'collective learning', 'social individual learning', and 'transformational leadership', as well as their relationship to 'team results' (research question 3). In addition, we aim to create a deeper understanding of these concepts, by studying the forms in which they manifest themselves (research question 4). In the third part of the study (Study 3) a game simulation is organized, in which teacher teams are confronted with the task to perform both efficiently and innovatively in a competitive environment. Such an experimental setting allows us to further study the relationship between 'collective learning' and 'team results', the latter specified into teams' financial and innovative performance (research question 5). Moreover, it allows us to study the relationship between teachers' individual perception of the collective learning process and teams' perceptions (research question 6).

3 The collective learning construct: empirical study 1a

> Team learning transforms dialogue and skillful discussion into capabilities as they become collective vehicles for building shared understanding (Mitchell & Sackney, 2000, p. 68).

3.1 STUDYING RESEARCH QUESTIONS 1 AND 2

This chapter starts with the questions how the collective learning construct, as described in Chapter 2, can be operationalized, how the hypothesized structure (see Chapter 2) and the measurement instrument can be optimized, and what the fit of the resulting model to the survey data is (research question 1). In further exploration of the collective learning construct, a model relating the factors of 'collective learning' is deduced from the theory and its fit to the data is tested (research question 2). Prior to presenting the results, the nature of the collective learning construct is discussed in order to understand the implications for measurement.

3.2 THE NATURE OF THE COLLECTIVE LEARNING CONSTRUCT

'Collective learning' is a collective, hypothetical construct. Following the work of Morgeson and Hofman (1999), two main issues arise. First, the construct is not directly observable; it is only a conceptualization. Its existence must be inferred from directly observable actions or features of the group that is learning. In this study 'collective learning' is conceptualized as an experiential learning process that is made up of six phases. These phases are considered the observable actions or features of the group that together make up the process of collective learning. While Dixon (1999) refers to phases that would ideally follow one upon the other, in this study a more limited approach is chosen. The primary focus here is on empirically identifying the factors (which resemble the phases) which are hypothesized to be part of the collective learning concept (in Chapter 3 and 4 referred to as 'construct' when the focus is on its structure) and to test the suggested factor structure. The latter analysis will show whether it is justifiable to consider the factors as discernible aspects of the construct. Second, the construct is a collective one, and is therefore subject to level-of-analysis issues. Can a group be said to learn collectively? Answering this question affirmatively might be considered an act of anthropomorphism (Lipshitz et al., 2007) or reification (Morgeson & Hofman, 1999), where a human capacity (learning) is attributed to a non-human entity (an organization) (Doving, 1996; Lipshitz et al., 2007). Moreover, it leads to the practical question of how to evaluate a group's collective learning process in survey-research, for 'the group' as an entity cannot be interviewed and aggregation of group members' individual evaluations leads to methodological concerns. For example, it leads to the question whether deviation in answers between group members should be considered noise (assuming that there is one 'real' group score) or whether it reflects individual differences in perceptions of a socially constructed and thus inherently subjective reality. As Morgeson and Hofmann (1999) argue, it is possible to measure collective constructs at the individual level and still

address theoretical questions at the collective level. To collect meaningful data they advise that questions be framed in collective terms, individuals be treated as informants about the collective process and researchers focus on the role of individuals in terms of the collective.

Reflecting on 'collective learning' as the (implicit) learning processes that arise when the members of a group cooperate to realize shared ambitions with respect to work, it can be said that such learning emerges "from a compilation process that begins at the individual level and proceeds to the dyadic level where individuals are linked by interdependencies" (Morgeson and Hofmann, 1999, p. 260). Both working and learning refer to individual processes that might be interpreted as collective ones once they are integrated and coordinated through interaction and coordination mechanisms. This leads to a structural perspective on collective constructs where the focus is on systems of interaction among members of a group. The actions of individuals meeting in time and space, leading to 'events', or encounters between ongoing individual processes. The structure of any collective action can be viewed as a series of events, enabling collective constructs to emerge. Reification is not a concern, because without events, social structures would not exist. Applying this line of reasoning to 'collective learning' means that learning can only be labeled or seen as 'collective' from an organizational point of view. While individuals differ to the extent in which they aim to integrate and coordinate their own processes with the processes of group members, 'collective learning' is driven by interaction, integration, interdependencies and coordination mechanisms. To what extent working and learning in a group has turned out to be integrated and coordinated can only be assessed from an organizational point of view. Individuals can be considered informants about the collective process in that they are able to indicate their own role (e.g., to what extent they coordinate their individual actions with the actions of other group members) as well as their perception of the degree of integration and coordination present in the group (e.g., to what extent they experience group members to work based on a shared vision). The empirical part of the present study is therefore based on data reflecting individuals' perceptions of the collective learning process. Because individual action is limited by the context as perceived by the individual, relationships between factors of 'collective learning' are assumed to be found at the individual level. This allows for an individual-level focus of analysis of the hypothesized structures underlying the collective learning concept.

3.3 MEASUREMENT MODEL AND INSTRUMENT

The focus of this study is on the perception of 'collective learning' by teachers. A questionnaire was constructed based on the six factors associated with the process of collective learning discussed above. Each factor was measured by a set of items constituting a scale. Items were formulated as statements to which participants could express their agreement on a four-point rating scale with response categories '1' = I disagree, '2' = I somewhat agree, '3' = I agree and '4' = I strongly agree[6]. Scales and their respective items are discussed below; a complete overview is presented in Appendix A (Table A1).

[6] With these response categories, we aimed to measure the extent to which respondents perceive specific characteristics of 'collective learning' (current chapter), social individual learning and transformational leadership (both Chapter 4) to apply to themselves, their teacher team, or their team leader (depending on the item). The response category '1' (I disagree) indicates that a respondent perceives a specific characteristic

Shared vision. The items of the 'shared vision scale' were adapted from the 'shared vision scale' by García-Morales et al. (2006). The item 'goals are created and upheld by the great majority, not just by the leaders or by certain members' from the original scale, was expanded to cover different areas of the educational process (see Appendix A, Table A1). Items in the new scale relate to the vision of the goals (item 11), the execution (items 21 and 24) and the development (items 17, 20 and 28) of the educational process. The scale was supplemented by one item we developed ourselves (item 18), reflecting potential ineffectiveness of the shared vision due to a disconnection between decision-making and practice. Following the ideas of De Laat and Simons (2002) our focus is on working teams – where 'collective learning' is not the aim but a byproduct of the work process – and all items have been restricted to relate to work-related goals only. One item from the original scale, 'the educational centre's mission or ultimate goal is well communicated and understood by all the members of the organization', was considered to be too broadly formulated and was therefore excluded from the scale.

Information generation. The items in the 'information generation scale' were inspired by the work of Dixon (1999) and Schechter (2008). As Dixon (1999) indicates, an important aspect of the information-generation phase is that information is collected and generated by the primary users themselves. The two items we developed ourselves (items 4 and 33) represent this aspect (see Appendix A, Table A1). The other items were adapted from the 'information-seeking scale' of the Organizational Learning Mechanisms instrument by Schechter (2008). One item of this 3-item scale, namely, 'there are professional learning linkages with other schools', was selected because it emphasized the importance of external information generation. This form of information generation can be considered an important source of innovative ideas. The item was reformulated in order to broaden its scope to include both important internal and external stakeholders, such as internal and external colleagues, students, the industry and experts in the field of (the theory of) education (items 15a – 15e). The new items were formulated in terms of 'knowledge sharing in meetings with others', aiming to include the social component that is relevant to the exchange of implicit knowledge. The items are intended to cover different types of information generation, such as learning from personal experience (e.g., errors), learning from client feedback (e.g., complaints), copying what others are doing, grafting carriers of new knowledge, and acquisition by carrying out focused and wide-ranging explorations of the external environment.

Information distribution. Central to the information distribution factor is the circulation of information among all team members and a broad availability of expertise (Dixon, 1999). The first aspect is covered by four items, each with a different focus (see Appendix A, Table A1). One item relates to the spread of information regarding the first phase of the learning cycle: reports about changes and innovations (item 10). This item was adapted from the 'receiving-disseminating information scale' of the Organizational Learning Mechanisms instrument (Schechter, 2008). Two items relate to the spread of information regarding the outcome of the learning cycle: reports about the evaluation of the curriculum and lessons

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as not applicable the other response categories indicate that a respondent perceives a specific characteristic to apply: a little bit ('2'), for the most part ('3'), or completely ('4'). For example, with respect to the statement 'I prepare my lessons together with colleagues' (item 38, see also Appendix 3.1) answer category '1' (I disagree) would represent the situation in which a teacher does not prepare lessons together with colleagues at all, whereas answer category '3' would represent the situation in which (s)he does prepare lessons together with colleagues for the most part.

learned (items 1 and 5). The former item was adapted from the 'receiving-disseminating information scale' (Schechter, 2008), the latter item was adapted from the 'systems-to-capture-learning scale' of the Learning Organization Questionnaire (Marsick & Watkins, 2003). Two items, also adapted from the 'systems-to-capture-learning scale', were added to complete the scale. One item explores the two-way nature of the communication of information distribution processes as such (item 7). A final item looks at the spread of expertise within the team (item 13), thereby including the second central aspect of the distribution phase in the scale.

Dialogue and inquiry. The items of the 'dialogue scale' were adapted from the 'dialogue-and-inquiry scale' of the Learning Organization Questionnaire by Marsick & Watkins (2003). This scale includes items related to exploring different interpretations of reality within the team (items 14 and 23), items related to the relational quality (items 8, 25 and 26) and one item (item 29) related to the perceived equality of participants in the dialogue (see Appendix A, Table A1).

Collective action. In measuring collective action in the context of educational institutions, one is confronted with the isolated position of teachers (Verbiest et al., 2005), specifically with respect to the core task of teaching. Therefore, next to items relating to collective action like working together on the same task (items 38 and 67), items were included that represent alignment of individual activities by means of collegial discussion and consultation (items 42, 54 and 65). We developed each of the items mentioned here ourselves. As most educational institutions are characterized by "norms aimed against co-operation, [and] dividing and sketchy goals" (Verbiest et al., 2005, p. 23), collective action is not standard practice. When achievements of the group are rewarded (Marsick & Watkins, 2003), group members are encouraged to align their individual actions with the goals of the group and collective action is stimulated. One item (item 16) was added from the 'collaboration-and-team-learning scale' of the Learning Organization Questionnaire (Marsick & Watkins, 2003) to look at rewards for achievements made by the group.

Evaluation and reflection. The items from the 'evaluation-and-reflection scale' were adapted from the 'reflection-scale' of the Critically Reflective Work Behavior instrument (Van Woerkom, 2003). Originally, the items reflected individual learning behavior and they were therefore rephrased to represent statements relevant to collective behavior. Two items (items 19 and 30) refer to the evaluation of performance against an external benchmark and one item (item 6) refers to an internal benchmark (last year's performance). Additionally, one item (item 35), adapted from the 'systems-to-capture-learning scale' of the Learning Organization Questionnaire (Marsick & Watkins, 2003), was added, for it relates to evaluation of performance against expected results. Furthermore, two items (items 2 and 12) related to reflection on the work process, one item (item 9) related to the learning outcomes and one item (item 32) related to the communication process were included.

3.4 RESEARCH DESIGN

In this section, the design of the study is presented. First we discuss the sampling method we applied in the present study, as well as the final sample. Next, we explain why and how we

have split the final sample into two subsamples and we describe both subsamples. Finally, in addressing the statistical analyses we used in the present study, we discuss the hierarchical structure of the data in our sample, multilevel covariance structure modeling, and the cross-validation procedure we followed.

Procedure and participants

An empirical study was conducted, with teachers as participants, to investigate and model the underlying structure of the collective learning construct. In total, the teacher teams of 42 bachelor programs were invited to participate in the study. These bachelor programs were chosen from 8 different Universities of Applied Sciences, both from urban and rural areas, each involved in one or more of the following fields: Education, Economics and Management, Healthcare, Technology, and Agricultural Studies. These universities were selected because of their participation in prior research into Career Guidance in higher vocational education (see Kuijpers & Meijers, 2012) – a generic innovation project – or because they were part of the researcher's professional network. Management of each program was contacted and if the contact person agreed to participation, the team leader of the study was contacted. This two-step approach was deemed necessary because of the particular culture present in Universities of Applied Sciences. Such institutions can be characterized as a rather loose collection of programs; the decision to participate in the research is made by the team leader at the level of a particular program. Of the 42 bachelor programs that were approached, 30 programs, which included 36 teacher teams, finally took part in the research. One faculty director declined the request for participation because the faculty (including 5 programs) was in the middle of an elaborate reorganization process.

The questionnaires were mostly filled in during regular team meetings. A number of teams were assisted by one of the researchers, who introduced, explained and collected the surveys. The other teams were assisted by a team-member acting as a contact person. Prior to the meeting, this contact person had received written and telephone instructions about the background of the research and an overview of frequently asked questions. In total, 495 of the 768 teachers who were invited to participate in the present study returned a questionnaire, resulting in a response rate of 64%.

The final sample was made up of 495 teachers, each teacher being a member of one of the 36 teacher teams included in the research. Two of these teams were related to part-time programs, the other teams to full-time programs. Of the initial sample, data of 19 respondents were removed before analysis due to large chunks of missing data, resulting in a final sample size of 476 participants. In the data collection phase, these dropped respondents indicated that they were unable to complete the questionnaire because they were newly employed and therefore new members of the teacher team; they reported having insufficient experience with the team to respond to certain team related items.

Exploration and validation subsample

A cross-validation approach was applied in order to explore and subsequently test the hypothesized structure underlying the collective learning construct. For this purpose, the sample was split randomly into two subsamples. After assigning each team a unique identifica-

tion number, the sample was split into odd-numbered teams and even-numbered teams. The subsample containing the 18 odd-numbered teams was called 'explorative subsample A' and the subsample containing the 18 even-numbered teams was called 'validation subsample B'. Finally, to achieve more equal sample sizes in both subsamples, a small team in subsample A was exchanged for a large team in subsample B. Purely by coincidence, this resulted in two subsamples of identical size.

Subsample A consisted of 238 teachers from 18 teacher teams associated with the 8 above-mentioned universities. Of these participants, the majority was aged 40 years or over (40-49 years, 31.8%; 50-59 years, 29.4%), followed by the group aged 30-39 years (20.6%) and the group aged 20-29 years (9.7%). A small group included those 60 years or over (5.0%); no participants were under 20 years of age and 2.5% did not indicate age. Of the participants, 50.4% was male, 46.6% was female and 2.9% did not indicate gender. The majority of the participants (56.3%) had successfully completed a study at the Masters' level (i.e., Research University), 39.0% had completed higher vocational education (i.e., University of Applied Sciences), 2.1% of teachers – instructors of practical skills – had vocational education, and 2.5% of respondents did not specify educational background. Most participants (46.2%) were employed part-time, but spent more than two days per week with their respective teacher team, 33.6% were employed full-time, 17.2% were employed one or two days a week, and 2.9% of respondents did not indicate their employment status.

As mentioned above, subsample B also consisted of 238 teachers from teams associated with the same universities. Of the participants in this subsample the majority was aged 30-39 years (29.0%) or 40-49 years (29.4%), followed by the group aged 50-59 years (24.4%), and the group aged 20-29 years (8.8%). A small group had respondents under age 20 (0.4%) or over 60 years (5.9%), and 2.1% did not indicate age. Of the participants, 44.5% was male, 53.4% was female and 2.1% did not indicate his or her gender. The majority of the participants (66.8%) successfully completed a study at the Masters' level (i.e., Research University), 29.4% did so at the level of higher vocational education (i.e., University of Applied Sciences), a few teachers (1.7%) at the level of vocational education, and 2.1% did not specify his or her educational background. Most participants (46.2%) were employed part-time, but spent more than two days a week with their respective teacher team, 40.8% were employed full-time, 10.1% were employed one or two days a week and 2.9% did not indicate their employment status.

Comparison of both subsamples shows that each group is highly similar to the other with respect to the variables indicated and that the differences are only minor. Subsample B includes slightly more participants aged 30-39 years and fewer of those between 50-59 years of age, more females, more participants who have completed a study at the Masters' level, and more full-time employees.

Statistical analyses

Hierarchical structure of the data. Data in the present study are clearly hierarchically structured. Basically, four levels can be distinguished, teachers who are nested within teacher teams, which are in turn situated within programs of study, which are then couched within universities. Technically, the hierarchical structure causes dependencies in the data that vio-

late the usual assumption of independent observations. Ignoring this fact causes traditional techniques to fail, for they then yield biased results in terms of, for instance, distorted significance tests and model interpretation. It is commonly known and accepted that a hierarchical data structure must be taken into account in statistical analysis (see f.i., Hox, 2002, p. 5). Therefore, in many cases in social science research, a so-called multilevel analysis approach is used so that a hierarchical data structure can be appropriately analyzed.

For the present study, we decided to take the four data levels into account as follows. Although 'collective learning' could be conceptualized as a group or team construct, it was intentionally operationalized in terms of individually observed actions or features of the team. Therefore, the individual teacher was chosen to be the primary unit of analysis. Starting from that individual level, the team level was considered the most important level of data at the next level, because teachers primarily act within teacher teams. We then decided to ignore both the program-level and institutional level in the data. The program level was ignored because the units at this level (n = 30) correspond to a large extent with the units at the team level (n = 36; for only a few programs more than one team was included in the study). The institutional level was ignored because the number of universities (n = 8) was considered far too small to estimate statistically sound variance components which would have indicated between-institute variation. This was also decided due to a severe imbalance of the distribution of teams over institutions (approximately half of the 36 teams was associated with one university). These data were considered inappropriate to provide meaningful fixed effects that would have indicated differences between universities.

In short, data-analysis for the present study had to take a two-level hierarchical structure into consideration: teachers (Level-1) nested within teams (Level-2). The strength of this hierarchical structure was assessed by estimating the intra-class correlation (*ICC*) for all items in the questionnaire. An *ICC* in this case indicates the proportion of observed variance of an item that can be attributed to team differences (compared to the total observed variance, that is, the sum of between-team and within-team, i.e. individual score variance). High, or relatively high, *ICCs* signify a substantial influence of the team context on the individual responses, indicating that teachers within a team are more similar to each other than teachers within other teams. In educational and organizational contexts, *ICC* values of 0.10 to 0.15 are considered medium to large respectively (Hox, 2002, p. 184). A rough rule of thumb is that *ICC* values over 0.10 indicate the necessity to take the hierarchical structure into account (see also Kreft & De Leeuw, 1998, p. 10).

Multilevel covariance structure modeling. The underlying factor structure of the collective learning construct was studied using multilevel covariance structure modeling (MCSM), more specifically multilevel confirmatory factor analysis, following the guidelines and steps presented by Muthén (1994). All MCSM was performed using the EQS 6.1 program (Bentler & Wu, 2002; Bentler, 2005). MCSM relaxes the assumption of identically distributed observations that are made in conventional covariance structure modeling; the independence of observations is not assumed over all observations but, in this case, only over teams. Technically, in MCSM the variance in the data is composed of a team component (between-team variance) and an individual component (within-team variance). Muthén (1989, 1990) presents a relatively simple set-up for this kind of modeling in which a covariance structure model is estimated at both levels. Conventional covariance structure modeling software can

handle this case as a two-group analysis, one group representing the within structure variance with corresponding model, and the other group representing the between structure variance with corresponding model.

In the present study, the aim is to identify and test the underlying factor structure of the collective learning construct on the basis of individual perceptions of team level characteristics. Individuals are considered informants about the collective process. Therefore, the main interest is in the individual (teacher) level modeling of the covariance structure. Following Muthén (1994), it was therefore decided that we concentrate on the analysis of the within-team covariance structure, without committing to a specific between-team structure. Technically, the MCSM then involves the modeling of the within-team covariance structure with unrestricted between-team covariances. In that way, the within-team, i.e. individual teacher level, analyses are regarded as having been corrected for the potentially distorting effects of the between-team (co)variances. Moreover, Muthén (1994) points out that in many cases the between-structure variance might be difficult to determine and/or the between-model might not be interpretable. This is not surprising, because usually in practice, measurement instruments are not designed to provide meaningful measurements for higher level units. It will often be unclear what the meaning is of a measurement for a higher level unit obtained by combining, e.g. aggregating, individual level measurements, leading to unpredictable effects on the between covariance structure[7].

Cross-validation procedure: model generation and model testing. To identify, optimize and test the hypothesized underlying factor structure of the collective learning construct, a cross-validation procedure (see Cudeck & Brown, 1983, for a general discussion about cross-validation of covariance structures) was carried out consisting of a model-generating and a model-testing stage (see, for instance, Yang et al., 2004; Rijkeboer & de Boo, 2010). The explorative subsample A was used for model generation (cf. Jöreskog & Sörbom, 1996); the initial, hypothesized model of 'collective learning' was modified stepwise and repeatedly tested until an acceptable fit was obtained. First, multilevel confirmatory factor analysis (MCFA) was conducted to optimize and test one-factor models for each hypothesized factor (scale) separately. For each factor, items with non-salient factor loadings ($\lambda < 0.40$) were removed step by step whereby at each step the item with the lowest factor loading was deleted. In this way, the best indicators (items) were selected to measure each factor. Next, in

[7] At first glance it may seem contradictory to correct for between-team differences in studying a process that could be conceived of as taking place at the team level whereby the characteristics across teams can be assumed to vary. However, as we explained earlier, in the present study we take the teacher as our primary unit of analysis and we concentrate on the individual perception of the 'collective learning' process. The correction we apply, removes the influence of the modeling results of differences in average team scores in all items and scales measuring the (individual) perception of collective learning. In that way, when we model the core construct of 'collective learning' and study the underlying factor structure, only the individual differences in terms of, for instance, high or low perceived level of ‘collective action’ plays a role, whereas the *team* differences in terms of high or low *average* perceived level do not. Apart from the statistical necessity to correct for dependencies in the data due to the nested structure of the teacher within a team, this is correct, because given the design of the measurement instrument that is directed at the individual team member, answering the question whether such team differences might influence (individual perceptions of) the 'collective learning' process is not part of evaluating the instrument and studying the underlying factor structure. The question as to whether team differences in terms of 'collective learning' have effects on other variables, such as organizational outcomes, is moreover a different research question all together.

order to test the hypothesized underlying factor structure of the collective learning construct, a MCFA was performed in which the obtained, separate factors were combined into one model allowing for correlations among the factors. Items with multiple loadings were identified and removed, and between-factor correlations were inspected. Factors that showed a strong relationship ($r \geq 0.80$) were checked for their theoretical independence in terms of the construct and its operationalization. If they were theoretically linked or showed strong overlap in the content of their items, factors were combined into a new factor. Generally, factor loadings were tested for significance in the usual way, using *z*-tests.

As this procedure of post hoc model modification involves a considerable risk of capitalization on chance, the re-specified model was tested for validation in subsample B (cf. McCallum & Austin, 2000). Several fit indices were inspected and reported in order to assess the fit of the model, including the χ^2-value and the number of degrees of freedom, and particularly the χ^2/df-ratio, since the χ^2-value is strongly influenced by sample size (cf. Jöreskog & Sörbom, 1989). Additionally, following recommendations by Hu and Bentler (1998) and Byrne (2006), the model fit was evaluated using the estimates of the *RMSEA* (with corresponding 90% confidence interval), *SRMR*, *NNFI* and *CFI* (see also, for a practical example, the procedure followed by Rijkeboer and de Boo, 2010). Models with a good fit are characterized by a χ^2/df-ratio < 2 (Mueller, 1996), *RMSEA* < 0.06 (Hu & Bentler, 1999), *SRMR* < 0.05 (Byrne, 2006), *NNFI* > 0.95 and *CFI* > 0.95 (Chou & Bentler, 1995; Hu & Bentler, 1999). As Byrne (2006) points out, different cut-off values have been suggested by different authors, leaving room for broader interpretations.

After identifying and testing the underlying factor structure, the collective learning construct was modeled further, allowing for structural relationships between the factors to be identified. This extends the model to a so-called 'full structural equation model' (cf. Byrne, 2006). In models of that kind, a measurement model (i.e., a confirmatory factor analysis) is combined with a model that specifies structural relationships among the factors (i.e., regression relations). For this final modeling task the same multilevel approach (MCSM) was applied as was explained above, that is, we modeled the within team covariance structure with unrestricted between-team covariances. Structural relations were tested using *z*-tests. All analyses were performed with the EQS 6.1 program (Bentler & Wu, 2002; Bentler, 2005). In the results section, standardized solutions, displaying standardized regression coefficients, are provided to present model estimates.

3.5 RESULTS

First, we discuss the intra-class correlations of the variables in our dataset as a way to evaluate the strength of the hierarchical structure in our data. Next, we discuss the results of the multilevel covariance structure modeling with respect to the (hypothesized) factor structure for the collective learning construct. In exploring this construct further, we then present our results on testing a second-order factor model regarding 'collective learning'. Finally, we present the results of testing two alternative process models of 'collective learning'.

Strength of the hierarchical structure

Intra-class correlations (*ICCs*) were found in the range 0.00 to 0.25 for subsample A and 0.00 to 0.27 in subsample B. Values equal to or over 0.10 were found for 18 out of 33 variables for subsample A and for 13 out of 33 variables for subsample B. Such results imply that, in our sample, teachers' scores with respect to 'collective learning' are influenced by the specific teams in which they work. Clearly, these values make it reasonable to correct for the potentially distorting effects of the between-team (co)variances by using a *multilevel* analysis technique, which can appropriately handle the hierarchical structure inherent to our data.

Model generation and validation

The measurement instrument developed in the present study translates the theoretically identified six-phase cycle of 'collective learning' into a hypothesized six-factor structure underlying the construct. This underlying structure was investigated by means of MCFA in the explorative subsample A. At the start of this procedure, we decided to exclude the items measuring the factor 'information generation' from the measurement instrument. In hindsight, five out of seven items of this factor, considered from the perspective of individual teachers, seem to refer more to organizational conditions than to teachers' behaviors or feelings (e.g., item 15a, 'Within my department meetings are being organized where knowledge can be shared with teachers within the department'; see Appendix A, Table A1, for a complete overview of the items measuring this factor). Of the remaining five factors, five items were removed in the first part of the analysis, i.e., fitting one-factor models for each separate scale: one item for 'information distribution', one item for 'collective action' and three items for 'evaluation and reflection'. In the model combining these five factors, one additional item was removed due to multiple factor loadings.

The combined model showed a very strong relationship ($r > 0.80$) between the factors entitled 'information distribution' and 'evaluation and reflection', and between the factors entitled 'shared vision' and 'dialogue and inquiry'. The high correlation between the factors 'information distribution' and 'evaluation and reflection' could be explained by the fact that two out of the three selected items measuring 'information distribution' relate to distributing information resulting from learning processes and imply evaluation and reflection (e.g.: 'Within my department the lessons learned are made available to all teachers in order for the teachers to make use of these'). Because of the small number of items measuring 'information distribution' and because of the overlapping content of these items with the items around the factor 'evaluation and reflection', both factors were combined to create a broader operationalization of the factor 'evaluation and reflection'. The one item (concerning 'information distribution') that did not relate to 'evaluation and reflection' was removed from the instrument. Despite the high correlation between the factors entitled 'shared vision' and 'dialogue and inquiry', these factors and their respective items seem to measure strongly related, but distinct concepts. Therefore, it was decided not to combine these factors, and to retain them as separate factors in the model.

The final model consisted of four factors – 'shared vision', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection' – and contained 26 out of the 33 items that were originally included in the analysis (see Appendix B, Table B1). Table 3.1 shows the values for

the array of indices used to assess the fit of this final model for the explorative subsample A. Three fit indices indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95), whereas two indices indicate an adequate fit (*RMSEA* = 0.06 and *SRMR* = 0.06). The upper limit of the confidence interval for the *RMSEA* value exceeds the cut-off value for a good model, but is still within the [0.05–0.08] interval associated with a model with reasonable errors of approximation (Browne & Cudeck, 1993; Byrne, 2006).

In order to cross-validate the final model, it was fit to the data of validation subsample B. Table 3.1 shows measures of fit for this model as well. Clearly, the final model in subsample B shows a slightly improved fit compared to subsample A results. Four fit indices indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95, *RMSEA* < 0.06 and the upper limit of the *RMSEA* confidence interval being equal to the cut-off value for a well-fitting model), whereas one fit index indicates an adequate fit (*SRMR* = 0.06). In general, it may be concluded that the final four-factor model of 'collective learning' fits the data well.

Table 3.1
Values of the different fit indices computed for the final four-factor model of Collective Learning, for both subsamples A and B

	χ^2	*df*	χ^2/df	*RMSEA* (90% *CI*)	*NNFI*	*CFI*	*SRMR*
Subsample A	538.81	293	1.84	0.062 (0.053-0.070)	0.960	0.964	0.063
Subsample B	485.42	293	1.66	0.055 (0.046-0.063)	0.969	0.972	0.062

For both subsamples A and B, factor loadings (*λ*) and corresponding standard errors (*SE*) of the final four-factor model are presented in Table 3.2. The factor loadings for subsample A fall within the range 0.47 to 0.80 (*M* = 0.63); for subsample B they fall within the range 0.49 to 0.75 (*M* = 0.65). All loadings are highly significant (all *z*-values > 3.50, *p* < 0.0005).

Table 3.2
Factor loadings (λ) and corresponding standard errors (SE) for all items in the final four-factor model measuring Collective Learning, for both subsamples A and B

	Item	*λ* (*SE*) Subsample A	*λ* (*SE*) Subsample B
Shared vision	3	0.59 (0.05)	0.49 (0.06)
	11	0.61 (0.05)	0.64 (0.05)
	17	0.70 (0.04)	0.61 (0.05)
	20	0.75 (0.03)	0.74 (0.04)
	21	0.67 (0.04)	0.71 (0.04)
	24	0.80 (0.03)	0.75 (0.04)
	28	0.78 (0.03)	0.75 (0.04)

Table 3.2 *(continued)*

	Item	λ (*SE*) Subsample A	λ (*SE*) Subsample B
Dialogue and inquiry	8	0.62 (0.05)	0.62 (0.05)
	14	0.65 (0.05)	0.73 (0.04)
	23	0.68 (0.04)	0.67 (0.04)
	25	0.57 (0.05)	0.69 (0.04)
	26	0.72 (0.04)	0.65 (0.05)
	29	0.50 (0.06)	0.67 (0.04)
Collective action	38	0.47 (0.06)	0.58 (0.05)
	42	0.62 (0.05)	0.66 (0.05)
	54	0.68 (0.05)	0.71 (0.04)
	55	0.74 (0.04)	0.74 (0.04)
	65	0.54 (0.06)	0.66 (0.05)
	67	0.48 (0.06)	0.52 (0.06)
Evaluation and reflection	2	0.69 (0.04)	0.61 (0.05)
	5	0.60 (0.05)	0.60 (0.05)
	6	0.53 (0.05)	0.60 (0.05)
	12	0.72 (0.04)	0.63 (0.05)
	13	0.71 (0.04)	0.61 (0.05)
	30	0.55 (0.06)	0.63 (0.05)
	35	0.48 (0.05)	0.53 (0.06)

Table 3.3 presents the factor correlations in the final four-factor model for both subsamples. Clearly, there are moderate to strong relationships among the four factors. Substantial correlations were expected, however, as the factors are part of one and the same construct, 'collective learning'. Notably, the factors 'dialogue and inquiry' and 'shared vision' show the strongest relationship (r = 0.81 (A), r = 0.75 (B)).

Table 3.3
Factor correlations and standard errors (between brackets) for the final four-factor model measuring Collective Learning, for both subsamples A and B

	Shared vision	Dialogue and inquiry	Collective action	Evaluation and reflection
Shared vision	–			
	–			
Dialogue and inquiry	A 0.81 (0.04)	–		
	B 0.75 (0.04)	–		
Collective action	A 0.44 (0.07)	A 0.57 (0.06)	–	
	B 0.54 (0.06)	B 0.59 (0.06)	–	
Evaluation and reflection	A 0.74 (0.04)	A 0.76 (0.05)	A 0.52 (0.07)	–
	B 0.64 (0.05)	B 0.73 (0.05)	B 0.55 (0.06)	–

Reliability estimates (Cronbach's α) for the scales corresponding to the four factors in the final model, for both subsamples A and B, are presented in Table 3.4. Results show that values for α are in the range 0.77 to 0.87, that is, they can be considered satisfactory to good.

Table 3.4
Reliability estimates (Cronbach's α) for the scales corresponding to the four factors in the final model measuring Collective Learning, for both sub samples A and B

	Cronbach's α	
	Subsample A	**Subsample B**
Shared vision	0.87	0.85
Dialogue and inquiry	0.79	0.83
Collective action	0.77	0.81
Evaluation and reflection	0.80	0.77

The modeling shown of the underlying factor structure of the collective learning construct only allows for correlations among the factors. However, elaborating on the factor model identified and tested in the previous section, various models for the relationships among the factors reflecting the process of collective learning could be hypothesized about. In further exploration of the construct in subsequent sections, three alternative models will be presented and tested: a second-order factor model and two process models. The second-order factor model only models the correlations among the factors by means of an additional underlying latent variable (i.e., 'collective learning'). Such an approach is in line with the correlational nature of our survey data. The process models, on the other hand, provide a more tentative description of the process of collective learning. These models describe the pattern of relationships among the factors in the form of a process. It should be noted though, that while the development and testing of process models is an interesting way to further explore the collective learning construct, the correlational data of our study cannot be used to prove causal relationships among the factors. Results should therefore be interpreted cautiously (see also the section 'Methodological evaluation').

A second-order factor model for modeling structural relationship among the factors of Collective Learning

In the present study, conclusions are drawn about four factors of 'collective learning' based on both theoretical assumptions and empirical findings. These factors are interrelated, because they are part of the overarching process of collective learning. One way to model the mutual relationships is to relate the factors in a second-order factor model. In such a model, the central variable is the second-order, latent (indirectly measured) variable 'collective learning', and the four factors associated with it are considered indicators of this central variable (modeled as first-order latent variables). The factors themselves are measured by means of the items presented in Table 3.2. The structure of the model is presented in Figure 3.1. The underlying thought is that the way a person perceives 'collective learning' within

his/her team, determines the way he/she perceives the four aspects associated with it. A significant positive relationship is therefore expected between the variable 'collective learning' and the four factors. In this section the second-order factor model of 'collective learning' is tested. In line with the prior analyses in the present study, the model is tested and, if necessary, optimized in subsample A. To cross-validate results, the modified models are retested in subsample B.

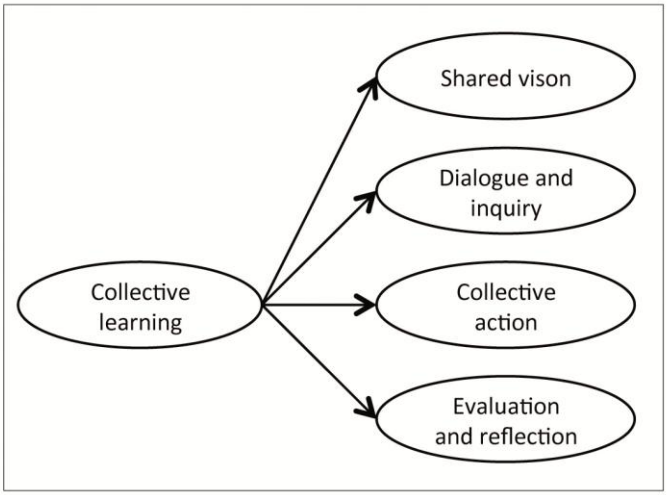

Figure 3.1. Second-order factor model of Collective Learning.

Table 3.5 presents the values of all indices used to assess the fit of the second-order factor model to the data in the explorative subsample A, and the validation subsample B, respectively. For this model, fit to the explorative subsample A, three fit indices indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95), one index indicates an adequate fit (*RMSEA* = 0.07), and one index indicates a moderate fit (SRMR = 0.07). The value for the *RMSEA* as well as the value for the upper limit of its confidence interval exceed the cut-off value for a good model, but can still be associated with a model with reasonable errors of approximation (see also above). The regression coefficients (*B*) corresponding to all hypothesized effects (i.e., the factor loadings corresponding to the second-order factor) are highly significant and positive (effect of 'collective learning' on 'shared vision', *B* = 0.480, *SE* = 0.049, *p* < 0.0005, on 'dialogue and inquiry', *B* = 0.551, *SE* = 0.050, *p* <0.0005, on 'collective action', *B* = 0.295, *SE* = 0.049, *p* <0.0005, on 'evaluation and reflection', *B* = 0.577, *SE* = 0.047, *p* < 0.0005, respectively). Because of the good fit of the second-order factor model and the significance of all regression coefficients, it was not modified and considered final, and the model was retested in validation subsample B.

Table 3.5
Values of the different fit indices computed for the second-order factor model for Collective Learning in the explorative subsample A, and the validation subsample B

	χ^2	*df*	χ^2/df	*RMSEA* (90% *CI*)	*NNFI*	*CFI*	*SRMR*
Subsample A	576.02	295	1.95	0.066 (0.058-0.074)	0.954	0.958	0.066
Subsample B	502.48	295	1.70	0.057 (0.048-0.065)	0.969	0.972	0.062

Table 3.5 shows a slightly improved fit for the model in subsample B, as compared to results in subsample A. Four fit measures indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95, *RMSEA* < 0.06, and the upper bound of the *RMSEA* confidence interval is within the [0.05-0.08] interval), whereas one index indicates an adequate fit (*SRMR* = 0.06). Results for subsample B showed significant, positive regression coefficients for all hypothesized effects as well (effect of 'collective action' on 'shared vision', *B* = 0.441, *SE* = 0.051, *p* < 0.002, on 'dialogue and inquiry', *B* = 0.578, *SE* = 0.048, *p* < 0.002, on 'collective action', *B* = 0.394, *SE* = 0.048, *p* < 0.002, on 'evaluation and reflection', *B* = 0.495, *SE* = 0.049, *p* < 0.002, respectively). In both subsamples, the factor loadings of the items measuring the 'first-order' factors 'shared vision', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection' (output not included) were highly similar, if not identical, to the CFA model reported in the section 'Model generation and validation'. In general, it may be concluded that the second-order factor model provides a satisfactory model for the relationships among the underlying factors of 'collective learning'.

The standardized solutions (displaying standardized regression coefficients) for the second-order factor model fit, in both subsamples A and B, are presented in Figure 3.2.

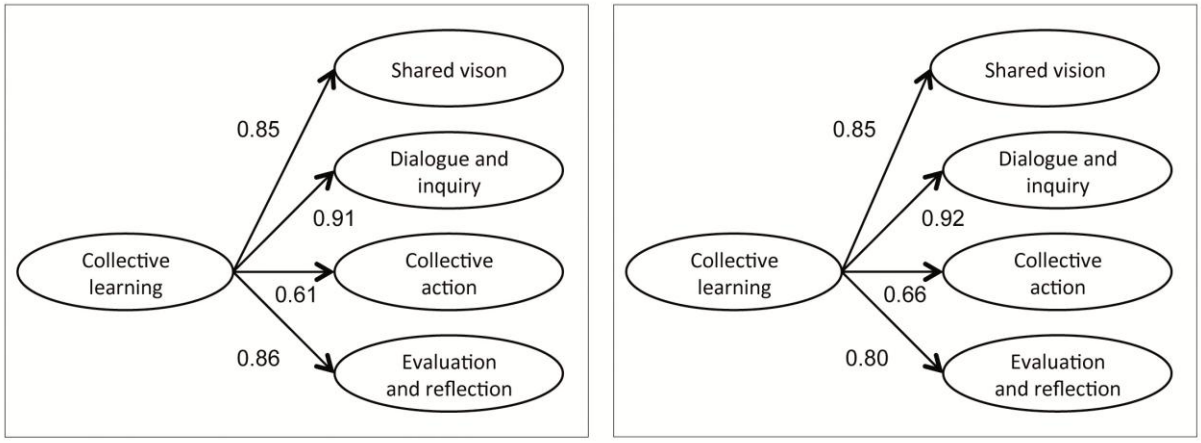

Figure 3.2. Standardized solution (displaying standardized regression coefficients or factor loadings) for the second-order factor model of Collective Learning for the explorative subsample A, and the validation subsample B.

Figure 3.2 shows a highly similar pattern of effects (factor loadings) in both subsamples. The standardized coefficients indicate that the factor 'collective learning' most strongly affects the factor 'dialogue and inquiry', directly followed by the factors 'shared vision' and 'evaluation and reflection'. In other words, 'dialogue and inquiry' is the strongest indicator of 'collective learning'. Furthermore, results show that the factor loading of 'evaluation and reflection' exceeds the loading of 'shared vision' in subsample A, whereas in subsample B the factor loading of 'shared vision' exceeds the loading of 'evaluation and reflection'. Differences are, however, only minor and they are considered to be sample specific. Therefore no additional conclusion is drawn from this observation. Finally, Figure 3.2 shows that 'collective learning' has a somewhat smaller, but significant, effect on the factor ‘collective

action’. In other words, 'collective action' is the weakest indicator of 'collective learning'. In short, results imply that 'collective learning' can be modeled as a second-order, latent variable, with 'shared vision', 'dialogue and inquiry', 'collective action' and 'evaluation and reflection' as its indicators.

A process model for modeling structural relationships among the factors of Collective Learning

In addition to the second-order factor model, 'collective learning' may be modeled by causally relating the four factors described and identified in the present study. Dixon (1999) describes 'collective learning' as a form of experiential learning with phases that ideally follow one upon the other. In addition, Rait (1995) states that incomplete learning cycles may hinder an organization’s ability to learn from the accrual of experience. Therefore, in translating a phase of the learning cycle into a factor of the four-factor model of 'collective learning', it might be intuitively appealing to formulate a causal model in which each factor is regarded as a predictor of its 'succeeding' factor (i.e., a cyclical model). In our opinion, however, this would be incorrect: while experience is the basis for reflection (Kolb, 1984), people do not automatically increase the amount of reflection they engage in simply because they have gained more experience. Generating and testing alternative models for the process of collective learning may, however, provide a first, although tentative, step in gaining further insight into this process. Such insight might indeed be beneficial for exploring ways to stimulate the process of collective learning from within an organization or team.

In this section two (non-cyclical) models for the process of collective learning are formulated and tested, in which specific, causal relationships among the factors of the construct are hypothesized about. Elaborating on the cyclical way of thinking described above, one of the factors of 'collective learning', 'dialogue and inquiry', is hypothesized to be the central factor influencing the other three factors. In this way, the focus is on one cycle of the hypothesized process and multiple effects between one key element in the process, 'dialogue and inquiry', and the remaining ones is allowed for. This model is referred to as Model 1. In line with the approach taken in the present study, the model is tested and optimized in subsample A. To cross-validate results, the modified models are retested in subsample B. Model 1 assumes both the presence of an effect of the factor 'dialogue and inquiry' on the remaining factors, and the absence of mutual relationships or effects among the three remaining factors. Mutual relationships among the three remaining factors are, however, likely. Such relationships potentially change any direct effect of 'dialogue and inquiry' on the remaining factors as hypothesized in Model 1. Therefore, a second model is tested in which specific relationships between the remaining factors are allowed for. This model is referred to as Model 2. The model test of Model 2 is used to assess whether the direct effects of 'dialogue and inquiry' on the other factors continue to be significant when specific additional effects between the remaining factors are taken into account.

Model 1. As 'collective learning' is a form of social learning (De Laat & Simons, 2002), it could be argued that a group's dialogical culture and its dialogue skills influence its ability to arrive at a shared vision, to act collectively, to evaluate the results of its actions and to reflect on its work and learning processes. Chiva-Gómez (2004), for example, considers dialogue, communication and social construction a facilitating factor for organizational learning, Kessels

(1996b) indicates that highly developed social and communication skills support a favorable learning climate, Marsick and Watkins (1996) argue that dialogue enhances team learning, and Verdonschot (2009) finds communicative and social skills to be the vessel in social processes of knowledge creation. Von Krogh, Ichijo & Nonaka (2000, in De Jong, 2010) argue that the quality of interaction has a great effect on learning and that learning demands an open atmosphere and communication, and Garvin, Edmondson & Gino (2008) consider 'appreciation of differences' and 'openness to new ideas' part of a supportive learning environment. Dialogue and inquiry lead people to "talk differently" and moves them "into exploring the social and cultural norms that socialize people into thinking and acting the way they do" (Marsick & Watkins, 1996, p. 19). Gubbins & MacCurtain (2008, p. 578) summarize the thoughts presented by these authors by stating that "[c]ollective learning is fundamentally concerned with social interaction and the development of relational synergies". In short, it seems reasonable to hypothesize a group's dialogical culture and its dialogue and inquiry skills (as measured by the dialogue and inquiry scale) to be a starting point in a particular cycle of the collective learning process. In terms of the model, a significant, positive effect of the 'dialogue and inquiry' factor on the other factors of 'collective learning' could be hypothesized. This structure is tested as Model 1 and presented in the left part of Figure 3.3.

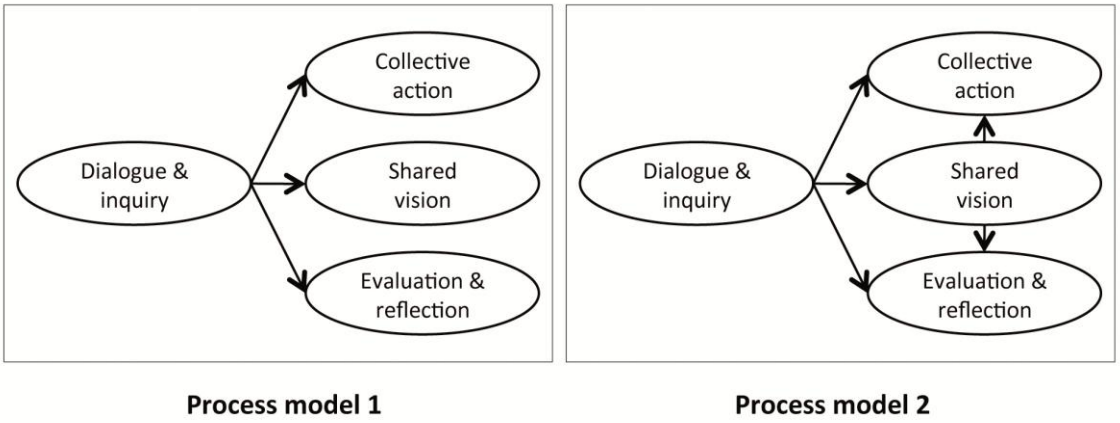

Figure 3.3. Two alternative models for the process of Collective Learning, specifying hypothesized causal relationships among the factors of the construct.

Model 2. Because of the importance of collective intent in the collective learning process (Senge, 1990), the factor 'shared vision' is likely to influence the factors 'collective action' and 'evaluation and reflection'. 'Shared vision' can be hypothesized to have a positive effect on the factor 'collective action', because a shared vision aligns individual actions. Moreover, it can be argued that a shared vision generates a common interest in the extent to which this vision is realized in practice and the results to which it has led. Because this type of information is the output of evaluation and reflection processes, an effect of 'shared vision' on 'evaluation and reflection' can be hypothesized as well. Model 2, presented in the right part of Figure 3.3, includes the two additional effects (compared to Model 1). Given the importance of dialogue in social learning processes, significant direct effects of 'dialogue and inquiry' on the three remaining factors are still expected when taking into account the direct effects of 'shared vision' on 'collective action' and on 'evaluation and reflection' (which may also be conceived as indirect effects of 'dialogue and inquiry' on 'collective action' and 'evaluation and reflection', respectively).

Results. Table 3.6 presents the values of all indices used to assess the fit of Model 1 to the data in the explorative subsample A, and the validation subsample B, respectively. For this model, fit into the explorative subsample A, three fit indices indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95), one index indicates an adequate fit (*RMSEA* = 0.06), and one index indicates a moderate fit (*SRMR* = 0.07). The upper limit of the confidence interval for the *RMSEA* value exceeds the cut-off value for a good model, but, as mentioned earlier, can still be associated with a model with reasonable errors of approximation (see also above). The regression coefficients (*B*) corresponding to all hypothesized effects are highly significant and positive (effect of 'dialogue and inquiry' on 'shared vision', *B* = 0.484, *SE* = 0.047, *p* < 0.0005, on 'collective action', *B* = 0.271, *SE* = 0.047, *p* <0.0005, on 'evaluation and reflection', *B* = 0.559, *SE* = 0.045, *p* < 0.0005, respectively). Because of the good fit of Model 1 and the significance of all regression coefficients, it was not modified and considered final, and the model was retested in validation subsample B.

Table 3.6 shows a slightly improved fit of Model 1 in subsample B, as compared to results in subsample A. Four fit measures indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95, *RMSEA* < 0.06 and the upper limit of the *RMSEA* confidence interval being equal to the cut-off value for a good fitting model), whereas one index indicates an adequate fit (*SRMR* = 0.06). Results for subsample B show significant, positive regression coefficients for all hypothesized effects as well (effect of 'dialogue and inquiry' on 'shared vision', *B* = 0.381, *SE* = 0.049, *p* < 0.002, on 'collective action', *B* = 0.368, *SE* = 0.047, *p* < 0.002, on 'evaluation and reflection', *B* = 0.470, *SE* = 0.048, *p* < 0.002, respectively). In both subsamples, the factor loadings for Model 1 (output not included) were highly similar, if not identical, to the CFA model reported earlier. In general, it may be concluded that Model 1 provides a satisfactory model for this particular pattern of relationships, i.e. effects, among the underlying factors of 'collective learning'. The hypothesized effects of the factor 'dialogue and inquiry' on the other factors in the collective learning process are confirmed by the data.

Table 3.6
Values of the different fit indices computed for (process) Model 1 of Collective Learning in the explorative subsample A, and the validation subsample B, respectively

	χ^2	*df*	χ^2/df	*RMSEA* (90% *CI*)	*NNFI*	*CFI*	*SRMR*
Subsample A	544.76	296	1.84	0.062 (0.054-0.070)	0.960	0.964	0.065
Subsample B	490.76	296	1.66	0.055 (0.046-0.063)	0.969	0.972	0.064

While Model 2, fit in the explorative subsample A, showed an adequate fit to the data (output not included), one regression coefficient, corresponding to the effect of 'shared vision' on 'collective action', was non-significant (*B* = –0.060, *SE* = 0.127, *p* = 0.6384). Consequently, this effect was omitted from the model. For the modified model, three fit indices indicated a good fit to the data (χ^2/df = 1.83, *NNFI* = 0.960, and *CFI* = 0.964), whereas two indices indicated an adequate fit (*RMSEA* = 0.064 [90% *C.I.* 0.053-0.070], *SRMR* = 0.064). The upper limit of the confidence interval for the *RMSEA* value exceeded the cut-off value for a good model, but could still be associated with a model with reasonable errors of approximation (see also above). In the modified model, the regression coefficients corresponding to all hypothesized effects were highly significant and positive (effect of 'dialogue and inquiry' on 'shared vision',

B = 0.470, *SE* = 0.047, *p* < 0.0005, on 'collective action', *B* = 0.272, *SE* = 0.047, *p* < 0.0005, and on 'evaluation and reflection', *B* = 0.348, *SE* = 0.087, *p* < 0.0005, respectively; effect of 'shared vision' on 'evaluation reflection', *B* = 0.397, *SE* = 0.148, *p* < 0.0074). Because of the good fit of modified Model 2 and the significance of all regression coefficients, it was not modified further and was considered final, and the model was retested in validation subsample B.

Retest results for Model 2 in subsample B (output not included as well) showed a slightly improved fit as compared to subsample B results. Four fit measures indicated a good fit to the data (χ^2/df = 1.66, *NNFI* = 0.969, *CFI* = 0.972, *RMSEA* = 0.055 [90% *C.I.* 0.046-0.063], and the upper limit of the *RMSEA* confidence interval being equal to the cut-off value for a good fitting model), whereas one index indicated an adequate fit (*SRMR* = 0.064). However, while Model 2 showed improved fit in subsample B, the effect of 'shared vision' on 'evaluation and reflection' could not be confirmed. Whereas all other effects were positive and significant (effect of 'dialogue and inquiry' on 'shared vision', *B* = 0.374, *SE* = 0.049, *p* < 0.0005, on 'collective action', *B* = 0.366, *SE* = 0.048, *p* < 0.0005, on 'evaluation and reflection', *B* = 0.378, *SE* = 0.076, *p* < 0.0005, respectively), the regression coefficient corresponding to this effect was non-significant (*B* = –0.281, *SE* = 0.148, *p* < 0.1416). We therefore decided to omit this effect from the model as well. To sum up, results for Model 2 indicate that the hypothesized effects of the factor 'shared vision' on both factors 'collective action' and 'evaluation and reflection' cannot be confirmed by the data. Omitting both effects yields a process model of 'collective learning' identical to Model 1. Apparently Model 1 provides the most adequate process model for 'collective learning'. The standardized solutions (displaying standardized regression coefficients) for Model 1 which fit in both subsamples A and B are presented in Figure 3.4.

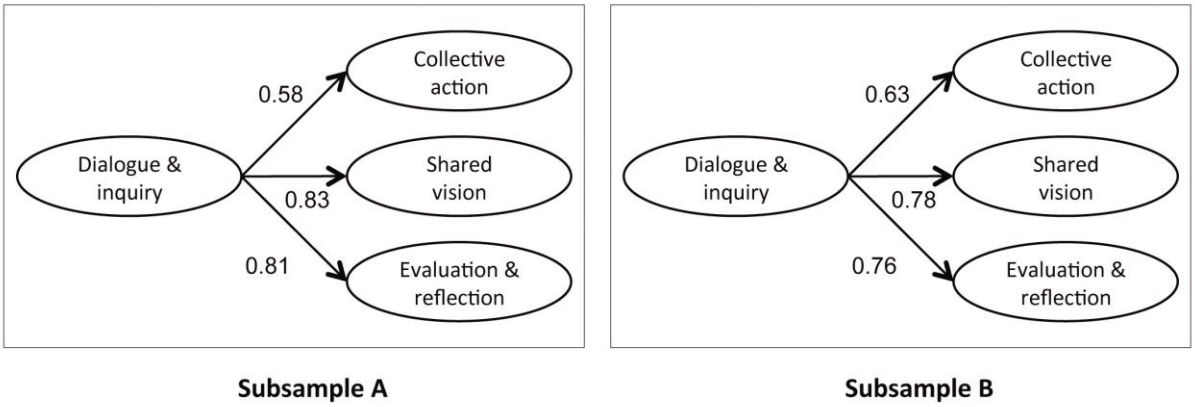

Figure 3.4. Standardized solution (displaying standardized regression coefficients) for the final process model (Model 1) of Collective Learning for the explorative subsample A, and the validation subsample B.

Figure 3.4 shows a highly similar pattern of effects in both subsamples. The standardized coefficients indicate that the factor 'dialogue and inquiry' most strongly affects the factor 'shared vision', directly followed by the factor 'evaluation and reflection'. 'Dialogue and inquiry' has a relatively smaller but significant effect on the factor 'collective action'. These results seems to imply that development of a group's dialogical culture and its dialogue and

inquiry skills will stimulate the process of collective learning from within. However, as the results are based on correlational data, conclusions about causal mechanisms remain of a tentative nature.

3.6 CONCLUSION AND DISCUSSION

Conclusion: answering research questions 1 and 2

This chapter has focused on reporting the results of designing and testing an instrument for measuring 'collective learning' as a significant determinant in organizational learning. 'Collective learning' is considered a process of experiential learning consisting of the six factors 'shared vision', 'information generation', 'information distribution', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'. In the present sample made up of teachers from higher education, only four factors could be identified. Due to flaws in the operationalization, the factor 'information generation' was excluded prior to the analyses. Furthermore, due to high factor correlation and item similarity, it was decided to combine the factors 'information distribution' and 'evaluation and reflection' into a new factor 'evaluation and reflection'. In both the exploration and the validation subsample the model representing the hypothesized four-factor structure showed an adequate to good fit to the data. In other words, teachers in our sample identify four aspects of collective learning processes. A second-order factor model relating the factors associated with 'collective learning' via a second-order variable showed a good fit to the data, indicating that 'collective learning' might be modeled as such. Subsequently, the interrelationships among the four factors could successfully be modeled by a second-order factor model. In this model, 'collective learning' serves as a central latent variable explaining the interrelations observed among the factors in the initial four-factor model of the construct. Alternatively, a (tentative) process model of 'collective learning' in which the factor 'dialogue and inquiry' is assumed to be the central factor positively influencing the other factors, also showed a good fit to the data. Overall, results lend support to the conceptualization of 'collective learning' as a social, experiential learning process.

Contribution of the study

As Leithwood, Leonard & Sharratt (1998, p. 268) argue: "although there are compelling reasons to view schools from an OL [organizational learning] perspective … empirical evidence is thin, to say the least". This chapter has focused on reporting the results of designing and testing an instrument for measuring 'collective learning' as a significant determinant of organizational learning. As the final model shows a good fit to the data, it offers a starting point for further research on the content, meaning and value of the collective learning concept and the postulated and largely untested hypothetical relationships with other relevant variables. Of particular importance seems to be the relationship to organizational results, considered an essential outcome of the collective learning process, for "to be worth continuing attention, OL must result in something consequential for schools" (Leithwood, Leonard & Sharratt, 1998, p. 250).

Critical reflection on the measurement instrument and suggestions for improvement

Critical reflection on the measurement instrument leads us to the following concerns. First, the existence of two factors of the collective learning process that were theoretically assumed could not be confirmed by the data. The underlying problem seemed to be the operationalization that was chosen for both factors. The items didn't sufficiently reflect the underlying factors that we intended to measure: information generation and information distribution. In a future version of the measurement instrument, items related to information generation should be defined more in terms of teachers' behaviors or feelings than in terms of organizational conditions, thereby complying with the items of the other scales. New items should be added to the information distribution scale in order to cover the broad range of information (e.g., not only information that results from evaluation and reflection) that is to be shared within an organization in order to stimulate learning. In a repeated model-generating procedure, a revised selection of items for both scales could show whether a satisfactory fit could be obtained for the hypothesized six-factor structure underlying the collective learning construct containing the factors 'information generation' and 'information distribution' (as suggested by Dixon, 1999).

Second, the items of the factor 'collective action' were phrased differently from the items of the other factors. 'Collective action' items were formulated in the 'I-form', whereas the items related to the other factors were formulated in the 'we-form' (see Appendix B, Table B1). Reflecting on the measurement procedure, this difference might have resulted in an unforeseen effect with regards to the answers provided by the respondents. Respondents may for instance have related the items formulated in the 'I-form' more to themselves and the items formulated in the 'we-form' more to their team members. If re-using the instrument, researchers might consider to reformulate the 'I-form' items to comply with the other items measuring the collective learning construct.

Third, relationships between variables can be hypothesized from the theory as well as observed from (empirical) data. This data-driven approach to develop a theory using observed relationships among variables introduces the risk of results being based on chance. Clearly, we prefer to work from a theory, specifying the nature of (core) concepts as well as their relationships to related concepts. In confronting a theoretical model with empirical data, the question as to whether the observed data supports the underlying theory is answered. However, since in the present study we are in the beginning phase of the development of a measurement instrument for 'collective learning', we did allow ourselves some freedom. In using a two-step approach, consisting of a model-generating and a model-testing stage, we assimilated our empirical findings in the process of theory development. An example of this can be seen in the process model we developed for 'collective learning'. The process model was inspired by the observation that the sub-construct 'dialogue and inquiry', an aspect of 'collective learning', was relatively highly correlated with the remaining sub-constructs of 'collective learning'. Theoretical considerations presented by various authors helped us to support and understand the relationship from a theoretical standpoint and laid the theoretical foundation for the process model.

Fourth, the four-factor model resulting from the model-generating procedure as reported in this chapter was tested using a sample of teachers from Universities of Applied Sciences. In

order to broaden the scope of the results, the model might be retested using a different sample, for instance one where teachers are teaching at a different level of education (e.g., primary or secondary education), or it might be retested in a non-educational context. Both types of research could explore the soundness of the model in alternative contexts.

Fifth, the concurrent validity of the four-factor model should be studied in future research by measuring both 'collective learning' and a concept that is strongly associated with it. Wenger's social-constructivist concept of 'communities of practice' (CoP) might be considered as a concurrent measure, for team learning is frequently discussed alongside this concept (Garavan & McCarthy, 2008). De Laat and Simons (2002) argue that participation in CoPs is a powerful way to stimulate 'collective learning'. Research by Mittendorff et al. (2006, p. 310) confirms this view, by showing that groups that have many characteristics of a CoP are "likely to encompass more collective learning and more collective learning outcomes".

Sixth, data analysis in the present study did not take the institutional level into account, thereby losing information about the between-institute variance and running the risk of introducing bias in the results. Future research done with a larger and broader sample of institutions (schools) could circumvent these problems and explore relationships and effects at this level of analysis.

Methodological evaluation and directions for future research

A methodological limitation of the present study is that results are based on correlational data, implying that conclusions about causal mechanisms are of a tentative nature. Although confirmatory factor analysis is a widely used – and generally accepted – approach to study of psychometric aspects of measurement instruments on the basis of correlational data, we have to be particularly cautious with respect to the causal interpretation of relationships among the underlying factors in the process model of 'collective learning'. Correlation between these latent variables is a necessary condition to establish the presence of a causal relationship. However, despite theoretical plausibility of hypothesized effects, alternative relational structures of the process may be conceivable as well and may also be confirmed by the data. Despite the drawbacks of the correlational approach used in the present study, in our opinion the results obtained are valuable and useful to learn from, and allow us to gain insight into the collective learning concept and the relationships among its factors.

A second limitation of the present study is its cross-sectional nature. To really take into account the *process-based* nature of 'collective learning', a longitudinal research method should be applied. In future research, methods might be considered in which respondents are repeatedly measured over the course of time while participating in a process of collective learning.

4 The dynamics of learning and leadership: empirical study 1b

> If there is one thing you should stay clear of during change processes, it is holding lots of meetings about the intended change. Instead, just embark on the change by acting together, exchange experiences, reflecting together upon what works, and committing to the next step (De Caluwé & Vermaak, 2004, p. 202-204).

4.1 TESTING HYPOTHESES 1 – 4

As argued in Chapter 1, Universities of Applied Sciences are increasingly confronted with a dynamic and uncertain environment which requires continuous organizational development via adaptive learning. This means learning at the level of individual teachers and at the level of the teams in which teachers operate; predominantly this is about social forms of learning whereby the organization forms the context in which such learning takes place. With respect to leadership, a transformational leadership style is repeatedly emphasized to stimulate organizational learning and innovation in educational contexts (see Chapter 2). In the first part of Study 1 we used part of the obtained survey data to explore the nature of the collective learning concept by testing its hypothesized factor structure as well as a process model (see Chapter 3). In this chapter we present the results of analyzing a larger part of this data set to explore the interrelationship between 'collective learning', 'social individual learning' and 'transformational leadership', respectively. In the theoretical model, we specified our expectation that 'social individual learning' has a positive effect on 'collective learning', and that 'transformational leadership' has a positive effect on both types of learning. In the present study we therefore test the following three hypotheses (see also Figure 4.1).

Hypothesis 1: Social Individual Learning has a positive effect on Collective Learning.

Hypothesis 2: Transformational Leadership has a positive effect on Collective Learning.

Hypothesis 3: Transformational Leadership has a positive effect on Social Individual Learning.

Additionally, to improve the internal validity of the study we indicated the need to take into account a number of background variables, describing teachers' personal and situational characteristics. These characteristics might also influence teachers' perception of learning and might therefore provide alternative explanations for the relationships found between 'collective learning', 'social individual learning' and 'transformational leadership'. That is why, in the present study we test the (additional) effects of gender, age, educational level, and employment status (part-time or full-time) on the relationships between 'social individual learning', 'collective learning' and 'transformational leadership'. As such, we test the following hypothesis (see also Figure 4.1).

Hypothesis 4: The positive effects of Transformational Leadership on Social Individual Learning and Collective Learning, as well as the positive effect of Social Individual Learning on Collective Learning, if found, are still present when the variables teachers' gender, age, educational level, and employment status (part-time or full-time) are taken into account.

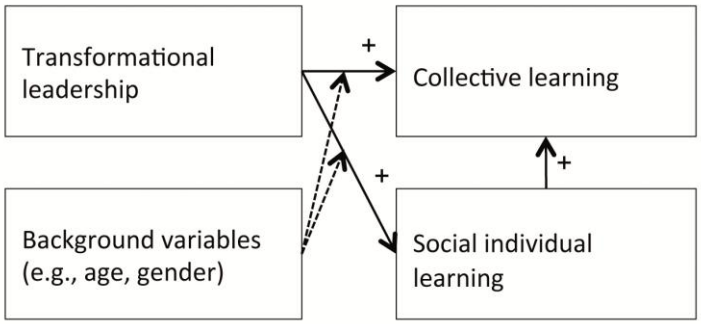

Figure 4.1. Relationships between Transformational Leadership, Collective Learning, and Social Individual Learning as hypothesized in the theoretical framework, as well as the potential moderating influence of background variables.

At the start of Study 1 we also intended to use the survey data to relate 'collective learning' to 'team performance' and 'team innovativeness' in order to test their hypothesized positive relationships (see Chapter 2). Most teachers in the sample, however, responded to the statements measuring team performance and innovativeness using the answer option 'I don't know'. As a result, the usable data obtained for both outcome measures was very limited and proved insufficient to allow for reliable statistical analysis. Consequently, the hypothesized relationships could not be tested in this study. The relationship between 'collective learning' and 'team results' will be addressed in Study 3 (Chapter 6), which uses a qualitative research method (i.e., a game simulation).

In this chapter, we first provide an overview of the measurement instruments used for 'social individual learning' and 'transformational leadership'. Subsequently, we present the study's research design, followed by the results of the statistical analyses with respect to testing and optimizing the measurement instruments for 'social individual learning' and 'transformational leadership'. Next, based on theoretical assumptions supplemented by insights gained from our analyses, we present two different approaches to model the relationships displayed in Figure 4.1. In line with the results of Chapter 3, a model is tested in which 'collective learning' is represented as a second-order factor, and a model is tested in which it is represented as a process with the sub-construct 'dialogue and inquiry' at its core. The chapter ends with a summary, conclusion and a critical reflection.

4.2 MEASUREMENT INSTRUMENTS

Social Individual Learning

In Chapter 2, 'social individual learning' is described as a collective process leading to individual outcomes. In the current study, three specific forms of 'social individual learning' are taken into account: 'learning from collaboration', 'learning from feedback', and 'learning from knowledge sharing'. The aspect 'learning from collaboration' is included, since many studies on continuous improvement in schools indicate that genuine collaboration is essential for learning and change (Fullan, 1991; Collinson et al., 2006). Moreover, Bolhuis and Simons (2001) acknowledge collaboration as a specific form of social interaction that is involved in 'social individual learning', Geijsel et al. (2009) indicate that teacher collaboration "has strong positive effects on professional development and change" (p. 410), and De Jong notes that "learning with the intention of innovating requires that relevant parties cooperate" (2010, p. 1). 'Learning from feedback' and 'learning from knowledge sharing' are included, because both are forms of social work-related learning that demonstrate teacher learning in the context of educational renewal (Runhaar, Sanders, Sleegers & Yang, 2011).

Drawing on the work of various authors, a measurement instrument was developed to quantitatively measure the construct of 'social individual learning'. Each of its aspects (e.g., 'learning from feedback') was measured by a set of items constituting a scale. Items were formulated as statements to which participants could express their agreement on a four-point rating scale with response categories '1' = I disagree, '2' = I somewhat agree, '3' = I agree and '4' = I strongly agree (see also Chapter 3). Scales and their respective items are discussed below; a complete overview is presented in Appendix C (Table C1).

Learning from Feedback. The items covering 'learning from feedback' were adapted from the 'asking for feedback' scale of the critically reflective work behavior instrument by Van Woerkom (2003). Three items (items 45, 47 and 61) were adapted for the educational context. Two items of the original scale were left out, because they did not seem to reflect asking for feedback on daily work activities and were too closely related to aspects of 'collective learning' (e.g., I discuss with colleagues what I find important in my work). We added one item we developed to the scale (item 52: 'I let colleagues observe my work'). In the educational context 'collective learning' might be hindered by the dominant culture, which is characterized by norms of privacy, isolation and autonomy (Ben-Peretz & Shonmann, 1998; Rait, 1995; Verbiest et al., 2005). Processes of collaboration and social learning require a sincere form of openness that is based on de-privatization of the work performed by individual teachers (Seashore Louis & Leithwood, 1998). Teachers who allow colleagues to observe their work demonstrate a willingness to de-privatize their work, thereby breaking through the isolated position of teachers. This might lead to an increase in solidarity and coherence as well as an increased capacity to learn and solve problems (Rowan, 1995).

Learning from Knowledge Sharing. The items covering 'learning from knowledge sharing' were derived from the 'knowledge sharing scale' by Van de Hooff and Huysman (2009). In order to limit the total length of the survey, only three of the original eight items were selected from this scale. One item (item 66) relates to gaining knowledge aimed at filling a knowledge gap (reactive learning behavior), one item (item 59) relates to gaining knowledge

by learning from others' strengths in order to develop personally and/or professionally (proactive learning behavior), and one item (item 37) relates to knowledge sharing with the goal to involve colleagues in one's own activities. We added one self-developed item to the scale (item 39: 'I discuss things I feel uncertain about with colleagues'). As Geijsel, Sleegers, van den Berg & Kelchtermans (2001) point out: "To fundamentally change teaching practices, the 'less convenient' emotions must also be placed on the educational agenda" (p. 158). In a traditional perspective on education teachers are selected because of their skilled understanding of the subject they are teaching (Meijers & Kuijpers, 2012). Such an expert status, resulting from 'knowing best', is not easily associated with taking a position of 'not knowing'. Therefore, uncertainty about one's own work might be considered an inconvenient emotion in the educational context, while, at the same time, it is inherent to learning.

Learning from Collaboration. The items covering 'learning from collaboration' were derived from the 'collaboration among teachers scale' by Geijsel et al. (2009). In order to limit the total length of the survey, only five of the original eight items were selected from this scale. The items measure the extent to which teachers experience a positive learning climate in terms of colleagues' interactive behavior. Such an environment is characterized by colleagues showing interest in one's work (item 36), giving positive feedback about one's teaching (item 22), discussing new teaching methods (item 31), giving support to experimentation with new teaching methods (item 27), and passing on things they have learned from further training (item 34).

Transformational Leadership

'Transformational leadership' is focused on realizing a culture change such that a working environment is created in which teachers work together optimally and in which they strongly identify themselves with the commonly created goals of the school (Ten Bruggencate, 2009). In educational settings, three core dimensions of 'transformational leadership' have been identified: vision building, providing intellectual support, and providing intellectual stimulation (Geijsel et al., 2009). Through identifying new opportunities for his/her team, developing (often collaboratively) and articulating a vision of the future, and by inspiring team members, a transformational leader contributes to vision building within his/her team (Geijsel et al., 2009; Leithwood, Jantzi & Steinbach, 1998). The vision "generates excitement, builds emotional attachment, and reinforces the personal and social identification of followers with the organization and thus increase collective cohesion.… As a consequence, … individuals may be more willing to internalize organizational goals, and may have more confidence in their ability to attain the vision" (Geijsel et al., 2009, p. 411). Individualized support represents practices on the part of the transformational leader that indicate his/her respect for individuals and his/her attempt to understand, recognize and satisfy teachers' feelings, concerns and needs while treating each teacher uniquely (Geijsel et al., 2009; Leithwood, Jantzi & Steinbach, 1998). Through individualized support, the transformational leader provides moral support, shows appreciation for the work of individual teachers and takes their opinion into account when making decisions (Mulford et al., 2004) and provides support for teachers' professional learning (Leithwood, Jantzi & Steinbach, 1998). Moreover, he/she assists teachers in linking their current needs to the team's goals (Geijsel et al., 2009), increasing their intrinsic motivation for their tasks. Through intellectual stimulation, the transformational leader challenges teachers' beliefs and assumptions about their work and stimu-

lates them to rethink how such work might be performed (Leithwood, Jantzi & Steinbach, 1998). In doing so, the transformational leader facilitates opportunities for teachers to learn from each other and models continual learning in his or her own practice (Mulford et al., 2004).

'Transformational leadership' is operationalized as a construct consisting of three sub-constructs, corresponding to each of the three dimensions identified above. Drawing on the work of Geijsel et al. (2009), a measurement instrument is developed to quantitatively measure the transformational leadership construct. Each dimension is measured by a set of items constituting a scale. Again, items are formulated as statements to which participants can express their agreement on a four-point rating scale with response categories '1' = I disagree, '2' = I somewhat agree, '3' = I agree and '4' = I strongly agree. Scales and their respective items are discussed below; a complete overview is presented in Appendix E (Table E1).

Initiating and identifying a vision. The first scale of 'transformational leadership' is adapted from the 'initiating and identifying a vision scale' by Geijsel et al. (2009) Items refer to the team leader's tendency to communicate the team's vision (item 70) and its impact on current actions (item 82), to define problems from the perspective of the vision (item 75), to explain the relationship between the vision and initiatives taken by the school board, alliances and the national government (item 79), and to refer to the team's objectives during the decision-making process (item 85).

Individualized support. The second scale of 'transformational leadership' is adapted from the 'providing for individualized support scale' by Geijsel et al. (2009). As was advised by Dr Geijsel in personal communications (March 4, 2009), one item (item 81) was added to the scale. Items represent practices on the part of the team leader that indicate respect for the beliefs of individual teachers (items 84), their feelings (item 87) and their ideas (item 81). Additionally, items cover the team leader's appreciation for teachers' attempts to improve their teaching (item 76) and his/her sensitivity to problems that teachers experience with the implementation of innovations (item 80).

Intellectual stimulation. The third scale of 'transformational leadership' is derived from the 'providing for intellectual stimulation scale' by Geijsel et al. (2009). As was advised by Dr Geijsel in personal communications (March 4, 2009), two items (items 73 and 86) were added to the scale. Items cover team leader's support for experimentation (items 71 and 78), innovation (items 74 and 86), work-related learning (item 83), and personal development (items 72, 73 and 77).

4.3 RESEARCH DESIGN

Procedure, participants, and subsamples

The analyses performed in this chapter are based on the data described in Chapter 3. Therefore, with respect to the design of the study and a description of the data, we refer the reader to Chapter 3. In this chapter a cross-validation approach (see Chapter 3) is applied to explore and subsequently test the hypothesized structure underlying the social individual

learning and transformational leadership concepts and to test the hypothesized interrelationships among 'collective learning', 'social individual learning' and 'transformational leadership'. For this purpose, a random division was performed on the sample to create two subsamples: explorative subsample A, and validation subsample B. After assigning each team a unique identification number, the sample was split in odd-numbered teams and even-numbered teams. Comparison of both subsamples shows that they are highly similar with respect to the variables indicated and that differences are only minor. Subsample B includes slightly more participants aged 30-39 years and fewer aged 50-59 years, somewhat more females, more participants who have completed a study at the Masters' level and more full-time employees. For a more elaborate description of subsamples A and B reference is made to these in Chapter 3. Since, in the present chapter, the influence of background variables (Hypothesis 4) is tested on the *entire* sample (see subsequent section) we now also provide a description of the total sample (including the exploration and validation subsample).

The total sample is made up of 476 teachers, each respondent being a member of one of the 36 teacher teams included in the sample. These teams were selected from 8 different Universities of Applied Sciences, both from urban and rural areas, each involved in one or more of the following fields: Education, Economics and Management, Healthcare, Technology, and Agriculture. Of these participants the majority were aged 40 years or over (40-49 years, 31.4%; 50-59 years, 27.1%), followed by the group aged 30-39 years (25.0%) and the group aged 20-29 years (9.3%). A small group was aged 60 years or over (5.5%), one participant (0.2%) was under 20 years of age (0.2%), and 1.5% did not indicate age. Of the participants, 47.9% is male, 50.4% is female and 1.7% did not indicate gender. The majority of the participants (62.1%) successfully completed a study at the Masters' level (i.e., Research University), 34.5% at the level of higher vocational education (i.e., University of Applied Sciences), a few teachers (1.9%) – instructors of practical skills – at the level of vocational education; 1.5% did not specify his or her educational background. Most participants (46.6%) were employed part-time, but dedicated more than two days a week to their respective teacher teams, 37.5% was employed full-time, 13.8% was employed one or two days a week, and 2.1% did not indicate their employment status.

Statistical analyses

As with 'collective learning', the hypothesized factor structure of the social individual learning and transformational leadership constructs was optimized and tested. Scales underlying the factors as well as the factor structure itself were optimized by means of multilevel covariance structure analysis (see Muthén, 1994) using the EQS 6.1 program (Bentler & Wu, 2002; Bentler, 2005). For additional information and further details concerning these analyses we refer to Chapter 3. Again, analyses were performed on the within-team covariance matrix, thereby correcting statistically for the nested structure of the data. The need to correct for this structure did not need to be assessed prior to the analyses, for it was already implied by the decision to correct the data on 'collective learning'. After identifying and testing the underlying factor structures for 'social individual learning' and 'transformational leadership', the constructs were related to 'collective learning' using structural equation modeling. So-called 'full structural equation models' (cf. Byrne, 2006) were formulated and tested, in which the measurement models for 'collective learning', 'social individual learning' and 'transformational leadership' were mixed with a model for the interrelationships between

the latent variables representing these three main constructs and/or their sub-constructs, i.e. their constituting factors. Based on theoretical assumptions and supported by the obtained correlations among the latent variables (see Appendix H, Table H1 and H2), two different approaches were taken to model the underlying relationships among the latent variables. The first model takes the second-order factor structure of 'collective learning' as a base (see Chapter 3). Here, the central, underlying variable is the second-order, latent variable 'collective learning', and the four factors associated with it (i.e., 'shared vision', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection') are considered indicators of this central variable (modeled as first-order, latent variables). A graphical representation is provided in Chapter 3, Figure 3.1. The second model takes the process model as a base. Here, the factor 'dialogue and inquiry' is assumed to be the central factor positively influencing the other factors of the collective learning process (i.e., 'shared vision', 'collective action', and 'evaluation and reflection'). A graphical representation is provided in Chapter 3, Figure 3.4. In both models we tested the interrelationships between the constructs 'social individual learning', 'collective learning' and 'transformational leadership', as hypothesized in the present study (Hypotheses 1 – 3). Structural relationships between the latent variables were tested using *z*-tests. Analyses were performed by means of multilevel covariance structure modeling, using the EQS 6.1 program (Bentler & Wu, 2002; Bentler, 2005). In the results section, standardized solutions, displaying standardized regression coefficients, are provided to present model estimates.

Finally, we examined whether the effects of 'transformational leadership' on 'social individual learning' and 'collective learning', as well as the effect of 'social individual learning' on 'collective learning' (if present) remain when the variables teachers' gender, age, educational level, and employment status are taken into account (Hypothesis 4). In examining this hypothesis we focused on the part of the structural equation model containing the interrelationships among the latent variables, the so-called 'structural model'. The question whether the hypothesized effects among the latent variables (see Hypotheses 1 – 3) are still present when the aforementioned set of background variables is taken into account, translates into the question whether the relationships specified in the structural model are similar within the different subgroups of participants that are defined by these background variables. More specifically, are the estimated model relationships similar for female as well as for male participants, for young as well as for older participants, for participants working full-time as well as for those working part-time, etc.? A straightforward approach to answering these questions in this case, is to reformulate the structural model as a multilevel multiple regression model, in which the possible effects of the background variables upon the structural model relationships are included as interaction variables that serve as predictors. In such a model, either 'collective learning' or 'social individual learning' serves as the dependent variable. The set of background variables, 'social individual learning' and/or 'transformational leadership' (depending upon the particular relationship tested), and their interactions serve as predictor variables. Hypothesis 4 is supported if the effects of 'social individual learning' and/or 'transformational leadership' on 'collective learning' are still significant and strong when all (main and interaction) effects associated with the background variables are included in the model. This support is even more convincing if at the same time all (main and interaction) effects associated with the background variables themselves are not significant (or significant but small).

Because 'collective learning' plays the role of the dependent variable, it was decided to take the first full structural equation model mentioned above as a starting point for this analysis, that is, the model in which 'collective learning' is modeled as a second-order factor with an underlying four-factor structure. To arrive at the regression set-up, 'manifest' versions of the latent variables were estimated by determining the mean of the items in a scale to form scale-scores. In a subsequent step for the second-order, latent variables 'collective learning' and 'transformational leadership' the weighted average of the (first-order) scales was taken to determine construct-scores. Weights for the scales were taken from the four-factor model of 'collective learning', and the three-factor model of 'transformational leadership', respectively. Because of their categorical nature, background variables were included using dummy-coding. In order to reduce the correlation between the interaction variables and their constituting main effects (e.g., the correlation between the variable 'transformational leadership' and the interaction variable 'transformational leadership x age') predictor variables in all models were centered around the grand mean. Regression (fixed) effects were tested using *z*-tests, variance components were tested by χ^2-tests (cf. Hox, 2010). All multilevel regression models were estimated using the MLwiN 2.20 program (Rasbash, Charlton, Browne, Healy & Cameron, 2009). Because in this final step of data analysis no model generation and validation was involved, multilevel regression modeling was performed on the entire sample (n = 472).

4.4 RESULTS

Optimization and testing of measurement instruments

In this section we explore, optimize and subsequently test the hypothesized structure underlying the constructs social individual learning and transformational leadership. As this procedure of post hoc model modification involves considerable risk of being based on chance, results are interpreted from the theoretical perspective presented in Chapter 2, and changes to the hypothesized structure are made in accordance with that. In addition, analyses are performed on exploration subsample A, and the re-specified models are tested in validation subsample B (cf. McCallum & Austin, 2000). The resulting measurement models are used to test the interrelationships between 'collective learning', 'social individual learning' and 'transformational leadership' in full structural equation models.

1. Social Individual Learning

With respect to 'social individual learning', three forms of learning ('learning from knowledge sharing', 'learning from feedback', and 'learning from collaboration') were included in the theoretical framework. The respective scales (see Appendix C, Table C1) as well as the hypothesized factor structure of 'social individual learning' were explored. Each of the three factors could be identified. All items relating to 'learning from knowledge sharing' and 'learning from feedback' held up in their one-factor models ($\lambda \geq 0.40$). However, given the high correlation between the factors (r = 0.98) and the underlying conceptual similarity between the scales – both represent an individual teacher's attempt to improve his/her own performance using colleagues' input – they were combined into a new factor, subsequently referred to as 'individual learning in interaction'. In hindsight, this factor seemed to be of a

different nature than the factor 'learning from collaboration'. While the former relates to learning-oriented action by teachers themselves, the latter represents the extent to which they experience a positive learning climate in terms of their colleagues' behavior. It might therefore more accurately be referred to as 'colleague support in learning'. Because of its contextual nature, the variable 'colleague support in learning' was not taken into account in any of the further analyses. Of the remaining scale, six items were removed based on their factor loading or high residual load. The resulting final (one-factor) model is made up of one scale which contains eight out of fourteen items that were originally included in the analysis (see Appendix D, Table D1). This narrowed-down version of 'social individual learning', further referred to as 'individual learning in interaction', only includes items relating to teachers' own learning-oriented initiatives.

Table 4.1 shows the values for the array of indices used to assess the fit of the final model in the explorative subsample A. The model shows a good fit to the data based on three fit measures ($\chi^2/df < 2$, *NNFI* and *CFI* ≥ 0.95), and an adequate fit on two measures (*RMSEA* = 0.06 and *SRMR* = 0.06). In order to cross-validate the modified model, this procedure was repeated for subsample B. The results show a slightly improved fit, with a good fit to the data on four fit measures ($\chi^2/df < 2$, *NNFI* and *CFI* ≥ 0.95, *RMSEA* < 0.06) and an adequate fit on one fit measure (*SRMR* = 0.06). In summary, we can state that the modified model for 'individual learning in interaction' fits the data well.

Table 4.1
Values of the different fit indices computed for the Individual Learning in Interaction scale, for both subsamples A and B

	χ^2	*df*	χ^2/df	***RMSEA* (90% *CI*)**	***NNFI***	***CFI***	***SRMR***
Subsample A	21.95	20	1.10	0.021 (0.000 – 0.063)	0.997	0.997	0.021
Subsample B	33.77	20	1.69	0.056 (0.019 – 0.088)	0.957	0.975	0.056

For both subsamples A and B, factor loadings (λ) and corresponding standard errors (*SE*) of the final scales are presented in Table 4.2. The factor loadings for subsample A fall within the range 0.45 – 0.85 (*M* = 0.63). For subsample B the factor loadings fall within the range 0.41 - 0.73 (*M* = 0.59). All loadings are highly significant (all *z*-values > 3.50, p < 0.0005).

Reliability estimates (Cronbach's α) for the 'individual learning in interaction scale' in the final model were computed for both subsamples A and B. In subsample A, α = 0.84 and in subsample B, α = 0.81. Hence, the reliability of the 'individual learning in interaction scale' can be considered good.

Table 4.2
Factor loadings (λ) and standard errors (SE) in the final models for all items of Individual Learning in Interaction, for both subsamples A and B

Item	Subsample A *λ* (*SE*)	Subsample B *λ* (*SE*)
37	0.62 (0.05)	0.62(0.05)
40	0.61 (0.05)	0.68 (0.05)
45	0.45 (0.06)	0.41 (0.06)
47	0.58 (0.05)	0.63 (0.05)
48	0.59 (0.05)	0.54 (0.06)
57	0.73 (0.04)	0.64 (0.05)
59	0.57 (0.05)	0.47 (0.06)
64	0.85 (0.03)	0.73 (0.04)

2. Transformational Leadership

With respect to 'transformational leadership', three dimensions ('initiating vision', 'intellectual stimulation', and 'individualized support') were distinguished in the theoretical model. The respective scales (see Appendix E, Table E1) as well as the hypothesized factor structure of the leadership construct were explored. In the CFA all three factors could be identified. The one-factor models showed that all items associated with the factors were relevant indicators ($\lambda > 0.40$).

Table 4.3 shows the values for the array of indices used to assess the fit of the three-factor model in the explorative subsample A. The model shows a good fit to the data on four fit measures ($\chi^2/df < 2$, *NNFI* and *CFI* ≥ 0.95, and *SRMR* < 0.05) and an adequate fit on one measure (*RMSEA* = 0.06). The upper limit of the confidence interval for the *RMSEA* exceeds the cut off value for a good model as suggested by Hu and Bentler (1995), but it is within the [0.05-0.08] interval, by Browne and Cudeck (1993) associated with a model that has reasonable errors of approximation (Byrne, 2006). In order to cross-validate the model, this procedure was repeated for subsample B. The results in Table 4.3 show a slightly reduced fit as compared to subsample A results, with a good fit to the data on three fit measures (*NNFI* and *CFI* ≥ 0.95, and *SRMR* < 0.05) and an adequate fit on two fit measures (*RMSEA* = 0.06 and $\chi^2/df = 2$). Again, the upper limit of the confidence interval for the *RMSEA* is within the [0.05-0.08] interval, which according to Browne and Cudeck (1993) is associated with a model that has reasonable errors of approximation (Byrne, 2006). In summary, we can state that the (unmodified) model for 'transformational leadership' fits the data well.

Table 4.3
Values of the different fit indices computed for the final three-factor model of Transformational Leadership, for both subsamples A and B

	χ^2	*df*	χ^2/df	*RMSEA* (90% *CI*)	*NNFI*	*CFI*	*SRMR*
Subsample A	243.54	132	1.84	0.062 (0.050-0.074)	0.981	0.984	0.048
Subsample B	276.13	132	2.09	0.071 (0.059-0.082)	0.982	0.970	0.041

For both subsamples, factor loadings (*λ*) and their corresponding standard errors (*SE*) of the final three-factor model are presented in Table 4.4. The factor loadings for subsample A fall within the range 0.63 – 0.82 (*M* = 0.73); for subsample B they fall within the range 0.66 – 0.83 (*M* = 0.76). All loadings are highly significant (all *z*-values > 3.50, *p* < 0.0005).

Table 4.4
Factor loadings (λ) and corresponding standard errors (SE) for all items in the final three-factor model measuring Transformational Leadership, in both subsamples A and B

	Item	Subsample A *λ* (*SE*)	Subsample B *λ* (*SE*)
Initiating vision	70	0.73 (0.04)	0.73 (0.04)
	75	0.75 (0.04)	0.80 (0.03)
	79	0.79 (0.03)	0.74 (0.04)
	82	0.77 (0.03)	0.77 (0.03)
	85	0.64 (0.05)	0.72 (0.04)
Intellectual stimulation	71	0.72 (0.04)	0.76 (0.03)
	72	0.63 (0.04)	0.73 (0.03)
	73	0.72 (0.04)	0.76 (0.03)
	74	0.68 (0.04)	0.81 (0.03)
	77	0.74 (0.03)	0.75 (0.03)
	78	0.69 (0.04)	0.66 (0.04)
	83	0.71 (0.04)	0.74 (0.03)
	86	0.73 (0.04)	0.76 (0.03)
Individualized support	76	0.66 (0.04)	0.75 (0.03)
	80	0.80 (0.03)	0.83 (0.03)
	81	0.82 (0.03)	0.82 (0.03)
	84	0.80 (0.03)	0.80 (0.03)
	87	0.67 (0.04)	0.69 (0.04)

Reliability estimates (Cronbach's *α*) for the scales corresponding to the three factors for both subsamples A and B in the final model, are presented in Table 4.5. Results show that values for *α* are in the range 0.85 to 0.91, that is, they can be considered very good.

Table 4.5
Reliability estimates (Cronbach's α) for the scales corresponding to the three factors in the final model measuring Transformational Leadership, for both subsamples A and B

	Cronbach's *α*	
	Subsample A	**Subsample B**
Initiating vision	0.86	0.88
Individualized support	0.89	0.91
Intellectual stimulation	0.85	0.87

Table 4.6 presents the factor correlations in the final three-factor model for both subsamples. Clearly, there are strong relationships between the three factors, though most notably between 'intellectual stimulation' and 'individualized support'. Similar results were found by other researchers, working with the Multifactor Leadership Questionnaire (e.g., Avolio, Bass & Jung, 1999; Bycio, Hackett & Allen, 1995; Den Hartog, Van Muijen & Koopman, 1994; Lievens, Van Geit & Coetsier, 1997; Tepper & Percy, 1994). In the field of education, high correlations were also found by Geijsel et al. (2009), who provided the basis for the measurement instrument for 'transformational leadership' used in the present study. Two approaches can be used to measure what accounts for the high inter-correlations among the factors. First, we can model 'transformational leadership' using a one-factor model including all items (e.g., Lievens et al, 1997). Second, we can model 'transformational leadership' as a second-order, latent variable (factor) (e.g., Bass, 1985). Because of the theoretical distinctions between the dimensions of 'transformational leadership', we decided to include it as a second-order, latent variable in the structural models (see below). In this approach, the central variable is the second-order, latent variable 'transformational leadership', and the three factors (i.e., dimensions) associated with it are considered indicators of this central, underlying variable (modeled as first-order latent variables). The factors themselves are measured by means of the items presented in Table 4.4. As such, a manager's transformational leadership style is considered an underlying general latent variable explaining the high inter-correlations among the three distinct (first-order) factors that make up the transformational leadership construct.

Table 4.6
Factor correlations and standard errors (between brackets) for the final three-factor model measuring Transformational Leadership, in both subsamples A and B

	Initiating vision	**Intellectual stimulation**
Initiating vision	–	
	–	
Intellectual stimulation	A 0.75 (0.04)	–
	B 0.87 (0.03)	–
Individualized support	A 0.72 (0.04)	A 0.88 (0.03)
	B 0.78 (0.04)	B 0.92 (0.02)

Hypothesized models examining relationships between Collective Learning, Individual Learning in Interaction, and Transformational Leadership

Based on theoretical assumptions, two approaches were followed in formulating a structural equation model for the interrelations among the leadership and learning constructs (see Figure 4.2 and 4.3; ovals indicate latent or indirectly measured variables; since the particular measurement models for each latent variable were discussed above, they were omitted from the graphs). Following the ideas developed in Chapter 3, Model 1 takes the second-order factor model of 'collective learning' as a base and Model 2 takes the process model of 'collective learning' as a base. Both models of 'collective learning' were developed in the first part of Study 1 (1a). As described below, in both models, the latent variable 'collective lear-

ning' is related to the latent variables 'individual learning in interaction' and 'transformational leadership', that match the respective constructs.

Model 1. In Model 1 (Figure 4.2), 'transformational leadership' predicts 'individual learning in interaction' and 'collective learning', and 'individual learning in interaction' in turn predicts 'collective learning'. In this model, 'collective learning' is modeled as a second-order factor including the first-order factors 'shared vision', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'. 'Transformational leadership' is modeled as a second-order factor including the first-order factors 'initiating vision', 'individualized support', and 'intellectual stimulation'. Model 1 intends to test our main hypotheses that, in teacher teams, 'individual learning in interaction' has a positive effect on 'collective learning' (Hypothesis 1), and that 'transformational leadership' has a positive effect on both 'collective learning' (Hypothesis 2), and 'individual learning in interaction' (as a narrowed-down version of 'social individual learning') (Hypothesis 3).

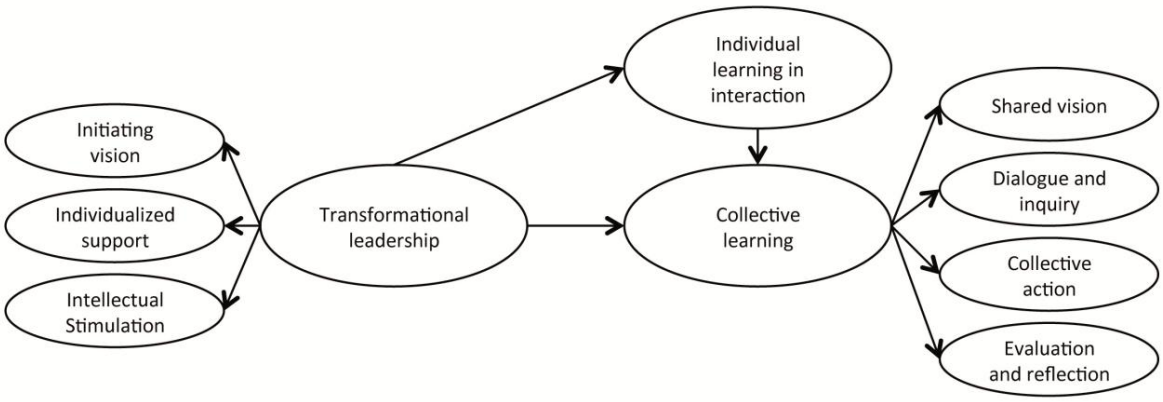

Figure 4.2. Model 1, specifying the structural relationships among Transformational Leadership, the different sub-constructs of Collective Learning taken together in a second-order factor model, and Individual Learning in Interaction.

Model 2. In Model 2 (Figure 4.3) comparable relationships are specified as in Model 1, though 'collective learning' is now conceptualized by means of the process model developed in the previous chapter. As such, 'transformational leadership' and 'individual learning in interaction' are assumed to have a positive effect on 'dialogue and inquiry', which in turn is assumed to have positive effects on 'shared vision', 'collective action', and 'evaluation and reflection', respectively. Model 2 is based on the idea we developed in the first part of Study 1 (1a), that the level and quality of processes of 'dialogue and inquiry' strongly influence the other aspects of the collective learning process (i.e., the process model of 'collective learning'). Relating 'collective learning' to 'individual learning in interaction', Model 2 hypothesizes that 'individual learning in interaction' specifically affects 'dialogue and inquiry'. Both aspects of learning are highly dependent on open and respectful communication, and teachers used to such communication in their personal learning processes ('social individual learning') are assumed to be more open in the process of dialogue and inquiry than teachers who are less used to such communication. Moreover, Model 2 hypothesizes that

'transformational leadership' indirectly affects the collective learning process, by affecting 'dialogue and inquiry'.

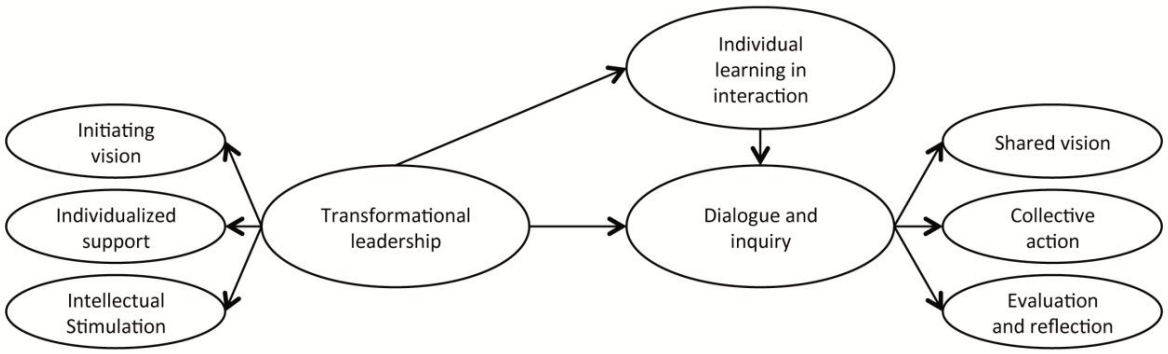

Figure 4.3. Model 2, specifying the structural relationships among Transformational Leadership, the different sub-constructs of Collective Learning mutually related in a process model, and Individual Learning in Interaction.

Model exploration and validation for the hypothesized structural models

The multilevel approach that was taken in the previous chapter to evaluate and optimize the measurement instrument for 'collective learning' was empirically justified by the estimated intra-class correlations (*ICCs*) of all items of 'collective learning'. For the present part of the study, we also checked the *ICCs* for all items measuring the additional constructs 'individual learning in interaction' and 'transformational leadership', respectively. Results are presented in Appendix F (Table F1). Regarding the full structural equation models developed above, the *ICCs* of the items measuring both additional constructs support a multilevel approach as well. Furthermore, in Appendix G (Table G1) we give descriptives for the (sub-)scales we computed on the basis of the obtained factor solutions in both subsamples for 'individual learning in interaction' and 'transformational leadership' (this chapter), as well as for 'collective learning' (see Chapter 3). Table G1 shows that the pattern of averages, standard deviations and ranges is highly similar in both subsamples A and B. Inspecting averages and standard deviations of the scales, all scales can be said to adequately discriminate among the participants (teachers). It was therefore decided that the scales could safely be used as 'manifest' versions of the latent variables they represent for our final modeling step, testing Hypothesis 4.

Model 1. Table 4.7 presents the values of all indices used to assess the fit of Model 1 to the data in the explorative subsample A, and the validation subsample B, respectively. For this model, fitted in the explorative subsample A, four fit indices indicate a good fit to the data ($\chi^2/df < 2$, *NNFI* and *CFI* > 0.95, *RMSEA* < 0.06 and the upper bound of the *RMSEA* confidence interval being equal to the cut-off value for a good fitting model), whereas one index indicates a moderate fit (*SRMR* = 0.07). The regression coefficients, or estimated effect parameters (*B*) corresponding to all hypothesized effects among the latent variables were highly significant (all *z*-values > 3.50, $p < 0.0005$) and positive (effect of 'transformational leadership' on 'individual learning in interaction', $B = 0.241$, $SE = 0.047$, and on 'collective

learning', *B* = 0.232, *SE* = 0.054, effect of 'individual learning in interaction' on 'collective learning', *B* = 0.410, *SE* = 0.097, respectively; effect of 'transformational leadership' on 'initiating vision', *B* = 0.593, *SE* = 0.043, on 'individualized support', *B* = 0.592, SE = 0.044, and on 'intellectual stimulation', *B* = 0.654, *SE* = 0.038, respectively; effect of 'collective learning' on 'shared vision', *B* = 0.932, *SE* = 0.190, on 'dialogue and inquiry', *B* = 1.107, *SE* = 0.215, on 'collective action', *B* = 0.722, *SE* = 0.164, and on 'evaluation and reflection', *B* = 1.170, *SE* = 0.227).

Table 4.7
Values of the different fit indices computed for model 1 in the explorative subsample A, and the validation subsample B, respectively

	χ^2	*df*	χ^2/df	*RMSEA* (90% *CI*)	*NNFI*	*CFI*	*SRMR*
Subsample A	2003.19	1265	1.58	0.052 (0.047-0.056)	0.968	0.970	0.073
Subsample B	2113.22	1264	1.67	0.055 (0.051-0.059)	0.970	0.971	0.073

Retest results for Model 1 show a slightly reduced, though still good fit of Model 1 in subsample B, as compared with results in subsample A. Four fit measures indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95, *RMSEA* < 0.06 and the upper limit of the *RMSEA* confidence interval being equal to the cut-off value for a well-fitting model), whereas one index indicates a moderate fit (*SRMR* = 0.07). Results for subsample B show highly significant, positive regression coefficients (all *z*-values > 3.50, *p* < 0.0005) for all hypothesized effects as well (effect of 'transformational leadership' on 'individual learning in interaction', *B* = 0.369, *SE* = 0.047, and on 'collective learning', *B* = 0.241, *SE* = 0.060, respectively; effect of 'individual learning in interaction' on 'collective learning', *B* = 0.590, *SE* = 0.137). This is also seen in the effect of 'transformational leadership' on 'initiating vision', *B* = 0.629, *SE* = 0.042, on 'individualized support', *B* = 0.671, *SE* = 0.037, and on 'intellectual stimulation', *B* = 0.736, *SE* = 0.032, respectively and in the effect of 'collective learning' on 'shared vision', *B* = 0.626, *SE* = 0.130, on 'dialogue and inquiry', *B* = 0.855, *SE* = 0.159, on 'collective action', *B* = 0.754, *SE* = 0.148, and on 'evaluation and reflection', *B* = 0.761, *SE* = 0.149). Summarizing, we can state that Model 1 provides a satisfactory model for showing this particular pattern of relationships (i.e., effects), among 'transformational leadership', 'individual learning in interaction' and 'collective learning'.

Figures 4.4 and 4.5 present the standardized solutions (displaying standardized regression coefficients, β) for the structural relationships among the latent variables in Model 1, fit in both subsamples A and B. For the factor loadings of the measurement models corresponding to each latent variable we refer to the section 'Model generation and validation' in Chapter 3 and the section 'Optimization and testing of measurement instruments' in this chapter. The set of factor loadings found for Model 1 is highly similar to the loadings found in the confirm factor analysis models reported in these sections[8].

[8] In testing the structural model in sub sample B, one item of the scale 'individual learning in interaction' (item 45) showed a factor loading with a value less than 0.40 (λ = 0.34, output not included). In the discussion section we will elaborate on possible explanations for the relatively low factor loading of this item, compared to the other items in the scale 'individual learning in interaction'.

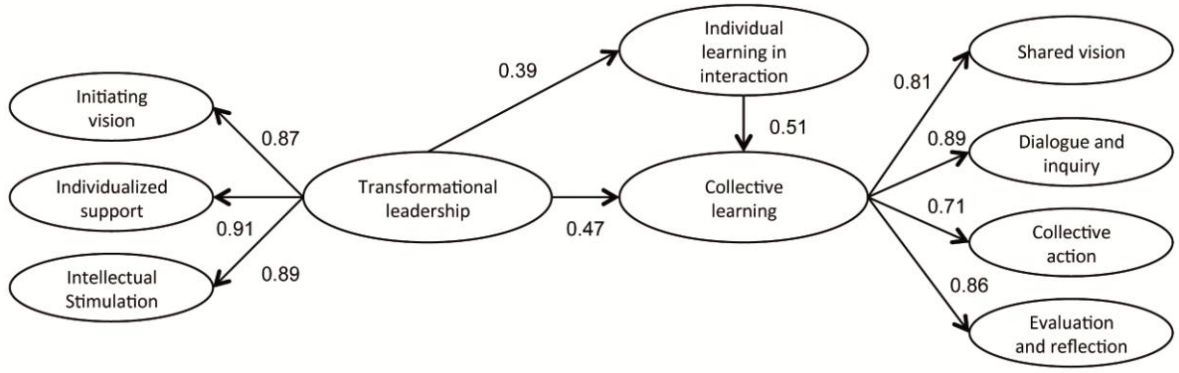

Figure 4.4. Standardized solution (displaying standardized regression coefficients) for Model 1, fit in the explorative subsample A.

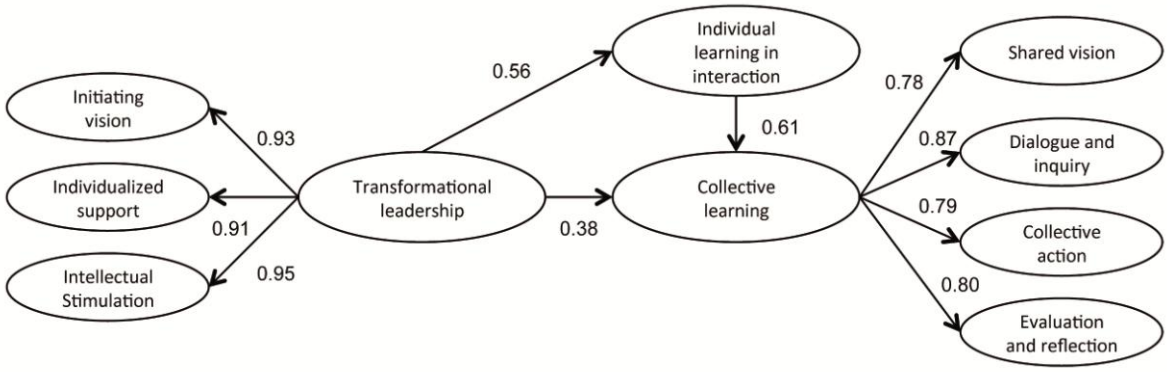

Figure 4.5. Standardized solution (displaying standardized regression coefficients) for Model 1, fit in the validation subsample B.

Interpreting the regression coefficients, results in both subsamples show that 'individual learning in interaction' and 'transformational leadership' both contribute to predicting 'collective learning' when it is modeled as a second-order construct. Additionally, 'transformational leadership' contributes to predicting 'individual learning in interaction'. In other words, teachers who perceive their managers as having a more transformational leadership style, or that perceive themselves to undertake more learning-oriented actions, also perceive a higher level of 'collective learning' in their teams. Moreover, teachers who perceive a higher level of 'transformational leadership' also perceive a higher level of 'individual learning in interaction'. Given the second-order factor structure of 'collective learning', the variables 'transformational leadership' and 'individual learning in interaction' contribute likewise to the prediction of each of the four discerned aspects (i.e., factors) of the collective learning process, namely: 'shared vision', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'. Such results lend support to our hypotheses that 'individual learning in interaction' (as a narrowed-down version of 'social individual learning') has a positive effect on 'collective learning' (Hypothesis 1), and that 'transformational leadership has a positive effect on both 'collective learning' (Hypothesis 2), and 'individual learning in interaction' (Hypothesis 3). Additionally, it can be observed from Figures 4.4 and 4.5 that in

both subsamples, the effect of 'individual learning in interaction' on 'collective learning' exceeds the effect of 'transformational leadership' on 'collective learning', though in subsample A the difference is only marginal. However, 'transformational leadership' also has an indirect effect on 'collective learning', via 'individual learning in interaction'. Notably, in subsample B the effect of 'transformational leadership' on 'individual learning in interaction' is stronger than in subsample A (β = 0.56 and β = 0.39 respectively).

While results in both subsamples lend support to the confirmation of the hypothesized positive relationships among 'transformational leadership', 'collective learning' and 'individual learning in interaction' when modeling 'collective learning' as a second-order construct, some differences between subsample A and B can also be observed. First, in subsample A, the effect of 'transformational leadership' on 'collective learning' exceeds the effect of 'transformational leadership' on 'individual learning in interaction' (β = 0.47, and β = 0.39, respectively), whereas in subsample B, the effect of 'transformational leadership' on 'individual learning in interaction' exceeds the effect of 'transformational leadership' on 'collective learning' (β = 0.56, and β = 0.38, respectively). Such result seems to imply that in subsample A the degree to which teachers perceive their manager's leadership style as transformational, contributes most to their perception of the presence of 'collective learning' in the team, while in subsample B the degree to which teachers perceive their manager's leadership style as transformational contributes most to their perception of the presence of 'individual learning in interaction', or the extent to which they undertake learning-oriented actions (though, conform Hypotheses 1 and 2, in subsamples A and B both effects are positive and significant). Second, in subsample A the effects of 'individual learning in interaction' and 'transformational leadership' on 'collective learning' are highly comparable (β = 0.51, and β = 0.47, respectively), whereas in subsample B the effect of 'individual learning in interaction' on 'collective learning' clearly exceeds the effect of 'transformational leadership' on 'collective learning' (β = 0.61, and β = 0.38, respectively). Such result seems to imply that in subsample A the contribution of 'individual learning in interaction' and 'transformational leadership' to teachers' perception of 'collective learning' is substantially equal, while in subsample B the extent to which teachers undertake learning-oriented actions contributes more to teachers' perception of 'collective learning' than the degree to which they perceive their manager's leadership style as transformational (while, conform Hypothesis 2, both effects are positive and significant). However, it remains unclear whether differences in the results of both subsamples reflect substantial differences in the size of the effects, or whether they are due to a certain amount of sample variation.

Model 2. Table 4.8 presents the values of all indices used to assess the fit of Model 2 to the data in the explorative subsample A, and the validation subsample B, respectively. For this model, fit for the explorative subsample A, four fit indices indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95, *RMSEA* < 0.06 and the upper limit of the *RMSEA* confidence interval being equal to the cut-off value for a well-fitting model), whereas one index indicates a moderate fit (SRMR = 0.08). The regression coefficients, or estimated effect parameters (*B*) corresponding to all hypothesized effects among the latent variables were highly significant (all *z*-values > 3.50, *p* < 0.0005) and positive (effect of 'transformational leadership' on 'individual learning in interaction', *B* = 0.240, *SE* = 0.047, and on 'dialogue and inquiry', *B* = 0.274, *SE* = 0.041, respectively; also the effect of 'individual learning in interaction' on 'dialogue and inquiry', *B* = 0.489, *SE* = 0.075) and the effect of

'transformational leadership' on 'initiating vision', *B* = 0.591, *SE* = 0.043, on 'individualized support', *B* = 0.595, *SE* = 0.044, and on 'intellectual stimulation, *B* = 0.654, *SE* = 0.038, respectively; effect of 'dialogue and inquiry' on 'shared vision', *B* = 0.751, *SE* = 0.091, on 'collective action', *B* = 0.551, *SE* = 0.088, and on 'evaluation and reflection', *B* = 0.924, *SE* = 0.096).

Table 4.8
Values of the different fit indices computed for Model 2 in the explorative subsample A, and the validation subsample B, respectively

	χ^2	*df*	χ^2/df	*RMSEA* (90% *CI*)	*NNFI*	*CFI*	*SRMR*
Subsample A	2008.58	1266	1.59	0.052 (0.047-0.056)	0.968	0.969	0.075
Subsample B	2129.93	1266	1.68	0.056 (0.052-0.060)	0.969	0.971	0.075

Retest results for Model 2 show a slightly decreased, though still a good fit of Model 2 in subsample B, as compared to results in subsample A. Four fit measures indicate a good fit to the data (χ^2/df < 2, *NNFI* and *CFI* > 0.95, *RMSEA* < 0.06 and the upper limit of the *RMSEA* confidence interval being equal to the cut-off value for a well-fitting model), whereas one index indicates a moderate fit (*SRMR* = 0.08). Results for subsample B show highly significant, positive regression coefficients (all *z*-values > 3.50, *p* < 0.0005) for all hypothesized effects as well (effect of 'transformational leadership' on 'ndividual learning in interaction', *B* = 0.368, *SE* = 0.047, and on 'dialogue and inquiry', *B* = 0.242, *SE* = 0.044, respectively; effect of 'individual learning in interaction' on 'dialogue and inquiry', *B* = 0.487, *SE* = 0.077. This is also the case with the effect of 'transformational leadership' on 'initiating vision', *B* = 0.627, *SE* = 0.042, on 'individualized support', *B* = 0.672, *SE* = 0.037, and on 'intellectual stimulation, *B* = 0.736, *SE* = 0.032, respectively; and with the effect of 'dialogue and inquiry' on 'shared vision', *B* = 0.671, *SE* = 0.088, on action', *B* = 0.697, *SE* = 0.086, and on 'evaluation and reflection', *B* = 0.791, *SE* = 0.090). Summarizing, we can state that Model 2 provides a satisfactory model for this particular pattern of relationships, i.e. effects, among 'transformational leadership', 'individual learning in interaction' and the process model of 'collective learning'.

Figures 4.6 and 4.7 present the standardized solutions (displaying standardized regression coefficients, β) for the structural relationships among the latent variables in Model 2, fit for both subsamples A and B. For the factor loadings of the measurement model corresponding to the factors we refer to the section 'Model generation and validation' in Chapter 3, and the section 'Optimization and testing of measurement instruments' in this chapter. The sets of factor loadings found for Model 2 are highly similar to the loadings found for the confirmatory factor analysis models reported in these sections[9].

[9] As with Model 1, in testing the structural model in sub sample B, one item of the scale 'individual learning in interaction' (item 45) showed a factor loading with a value less than 0.40 (λ = 0.34). In section 4.5.3 (Discussion) we will elaborate on possible explanations for the relatively low factor loading of this item, compared to the other items in the scale 'individual learning in interaction'.

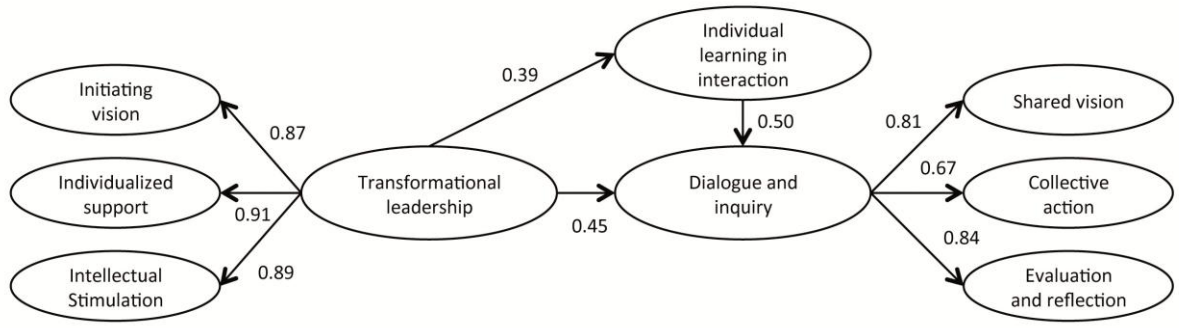

Figure 4.6. Standardized solution (displaying standardized regression coefficients) for Model 2, fit in the explorative subsample A.

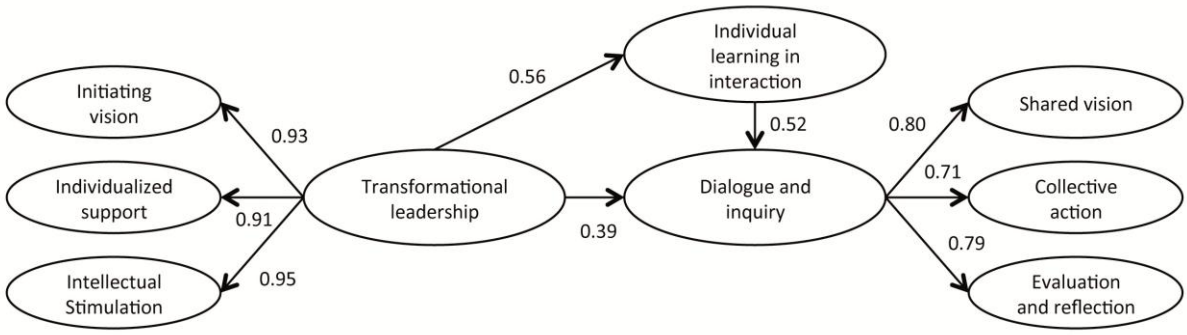

Figure 4.7. Standardized solution (displaying standardized regression coefficients) for Model 2, fit in the validation subsample B.

Interpreting the regression coefficients, results in both subsamples show that, when 'collective learning' is conceptualized as a (causal) process with 'dialogue and inquiry' at its core, 'transformational leadership' and 'individual learning in interaction' both contribute to predicting 'dialogue and inquiry'. 'Dialogue and inquiry', in turn, contributes to predicting the other aspects of the collective learning processes taking place in the team (i.e., 'shared vision', 'collective action', and 'evaluation and reflection'). Additionally, conform results for Model 1 (i.e., the second-order factor model of 'collective learning'), 'transformational leadership' contributes to predicting 'individual learning in interaction'. In other words, teachers who perceive higher levels of 'transformational leadership', or who view themselves as undertaking more learning-oriented actions, also perceive a higher level of 'dialogue and inquiry' in their teams. Teachers who perceive a higher level of 'dialogue and inquiry', in turn, perceive higher levels of 'shared vision', 'collective action', and 'evaluation and reflection' in their teams. Moreover, teachers who perceive a higher level of 'transformational leadership' also perceive a higher level of 'individual learning in interaction'. In sum, results for Model 2, based on a process model of 'collective learning', also lend support to our hypotheses that 'individual learning in interaction' (as a narrowed-down version of 'social individual learning') has a positive effect on 'collective learning' (Hypothesis 1), and that 'transformational leadership' has a positive effect on both 'collective learning' (Hypothesis 2), and 'individual learning in interaction' (Hypothesis 3). Additionally, they lend support to the hypothesis we developed in Chapter 3, that a team's dialogical cul-

ture positively influences its ability to arrive at a shared vision, to act collectively, to evaluate the results of its actions and to reflect on its work and learning processes.

Furthermore, it can be observed from Figures 4.6 and 4.7 that in both subsamples the effect of 'individual learning in interaction' on 'dialogue and inquiry' exceeds the effect of 'transformational leadership' 'dialogue and inquiry', though in subsample A the difference is small. However, 'transformational leadership' also has an indirect effect on 'dialogue and inquiry', via 'individual learning in interaction'. Notably, conform results for model 1 (i.e., the second-order factor model of 'collective learning'), in subsample B the effect of 'transformational leadership' on 'individual learning in interaction' is stronger than in subsample A (β = 0.56 and β = 0.39 respectively).

While results in both subsamples lend support to the hypothesized positive relationships among 'transformational leadership', 'collective learning' and 'individual learning in interaction' when 'collective learning' is modeled as a process with 'dialogue and inquiry' at its core, one notable difference in the results of subsample A and B can be observed. In subsample A, the effect of 'transformational leadership' on 'dialogue and inquiry' exceeds the effect of 'transformational leadership' on 'individual learning in interaction' (β = 0.45, and β = 0.39, respectively), whereas in subsample B, the effect of 'transformational leadership' on 'individual learning in interaction' exceeds the effect of 'transformational leadership' on 'dialogue and inquiry' (β = 0.56, and β = 0.39, respectively). Such a result implies that in subsample A 'transformational leadership' contributes most to predicting teachers' perception of 'dialogue and inquiry', while in subsample B 'individual learning in interaction', or the extent to which teachers undertake learning-oriented actions, contributes most to predicting teachers' perception of 'dialogue and inquiry' (though, conform Hypotheses 1 and 2, in subsamples A and B both effects are positive and significant). However, it remains unclear whether differences between the results of the subsamples reflect substantial differences in the size of the effects, or whether they are due to a certain amount of sample variation.

Comparison of the results of Model 1 with Model 2 is hindered by the fact that 'collective learning' is modeled as a second-order latent variable in Model 1 and as a process in Model 2. However, a comparison of results shows that the strength of the direct effect of 'transformational leadership' on 'individual learning in interaction' in Model 1 is identical to the strength of this effect in Model 2 for both subsample A (β = 0.39) and subsample B (β = 0.56). The direct effect of 'individual learning in interaction' on the second order variable 'collective learning' (Model 1) is comparable to the direct effect of 'individual learning in interaction' on the variable 'dialogue and inquiry' (Model 2) in subsample A (β = 0.51 in Model 1, β = 0.50 in Model 2), and slightly lower in subsample B (β = 0.61 in Model 1, β = 0.52 in Model 2). Moreover, the direct effect of 'transformational leadership' on the second order variable 'collective learning' (Model 1) is comparable to the direct effect of 'transformational leadership' on the variable 'dialogue and inquiry' (Model 2) in subsample A (β = 0.47 in Model 1, β = 0.45 in Model 2), as well as in subsample B (β = 0.38 in Model 1, β = 0.39 in Model 2).

In conclusion, both Model 1 and Model 2 provide a satisfactory model for the relationships among the constructs 'transformational leadership', 'collective learning' and 'individual learning in interaction'. Model 1 tests our initial hypotheses that 'social individual learning'

(as a narrowed-down version of 'social individual learning') positively affects 'collective learning' (Hypothesis 1), and that 'transformational leadership' positively affects 'collective learning' (Hypothesis 2) and 'individual learning in interaction' (Hypothesis 3). Our results lend support to both hypotheses. Model 2 tests the hypothesis we further developed in the course of our study, that 'collective learning' is a process in which the (sub-)construct 'dialogue and inquiry' is assumed to be the central factor, positively influencing the other three (sub-)constructs associated with this form of learning. Since both Model 1 and 2 show a good fit to the data, our results support the conceptualization of 'collective learning' both as a second-order factor, and as a process with 'dialogue and inquiry' at its core. Finally, however, it must be noted (again) that for this study we obtained and analyzed correlational data. Hence, it is important to emphasize here that conclusions about underlying (causal) mechanisms will remain of a tentative nature. In addition, we refer to Appendix H, where an overview is presented of the correlations among the latent variables in Model 1 (Table H1) and Model 2 (Table H2), for both subsamples A and B. In the discussion section we will elaborate on the problems that arise in studying causal mechanisms by analyzing correlational data using structural equation models.

Influence of background variables

In the final part of Study 1b we tested whether the positive effects of 'transformational leadership' on 'individual learning in interaction' and on 'collective learning', and the positive effect of 'individual learning in interaction' would still be present when the variables teachers' gender, age, educational level, and employment status (part-time of full-time) are taken into account (Hypothesis 4)[10]. As was explained in the section 'Statistical analysis', we used two multilevel multiple regression models to test this hypothesis. In the first model, 'collective learning' serves as the dependent variable. First, an 'unconditional model' (i.e., a multilevel regression model without any predictor variables) was specified, which serves as the baseline model. Next, in the 'primary effects model', the primary predictor variables 'individual learning in interaction' and 'transformational leadership' (indicating primary effects) were added to the regression model. Then, in the 'full model', the background variables (i.e., gender, age, educational level, and employment status) as well as the variables containing the interactions between the primary predictor variables and the background variables were simultaneously added to the regression model. Finally, from this model the non-significant effects (i.e., variables) were removed stepwise from the regression equation, leading to the 'final' model. One variable, specifically the variable with the least significant effect, was removed at a time. This procedure was repeated until only significant effects remained. In the model for the second dependent variable, 'individual learning in interaction', the same procedure was followed. With respect to the predictor variables, the regression equation (only) included 'transformational leadership' as a primary effect. In addition to this primary effect, the same set of background variables was included as in the first model, as well as the interaction effects between the background variables and the variable 'transformational leadership'.

[10] Additionally, the variable 'function' or position (i.e. teacher, teacher in higher education, senior teacher in higher education) was also initially included in the current study. Feedback of several respondents revealed, however, that teachers were not always aware of the function they were officially assigned to, leading to unreliable answers. Therefore, this variable was excluded from the data prior to the analysis.

As in ordinary regression analysis, in multilevel analysis an intercept is estimated, as well as regression weights (‘slopes’) for all predictor variables. The intercept can be interpreted as the expected value for the dependent variable, that is, the predicted value for the dependent variable for the case in which the value of all predictor variables equals zero. The multilevel regression model handles the hierarchical structure of the data as follows. In the present study, teachers are nested within teacher teams, and therefore we have two-level hierarchical data. This nested structure of the data causes a violation of the independence assumption commonly made in statistical analysis. Teachers within a team can be seen as more similar to one another than teachers within different teams. They share a 'common context'. In multilevel regression these dependencies are handled by modeling the intercept and slopes as either fixed or random parameters. Modeling a fixed intercept implies that all teacher teams are assumed to have the same average score on the dependent variable (e.g., the manifest version of the variable 'collective learning'). Modeling a random intercept reflects the idea that in principle each teacher team has its own unique average score on the dependent variable thereby indicating the specific context of that particular team. The same reasoning holds true for the slope of each predictor variable in the model. Modeling a fixed slope for a predictor variable (e.g., 'transformational leadership') implies that in all teacher teams the power of this variable to predict 'collective learning' is assumed to be identical, whereas modeling a random slope is based on the idea that the strength of the regression relation differs across teams. In the latter case, predictor variables are said to have a 'random' effect. In such a case and in practice, we do not really estimate unique slopes for each team, but instead we estimate a distribution of slopes, described by an average slope across teams, and a variance of the slopes indicating the extent to which teams differ in their unique slope estimates.

Compared to ordinary regression analysis, in which we only have a set of fixed effects, i.e. the regression weights, and a residual variance estimate, in multilevel analysis we can have an additional set of random effects, mostly called 'variance components'. In many cases, a random effect will be associated with the intercept of the model. Next, one or more predictor variables could have a random effect, i.e. the slopes of these variables could be modeled as random. During the course of the data analysis, it is common practice is to test whether intercept and slopes should be modeled as fixed or random, making it a process of optimally modeling the dependencies in the data. Subsequently, fixed and random effects (variance components) could be interpreted accordingly. For more details concerning the estimation of fixed effects and variance components we refer to Hox (2010).

The background variables are of a categorical nature and were therefore recoded into dummy variables prior to including them in the multilevel regression analysis. For the total sample, the frequencies of the background variables and the corresponding dummy variable(s) are presented in Appendix I (Tables I1 and I2, respectively). The variable 'Gender' was recoded into the dummy 'Male', with value '1' for all male participants in the sample, and value '0' for all female participants. As such, a regression coefficient, or an estimated effect parameter, is generated for males, with females as the reference group. For the variable 'Age', participants could choose from six answer categories (≤ 19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, and ≥ 60 years). However, data showed a very imbalanced distribution of participants over these categories. Therefore, we decided to merge categories, which leads to having three age groups: ≤ 29 years, 30-49 years, and ≥ 50 years.

Next, we recoded the variable 'Age' using two dummy variables, 'Age1' and 'Age2'. For 'Age1', all participants aged 30 to 49 years obtained the value '1', whereas all other participants obtained the value '0'. For 'Age2' all participants aged 50 years or over obtained the value '1', whereas all other participants obtained the value '0'. As such, regression coefficients are obtained for both dummies, where the indicated age groups are compared to the age category '29 years or less'. For the variable 'Educational level', participants could choose from three answer categories (lower vocational education, University of Applied Sciences, and Research University). Again, data showed a very imbalanced distribution of participants over these categories, with only 9 participants in the 'lower vocational education' group. Since we could not (theoretically) justify the merging of the 'lower vocational education' category with another category, we decided to remove these 9 participants from the data prior to the analysis.

Next, we recoded the variable 'Educational level' into a dummy variable, 'University', with value '1' for all participants in the sample with an education at Research University level, and value '0' for all participants with an education at University of Applied Sciences level. As such, a regression coefficient is generated for participants with an education at a Research University level, with participants with an University of Applied Sciences level as the reference group.

Finally, for the variable 'Employment status', participants could choose from three answer categories (part-time contract for one or two days a week, part-time contract for more than two days per week, and full-time contract). Therefore, we recoded the variable 'Employment status' using two dummy variables, 'Employment status 1' and 'Employment status 2'. For 'Employment status 1', all participants with a part-time contract for more than two days per week obtained the value '1', whereas all other participants obtained the value '0'. For 'Employment status 2' all participants with a full-time contract obtained the value '1', whereas all other participants obtained the value '0'. As such, regression coefficients are obtained for both dummies, were the indicated groups are compared with the group of teachers with a contract for three or fewer days per week.

Results for model 1: Collective Learning as dependent variable

Results of the analysis are presented in Table 4.9. First, for each model the table presents the regression (or fixed) coefficients, or estimated effect parameters (i.e. '*B*'), indicating the unique contribution of each of the predictor variables to the prediction of the dependent variable 'collective learning'. These effects are tested using *z*-tests (cf. Hox, 2010). Second, Table 4.9 displays for each model the random effects, or the variance components, at two levels: (1) the level-2 variances (σ_u^2), representing the variance components that can be related to the team structure inherent in the data, and (2) the level-1 variance (σ_e^2), which represents the error in prediction, or the variance that cannot be explained by the model. Finally, Table 4.9 presents the value of the deviance of the alternative models. Multilevel regression modeling commonly uses the method of maximum likelihood estimation. Parameter estimates are obtained by optimizing the likelihood function *L*, more specifically by minimizing *–2logL*, also called the 'deviance'. Deviance values of two different models may be compared if a particular model is nested within a second more elaborated model. In such a case, the difference between two deviance values (Δdev) follows a χ^2 distribution with degrees of freedom equal to the difference in number of estimated model parameters. Using

this χ^2 test (called likelihood-ratio test) we can assess general model improvement, and most importantly, we can assess the significance of variance components for which the common *z*-test approach used for fixed effects (or regression weights) is not appropriate (cf. Hox, 2010).

Table 4.9
Results of the multilevel regression analysis (unstandardized coefficients B, standard errors between brackets, and deviance) with Collective Learning as the dependent variable, as conducted in the total sample (n = 455)

	Unconditional model: no predictors	**Primary effects model: ILI and TL as predictors**	**Full model: ILI, TL, background variables, and interaction effects**	**Final model: only significant predictors**
Fixed coefficients				
Intercept (cons)	2.1263 (0.0250)	2.1183 (0.0037)	2.1165 (0.0151)	2.1163 (0.0150)
Primary predictor variables				
Transformational leadership (TL)	–	0.2841 (0.0220)	0.2894 (0.0223)	0.2865 (0.0219)
Individual learning in interaction (ILI)	–	0.3387 (0.0287)	0.3457 (0.0292)	0.3402 (0.0287)
Background variables				
Male	–	–	0.0003 (0.0320)	–
Age1[a]	–	–	-0.0106 (0.0407)	–
Age2[b]	–	–	-0.0187 (0.0429)	–
University[c]	–	–	0.0200 (0.0310)	–
Employment status1[d]	–	–	-0.0304 (0.0376)	–
Employment status2[e]	–	–	-0.0507 (0.0394)	–
Interaction effects				
Male x ILI	–	–	-0.0104 (0.0642)	–
Age1 x ILI	–	–	-0.1337 (0.0839)	-0.1147 (0.0460)
Age2 x ILI	–	–	-0.0575 (0.0911)	–
University x ILI	–	–	0.0455 (0.0613)	–
Employment status1 x ILI	–	–	0.0100 (0.0830)	–
Employment status2 x ILI	–	–	-0.0344 (0.0821)	–
Male x TL	–	–	0.1129 (0.0481)	–
Age1 x TL	–	–	-0.1141 (0.0791)	–
Age2 x TL	–	–	-0.0633 (0.0831)	–
University x TL	–	–	-0.0408 (0.0485)	–
Employment status1 x TL	–	–	-0.1635 (0.0637)	-0.1431 (0.0561)
Employment status2 x TL	–	–	-0.2209 (0.0672)	-0.2195 (0.0590)
Variance components				
Level-1 (σ_e^2)	0.1219 (0.0092)	0.0537 (0.0044)	0.0507 (0.0042)	0.0516 (0.0042)
Level-2 (σ_u^2)				
Intercept	0.0393 (0.0100)	0.0110 (0.0037)	0.0095 (0.0033)	0.0095 (0.0034)
Slope ILI	–	0.0222 (0.0100)	0.0221 (0.0097)	0.0219 (0.0096)
Covariance intercept-ILI	–	0.0100 (0.0042)	0.0112 (0.0040)	0.0115 (0.0041)
Deviance (*-2LogL*)	434.45	57.68	24.27	30.25

a) Age1: 30 - 49 years, with age ≤ 29 years as the reference group
b) Age 2: ≥ 50 years, with age ≤ 29 years as the reference group
c) Educational level: Research University, with University of Applied Sciences as the reference group
d) Employment status1: part-time 3-4 days per week, with part-time 1-2 days per week as the reference group
e) Employment status2: full time, with respect to part-time 1-2 days per week as the reference group

Results for the 'unconditional model' are presented in the first column of Table 4.9. In addition, we report the *–2logL* value for the version of the 'unconditional model' where the multilevel structure of the data is not taken into account (*–2logL* = 471.40, output not included). Comparing the *–2logL* values of the two versions of the unconditional model (the version that *does not* take into account the multilevel structure of the data compared with the version that *does* take it into account), the unconditional model shows a significant model improvement (χ^2 = 36.95, *df* = 1, *p* < 0.0000) when the multilevel structure is taken into account (or: when the intercept is modeled as a random instead of a fixed parameter at the team level), which results in it also supporting the *multilevel* regression approach taken here.

Next, in specifying the 'primary effects model', we add the primary predictor variables 'individual learning in interaction' and 'transformational leadership' to the unconditional model. In fine tuning this model, we investigate whether the slopes for these predictor variables should be modeled as random. Results show a significant model improvement when the slope of 'individual learning in interaction' is modeled as random instead of fixed (χ^2 = 11.39, *df* = 3, *p* < 0.0098, output not included). However, they show a non-significant model improvement when the slope of 'transformational leadership' is modeled as random (χ^2 =3.89, *df* = 3, *p* < 0.2731). The parameter estimates of this final model are presented in the second column of Table 4.9. It is clear that the addition of both predictor variables to the unconditional model leads to a very significant model improvement (χ^2 = 376.77, *df* = 4, *p* < 0.0000). Results show that both predictor variables have a significant, positive and strong effect on 'collective learning' (*B* = 0.2841, *z* = 12.91, *p* < 0.0000 for 'transformational leadership'; *B* = 0.3387, *z* = 11.80, *p* < 0.0000 for 'individual learning in interaction'). Clearly, this result is in agreement with the result of the multilevel covariance structure analysis presented in the section 'Model exploration and validation for the hypothesized structural models'. The significant random slope of the predictor variable 'individual learning in interaction' implies that teams significantly differ with respect to the strength of the regression relation regarding the prediction of 'collective learning' from this predictor variable. Likewise, teams do not significantly differ with respect to the strength of the regression relationships regarding the prediction of 'collective learning' from 'transformational leadership'.

Results for the 'full model' are presented in the third column of Table 4.9. They show that the significant, positive and strong effects of 'transformational leadership' and 'individual learning in interaction' on 'collective learning' remain when all background variables and interaction effects are added to the regression equation (*B* = 0.2894, *z* = 12.98, *p* < 0.0000 for 'transformational leadership'; *B* = 0.3457, *z* = 11.84, *p* < 0.0000 for 'individual learning in interaction'). Notably, the estimated effect parameters or regression weights (*B*) and the standard errors of 'transformational leadership' and 'individual learning in interaction' only change marginally by adding the background and interaction variables. Although we can see that the combined effect of the background and interaction variables to the regression model leads to a significant model improvement (χ^2 = 33.41; *df* = 18, *p* < 0.0149), most of the individual effects are non-significant (and very small). Such results imply that teachers' gender, age, educational level and employment status do not provide an alternative explanation for the positive effects of 'transformational leadership' and 'individual learning in interaction' on 'collective learning', as they were found in the multilevel covariance structure analysis.

In fine tuning the 'full model' we deleted the non-significant effects step by step. Results for this 'final model' are presented in the fourth column of Table 4.9. Again, the effects of the primary predictor variables 'transformational leadership' and 'individual learning in interaction' are highly identical to the model containing only the primary predictor variables, (again) confirming Hypotheses 1 and 2. The 'final model' shows that three interaction variables have a significant, but very small effect on 'collective learning'[11]: 'Male x Transformational Leadership' (B = 0.1129, z = 2.35, p < 0.0094), 'Employment Status 1 x Transformational Leadership' (B = –0.1635, z = –2.57, p < 0.0051), and 'Employment Status 2 x Transformational Leadership' (B = –0.2209, z = –3.29, p < 0.0005). The significance of these interaction effects might be related to the relatively large 'power' of the test to reveal small effects as significant, which results from the large sample size that is inherent to merging subsample A with subsample B. Moreover, because the particular effects of these interaction variables are not the focus of the present study, they will not be interpreted further here. A last check of the final multilevel regression model revealed that the slope of 'individual learning in interaction' is indeed best modeled as a random parameter, whereas the slope of 'transformational leadership' is best modeled as a fixed parameter.

In conclusion, results imply that teachers' gender, age, educational level and employment status do not provide an alternative explanation for the positive effects found around 'collective learning', 'individual learning in interaction' and 'transformational leadership', providing support for (part of) Hypothesis 4. We emphasize (again) that the construct of 'social individual learning' in our analyses has been narrowed down to 'individual learning in interaction', thereby slightly modifying the hypothesis. As a result, we find support for the (modified) hypotheses that the positive effect of 'transformational leadership' on 'collective learning', as well as the positive effect of 'individual learning in interaction' on 'collective learning', are still present when taking into account the variables teachers' gender, age, educational level, and employment status (part-time or full-time).

Results for model 2: Individual Learning in Interaction as dependent variable
Results of the analysis are presented in Table 4.10. Again, for each model, the table shows the regression (or fixed) coefficients, the variance components, and the value of the deviance. As with the regression model for the dependent variable 'collective learning', the deviance values of the models for the dependent variable 'individual learning in interaction' may be compared, for each model is nested within the more elaborate model(s).

Results for the 'unconditional model' are presented in the first column of Table 4.10. In addition, we report the *–2logL* value for the version of the unconditional model where the multilevel structure of the data is not taken into account (*–2logL* = 750.39, output not included). Comparing the *–2logL* values of the two versions of the unconditional model (the version that *does not* take into account the multilevel structure of the data compared with the version that *does* take it into account), the unconditional model shows a significant model improvement (χ^2=6.82, df = 1, p < 0.0090) when the multilevel structure is taken into account

[11] Due to the step-by-step approach taken to remove the non-significant effects (i.e., variables), some effects that were significant in the 'full' model are no longer significant in the 'final' model. Note however, that these effects are very small compared to the effects of the primary predictor variables. Their significance may be caused by the unpredictable consequences of including a relatively large set of interrelated predictor variables to the model.

(or: when the intercept is modeled as a random parameter instead of a fixed parameter at the team level); its result is once again supporting the *multilevel* regression approach taken here.

Table 4.10
Results of the multilevel regression analysis (unstandardized coefficients B, standard errors between brackets, and deviance) with Individual Learning in Interaction as the dependent variable, as conducted in the total sample (n = 455)

	Unconditional model: no predictors	**Primary effect model: TL as predictor**	**Full model: TL, background variables, and interaction effects**	**Final model: only significant predictors**
Fixed coefficients				
Intercept (cons)	2.8697 (0.0297)	2.8538 (0.0272)	2.8620 (0.0261)	2.8642 (0.0267)
Primary predictor variables				
Transformational leadership (TL)	–	0.3821 (0.0453)	0.3672 (0.0467)	0.3753 (0.0460)
Background variables				
Male	–	–	-0.1044 (0.0556)	-0.1081 (0.0534)
Age1[a]	–	–	0.0144 (0.0771)	–
Age2[b]	–	–	-0.0297 (0.0815)	–
University[c]	–	–	-0.0214 (0.0541)	–
Employment status 1[d]	–	–	0.1296 (0.0691)	–
Employment status 2[e]	–	–	0.2070 (0.0722)	0.1002 (0.0486)
Interaction effects				
Male x TL	–	–	0.0675 (0.0981)	–
Age1 x TL	–	–	0.1955 (0.1527)	–
Age2 x TL	–	–	0.2112 (0.1589)	–
University x TL	–	–	-0.1178 (0.0962)	–
Employment status 1 x TL	–	–	0.0354 (0.1158)	–
Employment status2 x TL	–	–	0.0196 (0.1191)	–
Variance components				
Level-1 (σ_e^2)	0.2615 (0.0195)	0.2038 (0.0164)	0.1939 (0.0159)	0.1986 (0.0163)
Level-2 (σ_u^2)				
Intercept	0.0319 (0.0138)	0.0253 (0.0114)	0.0175 (0.0100)	0.0207 (0.0106)
Slope TL	–	0.0552 (0.0282)	0.0611 (0.0286)	0.0551 (0.0281)
Covariance intercept-TL	–	-0.0290 (0.0123)	-0.0250 (0.0115)	-0.0256 (0.0118)
Deviance (*-2LogL*)	743.57	647.02	596.42	608.79

a) Age1: 30 - 49 years, with age ≤ 29 years as the reference group
b) Age 2: ≥ 50 years, with age ≤ 29 years as the reference group
c) Educational level: Research University, with University of Applied Sciences as the reference group
d) Employment status1: part-time 3-4 days per week, with respect to part-time 1-2 days per week as the reference group
e) Employment status 2: full time, with part-time 1-2 days per week as the reference group

Next, in specifying the 'primary effect model', we add the primary predictor variable 'transformational leadership' to the 'unconditional model'. Fine tuning this model, we investigate whether the slope for this predictor variable should be modeled as a random variable. Results show a significant model improvement when the slope of 'transformational leadership' is modeled as random instead of fixed (χ^2=11.31, *df* = 2, $p < 0.0035$, output not included). The parameter estimates of this final model are presented in the second column of Table

4.10. We can see that the addition of the predictor variable 'transformational leadership' to the 'unconditional model' leads to a very significant model improvement (χ^2 = 96.55, *df* = 3, $p < 0.0000$). Results show that the predictor variable 'transformational leadership' has a significant, positive and strong effect on 'individual learning in interaction' (*B* = 0.3821, *z* = 8.43, $p < 0.000$). Clearly, this result is in agreement with the result of the multilevel covariance structure analysis presented in the section 'Model exploration and validation for the hypothesized structural models'. The significant random slope of the predictor variable 'transformational leadership' implies that teams differ significantly with respect to the strength of the regression relationship with regards to the prediction of 'social individual learning' from this predictor variable.

Results for the 'full model' are presented in the third column of Table 4.10. They show that the significant, positive and strong effect of 'transformational leadership' on 'individual learning in interaction' remains when all background variables and interaction effects are added to the regression equation (*B* = 0.3672, *z* = 7.86, $p < 0.0000$). Notably, the estimated effect parameter or regression weight (*B*) and the standard error of 'transformational leadership' only changes marginally by adding the background and interaction variables. Although we can see that the combined effect of the background and interaction variables on the regression model leads to a significant model improvement (χ^2 = 50.60; *df* = 12, $p < 0.0000$), most of the individual effects are non-significant (and small). Such results imply that teachers' gender, age, educational level and employment status do not provide an alternative explanation for the positive effect of 'transformational leadership' on 'individual learning in interaction' as was found in the multilevel covariance structure analysis (see section 'Model validation for the hypothesized structural models').

In fine tuning the 'full model', we deleted the non-significant effects step by step. Results for this 'final model' are presented in the fourth column of Table 4.10. Again, the effect of the primary predictor variable 'transformational leadership' on 'individual learning in interaction' is highly identical to the model with only this variable as a predictor, (again) confirming Hypothesis 3. The 'final model' shows that two background variables have a significant, but very small effect on 'individual learning in interaction': 'Male' ($B = -0.1081$, $z = -2.02$, $p < 0.0217$), and 'Employment status 2' ($B = 0.1002$, $z = 2.06$, $p < 0.0197$). The significance of these effects might be related to the (relatively large) 'power' of the test to reveal small effects as significant, which results from the large sample size that is inherent in merging subsample A with subsample B. Moreover, because the effects of particular background variables are not the focus of this study, they will not be interpreted further here. A final check of the final multilevel regression model revealed that the slope of 'transformational leadership' is indeed best modeled as a random parameter.

In conclusion, results imply that teachers' gender, age, educational level and employment status do not provide an alternative explanation for the positive effect of 'transformational leadership' on 'individual learning in interaction', providing support for (part of) Hypothesis 4. We emphasize once again that the construct of 'social individual learning' in our analyses is narrowed down to 'individual learning in interaction', thereby slightly modifying the hypothesis. As a result, we find support for the (modified) hypotheses that the positive effect of 'transformational leadership' on 'individual learning in interaction' is still present when

taking into account the variables teachers' gender, age, educational level, and employment status (part-time or full-time).

4.5 CONCLUSION AND DISCUSSION

Conclusion: results for testing hypotheses 1 – 4

In this chapter we presented the results of testing the hypotheses that: 'social individual learning' has a positive effect on 'collective learning' (Hypothesis 1), that 'transformational leadership' has a positive effect on 'collective learning' (Hypothesis 2), and on 'social individual learning' (Hypothesis 3), and that the positive effects of 'transformational leadership' on 'social individual learning' and 'collective learning', as well as the effect of 'social individual learning' on 'collective learning', if found, are still present when the variables teachers' gender, age, educational level, and employment status (part-time or full-time) are taken into account (Hypothesis 4). Prior to the analysis, the hypothesized factor structures of 'social individual learning' and 'transformational leadership' were tested and their respective measurement instruments were optimized by means of a multilevel covariance structure analysis (see Muthén, 1994), using the EQS 6.1 program (Bentler & Wu, 2002; Bentler, 2005) (note that in Chapter 3, the hypothesized factor structure of 'collective learning' was tested and its measurement instrument was optimized).

With respect to the measurement instruments, the hypothesized three-factor structure of 'social individual learning' was not retained. First, for practical reasons the factor 'learning from collaboration' was not included in the analysis. Second, the high correlation found between the factors 'learning from knowledge sharing' and 'learning from feedback' led us to combine these factors into a new factor, namely, 'individual learning in interaction', representing a narrowed-down version of 'social individual learning'. Six items of the combined measurement scale were removed based on their factor loading or high residual loading. The resulting measurement model showed a good fit to the data in both subsamples. The hypothesized three-factor structure of 'transformational leadership' was confirmed by the data. Optimization of the measurement instrument did not result in the exclusion of any item. The measurement model showed a good fit to the data in both subsamples. Because in both subsamples a high correlation was found between the factors 'individualized support' and 'intellectual stimulation', we decided to model 'transformational leadership' as a second-order variable. Here, 'transformational leadership' is the central, underlying (second-order) factor, and the three dimensions (or first-order factors) associated with it are considered its indicators. The dimensions themselves are measured by scales, each consisting of a set of items. Such a structure takes into account the high correlation between the first-order factors, i.e. the dimensions of 'transformational leadership'.

The hypothesized interrelationships among 'social individual learning', 'collective learning' and 'transformational leadership' were modeled in two alternative structural equation models, which were tested by means of multilevel covariance structure analysis using the EQS 6.1 program (Bentler & Wu, 2002; Bentler, 2005). Since revision of the measurement instrument for 'social individual learning' led to a more narrow definition of the concept than was originally intended (and was therefore renamed as 'individual learning in interaction'), hypothe-

ses were slightly modified by replacing the construct 'social individual learning' with the construct 'individual learning in interaction'. In line with the results of Chapter 3, two models were tested: one model in which 'collective learning' is represented as a second-order factor with the four sub-constructs of 'collective learning' as indicators (first-order factors), and one model in which it is represented as a process with the sub-construct 'dialogue and inquiry' at its core. Results showed a good fit of both models to the data.

For the first model (the second-order factor model of 'collective learning'), results showed significant, positive effects of 'transformational leadership' both on 'individual learning in interaction' and on 'collective learning', as well as a significant, positive effect of 'individual learning in interaction' on 'collective learning'. As such, results confirmed the hypothesized positive effect of 'individual learning in interaction' (as a narrowed-down version of 'social individual learning') on 'collective learning' (Hypothesis 1), and the hypothesized positive effects of 'transformational leadership' on 'collective learning' (Hypothesis 2) and on 'individual learning in interaction' (Hypothesis 3). In other words, teachers who perceive higher levels of 'individual learning in interaction' also perceive a higher level of 'collective learning' in their teams. We can conclude that the learning-oriented actions that teachers undertake to improve the quality of their own work (i.e., 'individual learning in interaction') positively affect each of the aspects of 'collective learning' ('shared vision', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'). Such a result is consistent with the assumption that both forms of learning develop in a mutual relationship (Castelijns et al., 2009). Also, it lends support to our hypothesis that the process of collective learning is stimulated when teachers are actively involved in processes of individual learning through social interaction.

In addition, 'transformational leadership' also appears to be of relevance for the social learning processes taking place within the teams. Teachers who perceive their managers as showing a more transformational leadership approach also perceive themselves as undertaking more learning-oriented actions, and they perceive a higher level of 'collective learning' in their teams. As such we could state that 'transformational leadership' positively affects learning through social interaction, both learning which is aimed at improving the quality of individual teachers' work as well as learning aimed at achieving common learning and/or working outcomes. One plausible interpretation of these results is that 'collective learning' can be stimulated by a transformational leadership style, which ignites this type of learning directly, and indirectly (i.e., via 'individual learning in interaction'). Results are summarized in Figure 4.8.

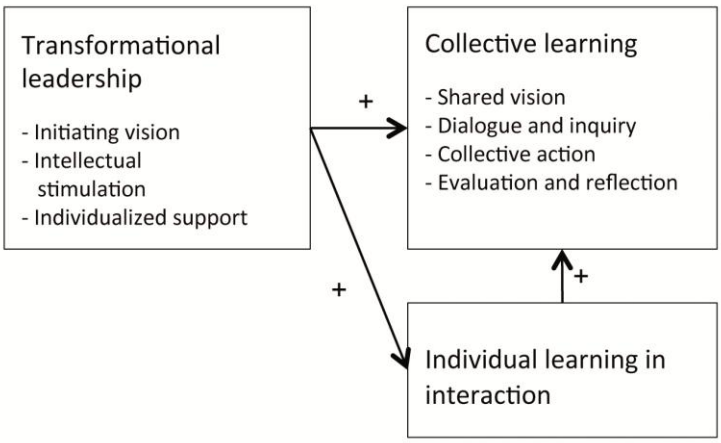

Figure 4.8. Relationships among Transformational Leadership, Collective Learning (as a second-order factor with four indicators), and Individual Learning in Interaction as hypothesized and supported by the data in Study 1b.

For the second model, the hypothesized positive effect of 'individual learning in interaction' (as a narrowed-down version of 'social individual learning') on 'collective learning' (Hypothesis 1), as well as the hypothesized positive effects of 'transformational learning' on 'collective learning' (Hypothesis 2), and on 'individual learning in interaction' (Hypothesis 3) could also be confirmed by the data when the collective learning concept is modeled as a process in which 'dialogue and inquiry' form the starting point of a particular cycle of the collective learning process. Results show that teachers perceiving higher levels of 'individual learning in interaction' also perceive a higher level of 'dialogue and inquiry' in their teams. The extent to which teachers undertake learning-oriented actions to improve the quality of their own work (i.e., 'individual learning in interaction') is thus related to the extent to which they experience a dialogical culture that allows for inquiry. We can say that 'dialogue and inquiry', in turn, positively affects the other aspects of the collective learning processes taking place in the team (i.e., 'shared vision', 'collective action', and 'evaluation and reflection'). Such results lend support to our hypothesis that a team's dialogical culture positively influences its ability to arrive at a shared vision, to act collectively, to evaluate the results of its actions and to reflect on its work and learning process. This seems to imply that a team's dialogical culture might well serve as a starting point in a particular cycle of the collective learning process.

In addition, 'transformational leadership' is shown to be of relevance for both 'individual learning in interaction', and for the team's dialogical culture. Conform results from the first model (i.e., the second-order factor model of 'collective learning'), teachers who perceive their managers as showing a more transformational leadership approach also perceive themselves as undertaking more learning-oriented actions. Moreover, they perceive a higher level of dialogue and inquiry' in their teams. One plausible interpretation of these results is that 'collective learning' can be stimulated by awakening a team's dialogical culture and its dialogue and inquiry skills. These things can be stimulated by a transformational leadership

style, which ignites a team's 'dialogue and inquiry' both directly and indirectly via 'individual learning in interaction'. Results are summarized in Figure 4.9.

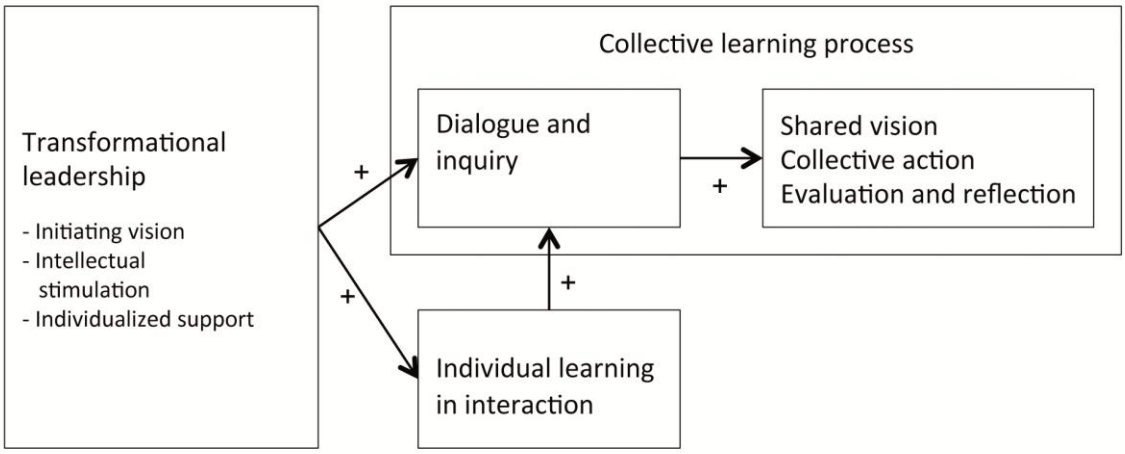

Figure 4.9. Relationships among Transformational Leadership, Individual Learning in Interaction, Dialogue and Inquiry, and the other aspects of Collective Learning, as hypothesized and supported by the data in Study 1b.

We hypothesized that the positive effects depicted in Figure 4.4 and 4.5 would still be present when a specific set of background variables (teachers' gender, age, educational level, and employment status - part-time or full-time) is taken into account (Hypothesis 4). We tested this hypothesis by means of multilevel regression analysis, using the MLwiN 2.20 program (Rasbash et al., 2009). Two series of multilevel regression models were tested: one series containing a manifest version of the variable 'collective learning' as dependent variable, and one series containing a manifest version of the variable 'individual learning in interaction' as dependent variable. Stepwise, the primary predictor variables ('individual learning' and/or 'transformational leadership'), dummy variables representing the background variables, and variables containing the interactions between primary predictor variables and the background variables were added to the models. Results for the models with only the main predictor variables, were highly similar to the results found in the multilevel covariance structure analysis, regarding the strong, significant positive effects of 'transformational leadership' on 'individual learning in interaction' and on 'collective learning', as well as regarding the strong, significant effect of 'individual learning in interaction' on 'collective learning'. When the background and interaction variables were added to the respective models, the estimated effect parameters and corresponding standard errors of the main predictor variables were highly identical to the estimated parameters of the models only containing the primary predictor variable(s). These results indicate that, in our sample, teachers' gender, age, educational background and employment status do not significantly influence the relationships between 'transformational leadership', 'collective learning', and 'individual learning in interaction'. The results of the multilevel regression analysis provide a form of internal validation of the relationships found between these three core constructs, and rule out the background variables included in the present study as alternative explanations for these effects. Hypothesis 4 is therefore supported by our data.

Contribution of the study

Results of Study 1 (1a and 1b, presented in Chapters 3 and 4 respectively) contribute to the development of theory within the field of Human Resource Development (HRD). HRD can be defined as an organizational process comprising "the skillful planning and facilitation of a variety of formal and informal learning and knowledge processes and experiences, primarily but not exclusively in the workplace, in order that organisational progress and individual potential can be enhanced through the competence, adaptability, collaboration and knowledge creating activity of all who work for the organisation" (Harrison and Kessels, 2004, p. 4). Study 1 has focused on creating a deeper understanding of 'social individual learning' and 'collective learning', two social, and predominantly informal forms of learning occurring in the workplace, and their mutual relationship. These forms, closely associated with the concepts of organizational learning and the learning organization, are increasingly acknowledged to be of importance for organizations operating in a knowledge economy. For educational institutions, the learning organization is increasingly put forward as a relevant organizational model (e.g., Collinson et al., 2006; Leithwood & Seashore Louis, 1998; Schechter, 2008; Silins et al., 2005; Watkins, 2005). An important aspect of such an organization is its ability to learn continuously at the individual and group level. In line with this, various scholars apply the ideas about organizational learning to educational institutions (e.g., Bowen et al., 2006; Collinson et al, 2006; Kezar, 2005; Lick, 2006; Verbiest, 2004; Verbiest et al., 2005; Austin & Harkins, 2008; Tynjälä & Nikkanen, 2009; Veisi, 2010; Bui & Baruch, 2011). However, given the limited number of research results available for this specific context, further research is recommended (Leithwood & Seashore Louis, 1998, p. 8). As for Study 1, the exploration and validation of the collective learning and social individual learning constructs contributes to theory development by further clarifying the concepts that lead to an understanding of organizational learning.

The organization forms the context in which organizational learning takes place; organizational factors therefore influence the associated forms of learning at the individual and group level. An organizational factor of which the importance is repeatedly emphasized for the educational sector is 'transformational leadership' (e.g., Leithwood, Jantzi & Steinbach, 1998; Verbiest, 2002; Geijsel, et al., 2009; Ten Bruggencate, 2009). Results of Study 1b show that it is plausible to state that both 'individual learning in interaction' and 'collective learning' are positively influenced by 'transformational leadership', indicating the importance of this style of leadership for social learning processes in teacher teams in Universities of Applied Sciences. In testing the relationship between 'transformational leadership' and 'collective learning', as well as the relationship between 'transformational leadership' and 'social individual learning' (though narrowed down to 'individual learning in interaction'), we contribute to the development of theory concerning these complex matters by providing more insight into which factors might foster organizational learning. Results of the present study might support practitioners striving to develop or improve processes of 'collective learning' within educational institutions in their ability to design organizational interventions. Our findings point to the likely importance of stimulating 'transformational leadership' and 'individual learning in interaction' and to the potential relevance of a team's dialogical culture and its dialogue and inquiry skills.

Methodological evaluation and directions for future research

Critical reflection on the measurement instrument, the methods of analysis and the results leads us to identify to various concerns. Four of those were already addressed in Chapter 3, which are: (1) the sample for our study only includes teachers from Universities of Applied Sciences, (2) the data analysis in our study does not take the institutional level into account, (3) drawbacks of the correlational approach used in the present study, and (4) the cross-sectional nature of the study. These concerns also apply to the results presented in this chapter. In addition, we identified a number of concerns specifically related to this chapter, and, where relevant, we will present suggestions for future research based on our concerns.

First, results for our study are based on a limited sample, which cannot be considered representative of the entire population. In scientific studies, external validity is the validity of generalized (causal) inferences (Mitchell & Jolley, 2001), and inferences about cause-effect relationships based on a specific scientific study are said to possess external validity if they may be generalized from the study's idiosyncratic settings, procedures and participants to other populations and conditions (Brewer, 2000). With respect to the present study, the question is whether the causal inferences, or conclusions, can reasonably be expected to apply to the target population (i.e., all teachers within Dutch University of Applied Sciences teacher teams). It is also worthwhile to reflect on the question as to whether our conclusions might apply to other populations (i.e., teachers in different educational sectors, or non-educational practitioners). We used a sample of teachers related to Universities of Applied Sciences and we aimed to generalize results to the target population. However, teams were not randomly selected, but their selection was based on their participation in prior research (see Kuijpers & Meijers, 2012), or because they were part of the researchers' professional networks. Such a design is likely to lead to a so-called selection bias and thus to a loss of external validity with respect to the causal inference to the target population. Because of this, we cannot be sure that the conclusions drawn do actually apply to teachers or teacher teams with features dissimilar from the teachers and teams involved in our study. However, teams with a varying background with respect to a number of relevant features did participate in the present study. Teacher teams were selected from eight different Universities of Applied Sciences, both from urban and rural areas, and the sample is characterized by a spread over five educational fields (Education, Economics and Management, Healthcare, Technology, and Agriculture). As such, part of the variety found in the target population is reflected in our sample, enhancing the study's external validity. On the level of the individual teacher, a reasonable spread was included with respect to teachers' gender, age, educational level, and employment status (part-time or full-time contract). In our research design we explicitly addressed the study's external validity. By randomly splitting the sample in two subsamples we generated two independent samples. We used exploration subsample A for model generation and fine tuning of our measurement instruments, and validation subsample B to (re-)test our results. Results for subsample B were highly comparable to results for subsample A, suggesting that within the limitations arising from a possible selection bias, our conclusions can reasonably be expected to apply to the target population, or at least can be expected to be reasonably stable and not sample specific.

As mentioned above, it is also relevant to reflect on the question as to whether inferences may indeed be generalized to other populations, such as teachers in different educational

sectors, or non-educational practitioners. Practitioners in sectors other than Dutch higher vocational education might have characteristics quite dissimilar from the teachers and teams involved in our study. In addition, the nature of their work as well as the organizations in which they work might have different features. Therefore, we cannot be sure that our conclusions do actually apply to such populations. That said, in the field of Human Resource Development (HRD) work-related learning is increasingly acknowledged as an important source of learning in many sectors (see, for example, various contributions in the Handbook Human Resource Development by Kessels & Poell, 2011). Likewise, 'collective learning' is argued to be relevant within a broader context (Thölke & Wierdsma, 2010; Van Lakerveld, 2011). Although conclusions based on our data are limited, our results with respect to 'collective learning' might be relevant to populations different from our target population. An interesting question would be, for example, whether processes of 'collective learning' are perceived in a similar way in other organizations mainly those employing 'professionals' (e.g., doctors, lawyers, scientists, technology experts). If so, processes of collective learning might be related to the professional nature of work, which might form a basis for generalizing our results to the other particular populations.

Second, as stated, the hypothesized factor structure of 'social individual learning' was not retained. In hindsight, the factor 'learning from collaboration' was not correctly operationalized in the present study. The other two types of 'social individual learning' ('learning from feedback' and 'learning from knowledge sharing') relate to learning-oriented action engaged in by teachers themselves, while 'learning from collaboration' represents the extent to which they experience a positive learning climate in terms of their colleagues' behavior. The latter might therefore more accurately be referred to as 'colleague support in learning'. Because of its contextual nature, this variable was not taken into account in any of the further analyses. In future research, a new measurement instrument should be developed for 'social individual learning', with a scale that measures teachers' conscious attempts or actions at learning as a result of collaboration with colleagues.

Third, in testing both structural models in subsample B, one item of the scale 'individual learning in interaction' (item 45) showed a factor loading with a value less than 0.40 (λ = 0.34), which was the cut-off value that was used in the optimization procedure of the measurement models of each of the latent variables. In the measurement model discussed, this item had the lowest factor loading of all items, with a value slightly over the cut-off value (λ = 0.41). Such result might indicate that this item ('I ask students what they think of my lessons') is not a very strong indicator for the scale 'individual learning in interaction'. In comparing the averages and standard deviations for each of the items in this scale for the whole sample (output not included) we noted that the average of this item (M = 3.32) exceeds the average of all other items in the scale (M = 2.71, 2.93, 2.88, 2.65, 2.61, 3.12 and 2.76, respectively, in order of item number). Its standard deviation (s = 0.79) is comparable to the standard deviation of the other items in the scale. In our sample, teachers more often ask their students for feedback than they ask colleagues or their team leader for feedback. A possible explanation for this could be that students' feedback is often collected systematically (see Chapter 5) and that this aspect of learning is thus institutionalized at the team level. If teachers refer to this process in responding to the statement 'I ask students what they think of my lesson', then this item would indeed barely be related to the scale 'individual learning in interaction'. An alternative explanation could be that teachers are more inclined to ask for

feedback from people who directly participate in their classroom activities (i.e., students). As such the item would theoretically be related to the scale 'individual learning in interaction', however, the item then seems to represent a different aspect of individual learning for the teachers in our sample. Asking teachers about the forms of feedback they actively search for might lead to more insight into the relevance of including this item in the scale. Future research, likely qualitative research, might shed more light on the specific nature of the act of collecting students' feedback and its relationship with teachers' individual and collective learning processes. For now, reflecting on the scale measuring 'individual learning in interaction' we do not consider item 45 a good indicator of this scale, and for future research we advise that it be deleted.

Fourth, two structural models were tested in this chapter, both relating to the latent variables 'transformational leadership', 'individual learning in interaction' and 'collective learning'. The first model was based on a second-order factor model of 'collective learning', whereas the second model was based on a process model of 'collective learning', with the factor 'dialogue and inquiry' at its core. Both models showed a good fit to the data, a result which supports our hypothesis that 'transformational leadership' has a positive effect on 'individual learning in interaction' (as a narrowed-down version of 'social individual learning') and on 'collective learning', and that 'individual learning in interaction', in turn, has a positive effect on 'collective learning'. Such a result, however, should be interpreted carefully. Since we obtained and analyzed correlational data, it does not provide us with 'proof' on how 'transformational leadership', 'individual learning in interaction' and 'collective learning' are related in terms of cause-effect relationships. For example, if we reversed the 'arrows' in both models (thus turning around the implied cause-effect between the latent variables), the models would show a good fit to our data as well. Therefore it could be that 'collective learning' stimulates 'individual learning in interaction' as well. In such a case, the collective learning processes that teachers perceive in their teams would stimulate individual teachers to improve the quality of their work via social learning processes. The 'collective learning' going on in the teams could then be considered a team characteristic influencing teachers' individual social learning processes. In Chapter 7 we will further elaborate on the relationship between individual and collective learning.

Moreover, various alternative models might be specified that mutually relate the latent variables, and such models might also show a good fit to the data. In general, a model cannot be said to be 'true'. Likewise, models with a better fit to the data cannot be said to be more 'true' than models that don’t fit the data as well (except when the models are nested). Models only provide more or less convincing support for a research hypothesis. Data solely, therefore, cannot 'prove' that a specific structural equation model is to be preferred over another, simply because it is more closely related to 'reality'. In order to prevent arbitrary models from being formulated or data-driven conclusions to be drawn, models should be inspired by theoretical considerations, enhancing the theoretical plausibility of the models themselves. Our literature study (see Chapter 2) led us to formulate the two models we deemed as useful representations of reality. The adequate fit of those models to our data shows that the cohesion of our (empirical) data supports our theoretical considerations and our hypotheses. In future research, theoretical considerations might also lead to testing alternative models.

Fifth, as was already discussed in Chapter 3, the present study started from theoretical assumptions, but by using a model-generating and a model-testing procedure, we assimilated our empirical findings in our process of theory development. An example of that is the integration of items from sub-scales of 'social individual learning' in the new scale 'individual learning in interaction', which was triggered by high correlations between the two constructs. From a data-driven point of view, high correlations between (sub-)constructs can be reason to combine them, or to connect them with an 'arrow' in a structural equation model. Appendix H shows the correlations among the latent variables in Model 1 (Table H1) and Model 2 (Table H2). Notably, in Model 1 'individual learning in interaction' and the second order construct 'collective learning' are highly correlated (r = 0.70 in subsample A, and r = 0.82 in subsample B, respectively). In Model 2, 'individual learning in interaction' and the four sub-constructs of 'collective learning' are relatively highly correlated (r varies from 0.45 to 0.67 in subsample A, and from 0.52 to 0.74 in subsample B, respectively). Such high correlations might lead to the question as to whether the two constructs in our sample can be really distinguished from one another (in other words, whether the discriminant construct validity is sufficient), or whether they actually refer to the same phenomenon. In Chapter 7 we will elaborate on this issue. Despite the conceptual overlap, a correlation of r = 0.82 (correlation between 'individual learning in interaction' and 'collective learning' in Model 1 in subsample B) amounts to 67% shared variability (or variance). This in turn implies that 33% of the variance of 'individual learning in interaction' and 'collective learning' is unique regarding these latent variables. In subsample A the shared variance is 49%, and the unique variance for both constructs is 51%. While pointing to a potential overlap of 'individual learning in interaction' and 'collective learning', these results also seem to point to a unique contribution of 'collective learning' over and above 'social individual learning' and vice versa.

In reflecting on the manifest overlap between the constructs, we also acknowledge the influence of two non-theoretical causes. First, we could not measure 'collective learning' directly, and we could not measure it at the group level. Instead, we used teachers' individual perceptions of the collective learning processes in their teams. As such, we used individual teachers as informants about the group-level phenomenon 'collective learning'. Second, measurement errors might be present in our data. It might be that respondents were not able to sufficiently understand the difference between the items formulated for the scales of 'collective learning' and 'individual learning in interaction' as items of both scales represent actions involving learning as well as participation of two or more colleagues[12]. Respondents might not have noted the different nature of the outcomes of the learning processes (i.e., individual outcomes for individual processes and collective outcomes for collective processes) and they might have considered the items as 'more of the same' (i.e., learning together in interaction). If so, a flaw is present in the operationalization of both concepts, resulting in an

[12] A clear example is provided by the items 'I discuss problems in my work with others' ('collective action') and 'If I think I have not done my work well, I discuss this with colleagues' ('individual learning in interaction'). The difference between the items is a matter of nuance. The former relates to problems that teachers do not necessarily attribute to themselves. Teachers may ask colleagues' advice on problems they encounter at work, for example teaching a group of unmotivated students, in order to enrich their problem solving strategy or to align what they do with their colleagues' strategies. The latter relates to problems that teachers do attribute to themselves. Discussing this type of problems with colleagues requires that teachers have an 'open' attitude and are not afraid to admit their mistakes. Such behavior is associated with individual teachers demonstrating a learning orientation and it is therefore interpreted as an aspect of individual learning as opposed to collective learning.

artificially high correlation between them. It might be that, without such a potential flaw, the correlation between 'individual learning in interaction' and 'collective learning' would be lower. This hypothesis might be tested in future research by using an improved measurement instrument for 'individual learning in interaction' (or 'social individual learning'), stressing the individual nature of the learning results in the items included in its scale.

Finally, the structural models as reported in this chapter did not include an outcome measure, neither at the individual teacher level, nor at the level of the team. As such, the criterion validity of the collective learning concept could not be studied. At the start of Study 1 we did intend to collect survey data measuring the constructs 'team performance' and 'team innovativeness' in order to test the hypothesized positive relationship with 'collective learning'. Therefore, measurement scales were included for both variables. However, most teachers in the sample responded to the statements measuring 'team performance' and 'team innovativeness' with the answer option 'I don't know'. The limited amount of data resulting for both these outcome measures proved insufficient to allow for reliable statistical analysis. Consequently, the corresponding hypothesis could not be tested in this empirical study. The relationship between 'collective learning' and 'team results will be addressed in Study 3 (see Chapter 6), which is based on a qualitative research approach (i.e., a game simulation). In future research, alternative structural models may be formulated, including organizational outcome measures associated with 'collective learning' (e.g., 'team performance' or 'innovativeness'). Careful consideration should then be given to the act of measuring these outcomes, either at the individual level, or at the team level, given that most teachers in the present study found themselves unable to assess these.

The present study can be considered limited concerning the development of theory about the nature and measurement of 'collective learning', 'social individual learning' (narrowed down to 'individual learning in interaction') and 'transformational leadership', and concerning the mutual relationships among these constructs. However, despite the drawbacks discussed above, in our opinion our research offers a valuable contribution to theory development in the field of Human Resource Development (HRD). We thoroughly studied and explored 'collective learning', a concept that is increasingly considered to be important to organizational development but that we did find to be consistently operationalized. As such, it provides a foundation for further research aimed at understanding the concept more fully. Moreover, our research suggests a nomological network, relating 'collective learning' to the concepts of individual learning in interaction and transformational leadership and provides measurement instruments for each of these concepts. Future research might further explore this suggested network, or expand it by adding other relevant concepts.

5 The innovation of career guidance as a project of organizational change, a case-study: empirical study 2

> If there is one thing you should stay clear of during change processes, it is holding lots of meetings about the intended change. Instead, just embark on the change by acting together, exchange experiences, reflecting together upon what works, and committing to the next step" (De Caluwé & Vermaak, 2004, p. 204).

Prior to the quantitative study, a qualitative study was conducted in order to explore the organizational factors that educational practitioners associate with successful innovation in their specific context. To that aim three academic departments, that had demonstrated above average success in developing and implementing an innovative career guidance program (CGP) in earlier quantitative research (see Kuijpers & Meijers, 2012), were used as case studies. These cases will from now on be referred to as the 'best practice cases'. In interviews, participants were asked two questions: (1) “What does their CGP look like?”, and (2) “What factors have contributed to its success?”. The initial analysis of the data has drawn our attention to processes of learning and leadership, because participants associated aspects of both with the success of the program. Based on this result, we conducted a literature study to explore both concepts in their mutual relationship and in their relationship to organizational innovation. As a result, we made a distinction between 'social individual learning' and 'collective learning' and our attention was drawn to 'transformational leadership'. In the theoretical framework (see Chapter 2), we hypothesized a positive effect of 'transformational leadership' on both forms of learning, as well as a positive effect of 'collective learning' on 'team results' (i.e., team performance and innovativeness). Moreover, we hypothesized a positive effect of 'social individual learning' on 'collective learning'. The relevant part of the framework is depicted in Figure 5.1.

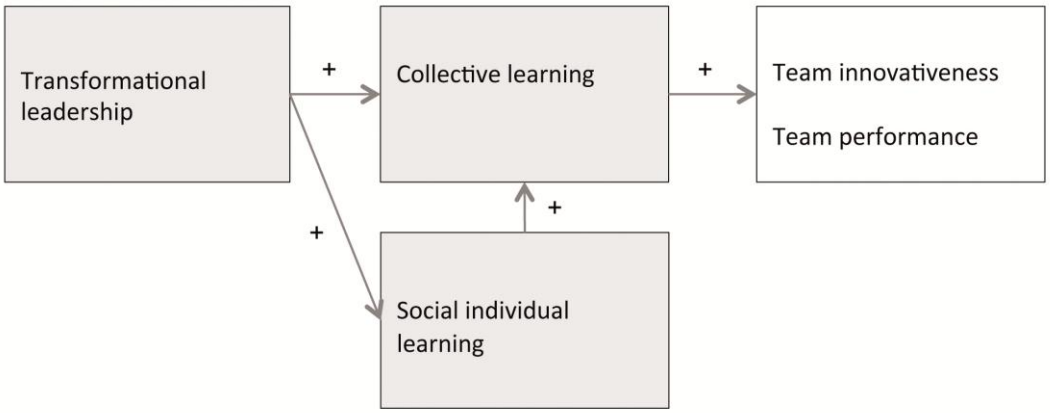

Figure 5.1. Relationships among Transformational Leadership, Collective Learning, Social Individual Learning and Team Results, as hypothesized in the theoretical framework. Relationships among the gray colored concepts were supported by the findings in Study 1b.

Subsequently, a quantitative study was conducted (Studies 1a and 1b), aiming to create a better understanding of the core concepts and their mutual relationships. We tested whether 'social individual learning' has a positive effect on 'collective learning' (Hypothesis 1), and whether 'transformational leadership' has a positive effect on both forms of learning (Hypotheses 2 and 3). Results largely supported the hypothesized factor structure of 'collective learning' and 'transformational leadership'. The hypothesized factor structure of 'social individual learning' was not supported, and the construct was narrowed-down to a one-factor model referred to as 'individual learning in interaction'. With respect to the relationships between the core concepts, results supported the hypothesized positive effect of 'individual learning in interaction' on 'collective learning' – though a relatively high correlation between the concepts was found – and the hypothesized positive effects of 'transformational leadership' on both forms of learning**.** The hypothesized positive effect of 'collective learning' on organizational outcomes could not be tested for practical reasons.

In Study 1b, the left part of Figure 5.1 (indicated in gray) was tested. In order to shed new light on the insights gained, in the present study (Study 2) we re-explore the concepts of collective learning, social individual learning, and transformational leadership, as well as their mutual relationships by means of a qualitative research method. Particularly, we performed a second analysis on the interview data collected for the three best practice cases. As such, we try to expand and deepen our understanding of these core concepts and their interrelationships. More specifically, based on three concrete educational innovation projects, we aim to enrich Figure 5.1 by 'filling' the squares with practice-based examples. We study *best practice* cases, because we assume that in successful innovation projects we will be able to find evident examples of the core concepts. Additionally, we aim to illustrate the arrows in the figure, by discussing how, in these specific projects, 'social individual learning', 'collective learning' and 'transformational leadership' are related to each other and to the innovation projects.

5.1 STUDYING RESEARCH QUESTIONS 3 AND 4

The three CGP best practice cases are analyzed in order to enrich the results of the quantitative study, by exploring the dynamics of 'social individual learning', 'collective learning', 'transformational leadership' and 'team results' in innovation processes where academic departments have successfully developed and implemented a career guidance program; the 'arrows' in Figure 5.1. Specifically, we try to find an answer to the following research question:

Research question 3: What connections can be found between Collective Learning, Social Individual Learning, Transformational Leadership and Team Results in daily practice, specifically in educational innovation processes where teams have successfully developed and implemented a career guidance program?

Moreover, cases are analyzed in order to explore what, in daily practice, is actually behind the abstract concepts of social individual learning, collective learning and transformational leadership, as described in the theoretical model. In the quantitative study we used a number of items to construct scales measuring these concepts. By combining results of the best

practice cases, we looked into the various ways in which they manifest themselves in the innovation processes described above. As such, using a qualitative research design we try to map the concepts' variety and richness. Specifically, an answer is sought to the following research question:

Research question 4: What forms of Social Individual Learning, Collective Learning and Transformational Leadership can be identified in the educational innovation processes described above?

5.2 RESEARCH DESIGN

In this section the design of the study is presented. First, we explain how the three best practice cases were selected, and how, within each case, participants were selected. Next, we describe the guidelines we followed in the interviews. Finally, we describe the method of analysis that we used to study the data obtained during the interviews.

Selection of the cases

Starting from the assumption that students increasingly need to be able develop career competencies, Kuijpers and Meijers (2012) theorized that a career-related program organization (which is practice- and inquiry-based) advances the use of career competencies (i.e., career reflection, work exploration, career action and networking) by students. In higher vocational education, the development of such competencies is often considered the goal of the CGP. Based on a quantitative study, conducted among 4820 students from the different departments of 11 Universities of Applied Sciences in the Netherlands, they were able to confirm the hypothesis that a career-oriented learning environment, one that "stimulates real-life work experiences, that gives the students opportunities to influence their own course of study by offering them the opportunity to make choices, and also fosters a dialogue about these experiences and choices" (Kuijpers & Meijers, 2012, p. 11), contributes to the use of career competencies. Moreover, they found that curricula of the departments participating in the study were barely practice or inquiry based and that they fell particularly short in the area of dialogue. Respondents were students studying at the following departments: healthcare (22%), technical studies (24%), economics (30%), education (16%) and agriculture (8%). In follow-up research, three best practice academic departments were selected from the sample, each from a different university. Students from these departments showed above-average levels of career competence (i.e., career reflection, work exploration, career action, networking) and reported having experienced an above-average level of career-orientation in their learning environment. In each of the departments, high scores were found on the aspects: practice-and inquiry based educational practice.

Description of the cases

Case 1 relates to an academy (i.e., a sub-unit of a university) in the healthcare sector, comprising two bachelor programs. Two teacher teams (68 teachers in total) are involved in this academy, one working at the propeadeutic level (year 1 of the curriculum) and the other on the main phase of the curriculum (years 2 to 4). This case can, based on the results of

Kuijpers and Meijers (2012), be described as an institution with a strong dialogical culture where students can actively participate in the dialogue about their own development and the growth of their careers. Students in CGP learn to orientate themselves in their field and learn to think about what kind of work fits with them.

Case 2 covers one bachelor's program in the agriculture sector. Two teacher teams (40 teachers in total) are involved, each attached to a specific program unit. This case can also be described as one about an institution that has a strong dialogical culture, where students actively participate in a conversation about their education, but to lesser degree about their work. In CGP they learn to navigate in their desired direction, in part by actively developing and using their networks.

Case 3 relates to an institution with three bachelor programs, two in healthcare and one in education. Three teacher teams (83 teachers in total) are involved in this case, each one attached to a specific bachelor's program. This case, just like in Case 1, can be described as a program with a strong dialogical culture, where students take an active part in the dialogue about their development in relation to work and career. This educational institution is (even more) strongly practice-and -inquiry based than the other two, but the conversations about the experiences gained are less reflective and action-oriented. The students report talking quite a bit about self and work, however the conversations lead less frequently to the development of career competencies than in the other two cases.

Selection of participants

At the start of the study, the person who had been the contact person in the prior quantitative study by Kuijpers and Meijers (see Kuijpers & Meijers, 2012) was approached. He or she was asked to participate in qualitative follow-up research aimed at gaining more insight in the content of the academy's CGP and the relevance of context-specific organizational factors. After collegial consultation, each of the contact persons agreed to participation.

The contact persons were asked to organize a series of interviews in which we could familiarize ourselves with as many different perspectives on CGP as possible. Specifically, the request was made to include one or more interviewees from each of the following groups: program developers, program coordinators, managers, CGP-teachers and students. The estimated length of the interviews with managers was half an hour; the interviews with each of the individuals from the other groups averaged around an hour. In total 16 people, selected by the contact persons were interviewed: three managers, three program developers (of which two were innovation project leaders), three CGP-coordinators, two teachers, and five students (see Table 5.1 for a specification per case). Each of them was, at the time of the interview, involved in the development or implementation of the educational program within one of the best practice cases. For organizational reasons it was only possible to interview the CGP-coordinator and one student in Case 2. In Case 1, six out of seven participants were female, in Case 2 one out of two, and in Case 3, two out of seven.

Table 5.1
Interviews held within each of the cases

Case 1	**Case 2**	**Case 3**
1 team leader & 1 CGP-developer/teacher 1 CGP-coordinator 1 CGP-developer/ innovation project leader 1 CGP-teacher 1 department manager 2 students	1 CGP-coordinator 1 student	1 CGP-developer/ management team member/ innovation project leader 1 team leader 1 CGP-coordinator 1 CGP-teacher 1 CGP-developer/ teacher 2 students

Interview guidelines

The interviews were semi-structured. Before the interviews were held, a set of questions was formulated for staff (see Appendix J, Table J1) and students (see Appendix J, Table J2). Because of the complexity of the CG-programs, interviewees were allowed to 'tell their own story'. During the interviews we tried to find answers to the predefined questions by elaborating on the participants' stories. Topics that were not discussed during that part of the process were subsequently addressed at the end of the interviews, if participants' agendas allowed for the interviews to continue.

In two cases, the interviews were tape-recorded and transcribed. In one case the interviews were not recorded (because of failure of the recording device), but notes were taken during each interview and these were processed directly after the interview and resulted in an interview report. Based on the interview reports and available documents, case descriptions were made for the three cases. The case descriptions were presented to the contact persons, who validated those, and their suggestions concerning factual aspects (e.g., the content of CGP, or its origin) were taken into account for the final case descriptions.

Analysis of the cases

In order to find an answer to the research questions, two types of analysis were performed: a within-case analysis and a cross-case analysis. In answering research question 3, a within-case analysis was performed first. This analysis was aimed at understanding, at case level, the connections between 'collective learning', 'social individual learning', 'transformational leadership' and 'team results'. Next, data related to all three cases were combined and a cross-case analysis was performed. This analysis was aimed at understanding patterns, as well as each case's unique contribution to our insight in the dynamics between the core concepts. In answering research question 4, a cross-case analysis was performed. For each of the core concepts we made an inventory of the various ways in which it manifested itself in the innovation projects.

Data (i.e., interview transcripts and reports) were prepared for the analyses using a three-step approach. First, interview transcripts and reports were coded, using Atlas.ti 6. Relevant quotes (i.e., recorded comments) were selected, marked and assigned a general code, using the six aspects of 'collective learning', the three types of 'social individual learning', and the

three dimensions of 'transformational leadership' identified in our theoretical framework (see Chapter 2). For quotes that were linked to the core concepts but that could not be organized by means of the codes available, new codes were developed. Then, a list was generated of relevant quotes, organized into main categories. Within each main category, quotes which had content-based resemblance were clustered and sub-codes were assigned to each cluster. Second, for all quotes we assessed whether they might additionally be placed within one or more other (sub-)categories, and a list was generated of all quotes that had multiple codes assigned to them. Such a list showed which (sub-) categories, if any, overlapped. Strongly overlapping (sub-)categories were considered insufficiently distinctive. In such a case, either the categories were combined into one new, broader category (if they presented interwoven, but different concepts), or one of the categories was removed from the list (if they presented the same concept that was assigned to more than one main or subcategory). As a result of the first two steps, an overall overview of the aspects of 'social individual learning', 'collective learning' and 'transformational leadership' identified in the interviews was developed. Finally, for each sub-category quotes were organized by case and by interview.

For both analyses, case descriptions were used in conjunction with the quotes list. Using these data, we first describe the innovation (i.e. the development and implementation of the CGP) based on the commonalities between the cases. Next, as a result of the within-case analysis, per case we provide a description of the forms of 'social individual learning', 'collective learning' and 'transformational leadership' that we identified in the interviews. Moreover, we discuss the connections between these concepts as well as their connections to 'team results' (i.e., the learning environment created for students). Presenting results of the cross-case analysis, we discuss similarities and differences between the cases. Finally, combining results of all three cases, we provide an overview of the forms of 'social individual learning', 'collective learning' and 'transformational leadership' that we identified in the interviews.

5.3 RESULTS

The innovation: developing and implementing the CGP

The three cases show strong similarities with regards to the innovation trajectory and the way in which that was organized (for descriptions of the innovation per case we refer to Appendix K). Such a result is not surprising given that teacher teams aiming to innovate are to a large extent faced with comparable conditions at the start (see f.i., Kessels & Ehlen, 2006; Bronneman-Helmers, 2011; Meijers, 2012), and the development of a CGP requires a specific way of learning (i.e., third-order learning, see Chapter 2). The origin of the innovation is the 'shifting' of the educational model that has taken place within the particular programs involved. This shift can be described as the transition from a teacher-directed standard program aimed at knowledge transfer to a student-directed tailor-made program directed at knowledge construction and competencies. It is a change that is felt in every part of the curriculum and in every aspect of the organization. This is why a complete renovation of the educational programs along the lines of competence-focused and inquiry-based learning is chosen in the cases. The combination of competence-focused and inquiry-based learning requires a didactical approach whereby experiential learning – in the form of practical and

workplace learning – is at the heart of the curriculum. The overhaul within institutions is seen as a radical organizational change based on a paradigm shift in the underlying vision of learning and education. Students are expected to be in a meaningful learning environment where they will be involved in dialogues with relevant others (e.g. peers, teachers, colleagues, leaders) about their own continuing learning process, which they will keep alive, and for which they will set out their own learning trajectory based on personal life questions. They are guided so that they can develop a reflective and inquisitive attitude that is focused on self-development. The competence-focused and inquiry-based shaping of the curriculum makes it possible for students to have personally meaningful practical experiences within their learning trajectories, to reflect on these, and make conscious choices about developmental paths, while also contributing to the way their own learning environments are set up.

The dynamics between Social Individual Learning, Collective Learning, Transformational Leadership and Team Results per case

Prior to presenting case-level results it should be noted that we could not clearly distinguish between 'collective learning' and 'social individual learning' (see section 'Forms of Collective Learning, Social Individual Learning and Transformational Leadership'). As a result we will only address 'collective learning', 'transformational leadership' and 'team results'.

Case 1

A graphic representation of the results for Case 1 is provided in Figure 5.2, presented at the end of this section. This figure presents a first regulation or ordering of the data, and, as such, provides a tentative case description[13].

Collective Learning and Transformational Leadership in the innovation process. Referring to the starting phase of the innovation trajectory, participants emphasize the learning approach that was taken by the team leader at the time. Quotes predominantly come from the team leader herself, but the image she sketches is repeatedly confirmed in the interviews with other team members. The innovation trajectory is considered a continuous learning process. As the academy director notes, the goal of the trajectory is really a 'moving target' and therefore continuous adaptation is deemed necessary. The former team leader stresses the importance of social learning in the process.

In terms of 'collective learning', the team works from a clear *vision*, though not all teachers seem to be committed to such a vision. This is partly attributed to the misalignment between teachers' capabilities/ intrinsic motivation and the tasks they are provided with by their team leader. Such misalignment results from the large number of CGP-teachers that are required to provide the extensive guidance to students. Social forms of learning (e.g., intervision[14], peer coaching, feedback and knowledge exchange), are institutionalized in or-

[13] We emphasize that Figure 5.2 does not represent a conceptual model. Using results of the cross-case analysis and results of our other two empirical studies, in Chapter 7 we will formulate a revision of the conceptual model presented in Chapter 2.

[14] Intervision is an organized conversation between people who work or are in training in the same field. Participants in the conversation discuss the work performed and work-related problems; intent is that the expertise of those involved increases and the quality of work improves. Unlike supervision, there is no hierarchical situation where someone is in charge (http://nl.wikipedia.org/wiki/Intervisie).

der to support teachers' individual and collective learning processes. Via such forms of learning teachers are able to master required skills, to expand their own cognitive and behavioral repertoire, and solve problems they encounter at work. The team leader considers both open communication and teachers' determination to share experiences, thoughts and feelings with colleagues to be necessary conditions for the learning process. *Knowledge exchange* is not restricted to the team-level, but also includes students, other studies within or outside the educational institute, internal and external experts, and the work field. Moreover, specific CGP knowledge is spread by capable and motivated team members participating in training done at the institutional-level. In line with the focus on social forms of learning, *dialogue and inquiry* are considered to play an important role in the innovation process. It is used to make teachers think along about the innovation process, to create a foundation for the CGP, to align teachers' ideas, and to address differences of opinion and resistance to change. With respect to '*collective action*', differences between teachers' CGP approach are repeatedly emphasized. Most participants say they accept such differences, specifically when team goals are met. However, some perceive differences to be problematic, and feel they harm the unity and coherence of the program. As is consistent with any learning approach, team results are *evaluated* against the goals set by the team and program results are evaluated based on students' feedback.

Participants in the interviews emphasize how the (former) team leader supported the team by making the innovation project a priority and by institutionalizing and supporting social learning processes. In terms of 'collective learning' she has created conditions which made it attractive for the team to focus on the development of the CGP (team vision), and to be actively involved in the social learning processes associated with it. Participants indicate that the team leader's learning approach and her expectation of continuously improving performance created resistance to change in some teachers. Other quotes with respect to leadership predominantly come from the interview with the former team leader herself, but (as was noted before) her ideas are confirmed in the other interviews. Through processes of dialogue and inquiry, the team leader supported the creation of a shared understanding within the team (e.g., inquiring about the team’s vision, openly discussing resistance to change). She urges team members personal development and team development as important means by which to stimulate the learning processes underlying the innovation. She supported both types of development in various ways (e.g., by offering support to team members in the innovation process, inquiring about their ideas, stimulating the generation of ideas, helping teachers reflect on experiences gained), which might be considered consistent with a transformational leadership style. One of the team leader's focus points in the innovation process was to achieve a match between team members' preferences with respect to work and the tasks they were provided with. She tried to 'put the right person in the right place' in order to utilize teachers' strengths and motivation. To that aim she asked teachers about their specific 'added value' to the team and the way they would like to contribute to team results. As such, she seemed to be striving for aligning team members' individual goals and team goals, thereby increasing the chance that team members would actively contribute to realizing the team's vision. In addition, the team leader held team members responsible for their joint performance, and by doing so stimulated collective evaluation, specifically in the light of the team's vision. The team leader and the innovation project leader indicate that they actively refocused the team's attention when the development of the CGP seemed to become diluted too much.

In addition, participants point to a number of factors they perceive to be limiting the innovation process and which seem to be related to the core concepts of collective learning, transformational leadership, or team results. Participants in the interviews associate the leaving of the team leader with a decreased managerial focus on CGP, resulting in a decreased teacher commitment and involvement in learning and innovation. Other limitations to the innovation process are its high costs and a lack of time (i.e., time pressure) perceived by CGP-teachers. The high costs are specifically perceived as problematic in the light of the change of management and the decreased focus on CGP, the lack of time is attributed to the latter. The lack of time leads to the diminishment of teachers' involvement in the innovation trajectory and the underlying learning process. For example, as a result of time pressure teachers choose not to participate in intervision groups any longer. Participants also refer to organizational conditions, specifically to structural inflexibility. They point to the fact that the amount of flexibility that can be offered to students in the curriculum is restricted, hindering CGP-teachers from offering students the inquiry-based program envisioned at the start. As such, structural inflexibility might limit teachers in acting upon the vision they formulated in the learning process. Finally, participants point to the misalignment between teachers' capabilities/ intrinsic motivation and the tasks that were assigned to them by their team leader. Participants associate such misalignment with sub-optimal performance and with a lack of motivation to accomplish the team's vision with respect to the CGP.

Result of the innovation process: relating organizational innovation to Team Results. An interesting parallel can be drawn between the way students are guided within the context of CGP and between the way teachers are guided within the context of the innovation trajectory. The approach that is chosen to guide teachers through the CGP innovation process is comparable to the approach taken to guide students in their personal and professional development. Both processes are considered a learning process, where learners predominantly learn in an experiential way. Realistic work situations, either simulated or real, provide students with practical experience; experimental settings and daily work situations provide teachers with practice. Looking back at experiences gained, insight can be developed. For students and individual teachers, the learning process is focused through learning questions (which might be formulated in a personal development plan), for the team it is focused through the team's vision. Moreover, students and teachers are supported in exploring and utilizing their strengths in order to be able to deliver a unique contribution to their environments. Such an approach inevitably leads to differences between students (as is acknowledged in the personal learning trajectories) and between teachers (as is repeatedly emphasized by team members). Variety is, at its core, thus not perceived as problematic. Next to experiential, the learning processes of both students and teachers are considered of a social nature, with dialogue as a central means of enhancing learning. Intervision, supervision and feedback are institutionalized as important ways to stimulate learning by students and teachers. Both need to learn to communicate openly and receive feedback. As two participants mentioned, this requires that teachers and managers model such behavior.

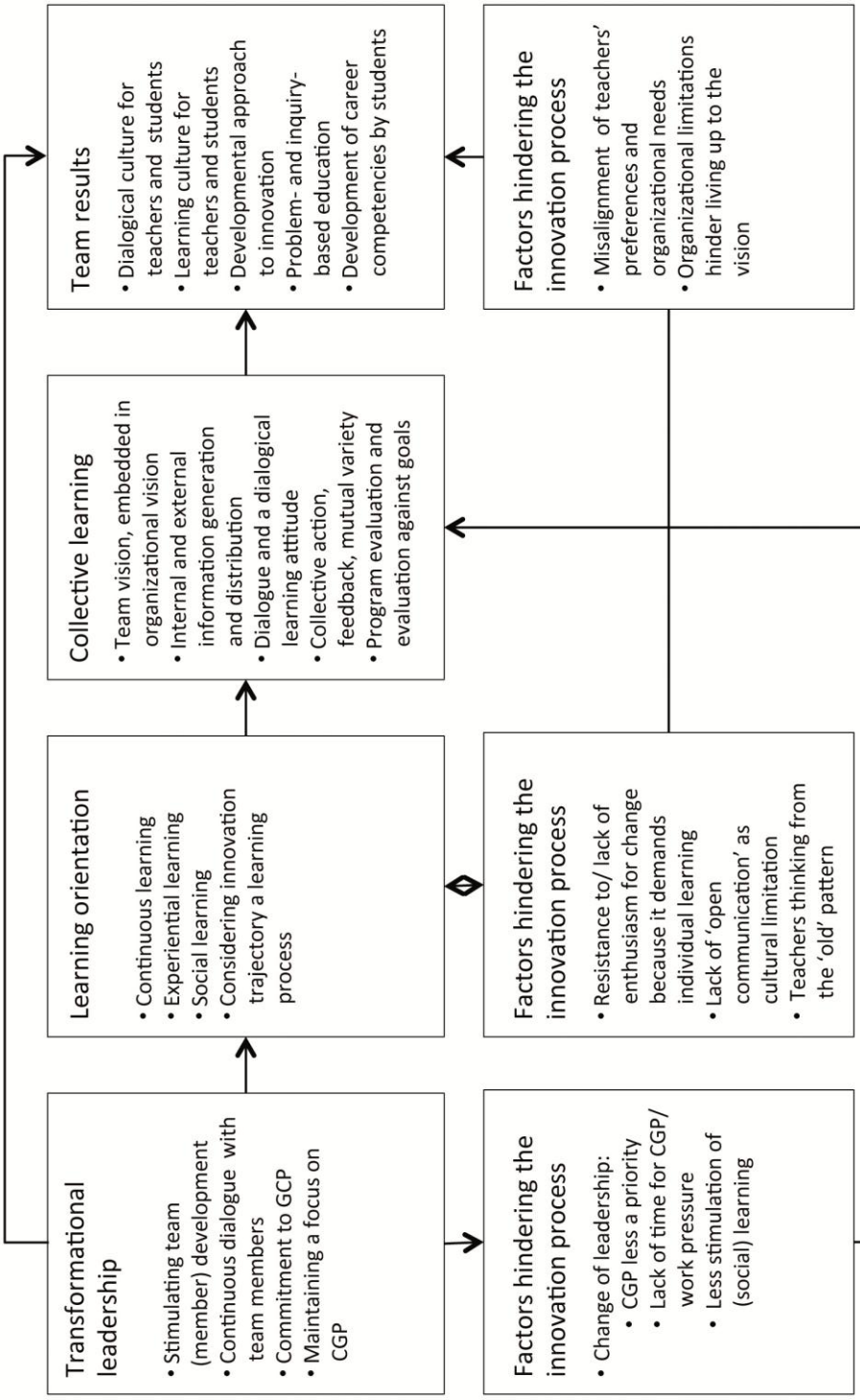

Figure 5.2. Tentative case description, displaying the interactions between Collective Learning, Transformational Leadership and Team Results in Case 1. In addition to results for these core concepts, supplementary results are depicted with respect to factors perceived to be negatively influencing the innovation process and which seem to be related to the core concepts.

The motto of Case 1 might be described as 'practice what you preach'. Teachers seem to be able to offer students a powerful learning environment, for they themselves operate in a powerful learning environment. Such environment demands commitment to the goals set in the CGP; the decreased focus on the CGP, caused by the replacement of the team leader, decreased teachers' ability (and likely their willingness) to be involved in the CGP. Various participants consider this to be a limiting factor in the academy's CGP innovation process.

Case 2

A graphic representation of the results for Case 2 is provided in Figure 5.3, presented at the end of this section.

Collective Learning and Transformational Leadership in the innovation process. Case 2 differs from the other two cases in that only one interview is held at this academy. The CGP-coordinator as well as a student participated in this interview, and their focus was on the content of the CG-program and the student's experiences with it. Due to time limitations, not all questions in the interview guideline (see Appendix J, Table J1) could be addressed; specifically the topic leadership remained unaddressed. As a result, for this case, only interactions between aspects of learning and innovation can be seen.

In general, the CGP is developed by means of a process approach, with experiential learning at its core. While the main features of the curriculum are known in advance, its specific content, and consequently the content of the CGP, result from the experiences (CGP-) teachers continuously collect and the meaning they attach to those experiences. As such, the development of meaning is considered a ongoing process. The coordinator notes that, as a result of the strong dependencies among its constituting elements, the curriculum is a complex system. Fundamental changes in the CGP would force change in other parts of the curriculum and are therefore limited. In this case, the structural inflexibility resulting from the curriculum seems to hinder radical innovation. As such, structural inflexibility seems to influence the relationship between 'collective learning' and 'team innovativeness'.

With respect to 'collective learning', there is an explicit focus on creating a *shared vision* on the CGP as well as on the underlying educational philosophy. Team members meet several times per year to reflect on the team's vision on the CGP and to adjust it, if necessary, to newly-gained insights. Meetings are organized for the group of CGP-teachers, as well as the whole teacher team. During these meetings teachers are encouraged to put forward their own ideas and to discuss those via 'World Café'- for instance methods for hosting group dialogue. As such, the vision is continually updated in response to the evolving shared understanding within the team. The CGP-coordinator indicates that, as a result, the CGP-vision is supported by the team members.

Team meetings and sub-team meetings are considered an important way to *generate and distribute information*. For example, CGP-teachers regularly meet to share their experiences, to discuss the development of the CGP and to instruct and coach each other in using various CGP-instruments. Besides internal ways of information generation and distribution, external ways are also utilized. Teachers participate in a training program developed and offered in cooperation with a consultancy bureau. One of the main goals of this program is to develop

teachers' dialogical and coaching skills. In addition, the CGP-coordinator actively and continuously exchanges knowledge and insights with the CGP-coordinator of the second bachelor's program provided by the overarching educational institution. Knowledge is also generated by cooperating with research groups within the institution. If specific research questions arise within the team, teachers may participate in a research group to explore the question under the supervision of a professor. Such cooperation is also used to create possibilities to experiment with new ideas in a systematic and controlled way. Through the research conducted via the research groups, the method of evidence-based development and learning is explicitly applied as an impetus for the CGP development process. The knowledge that is created within research groups is exchanged with managers, as well as relevant project teams and program coordinators. Moreover, internal or external experts (e.g., educationalists) are consulted if the team is confronted with questions which cannot be answered by the team members themselves.

As a consequence of the meaning attached to undertakings based on shared understandings, *dialogue* is considered an important means to foster innovation. Teachers are invited to create, via a dialogue, a shared understanding of the team's current situation, the situation envisioned for the future, and ways to develop the former into the latter. The variety of ideas present within the team is welcomed and teachers are encouraged to share and discuss their ideas and experiences. As such, inquiry is encouraged.

With respect to *collective action*, teachers are provided with a certain amount of flexibility to design their own approach to the CGP. Within the boundaries set by the CGP-vision (which result in 'themes' that need to be addressed by all CGP-teachers), teachers may choose their own methods and set their own schedule. Such a flexible approach facilitates customization of the CGP among teachers and their groups. Moreover, it allows for experimentation with alternative ways to realize the team's ambitions with respect to the CGP, thereby increasing the team's behavioral repertoire.

Evaluation is considered an essential part of the ongoing learning process associated with the development of the CGP. CGP-teachers regularly meet to discuss their experiences with the CGP, to evaluate the results (also with respect to the goals set in advance), as well as the way those were achieved. As a result, the quality of the CG-program and the development process is continuously improving. The CGP-coordinator notes that the learning approach chosen for the development of the CGP is strongly supported by that teachers within the team are open to change and personal development.

Result of the innovation process: relating organizational innovation to Team Results. As in Case 1, in Case 2 an interesting parallel can be drawn between the way students and teachers are guided within the context of CGP. Both students and teachers find themselves in a continuous and predominantly experiential learning process. While students mainly learn in the context of realistic work situations, teachers learn in their daily work situations. By evaluating the experiences gained, they develop insight in the learning processes they are involved in. Social learning has a prominent place in the learning process of both students and teachers. Students evaluate and reflect on their experiences in their CGP-groups, teachers do so within their team.

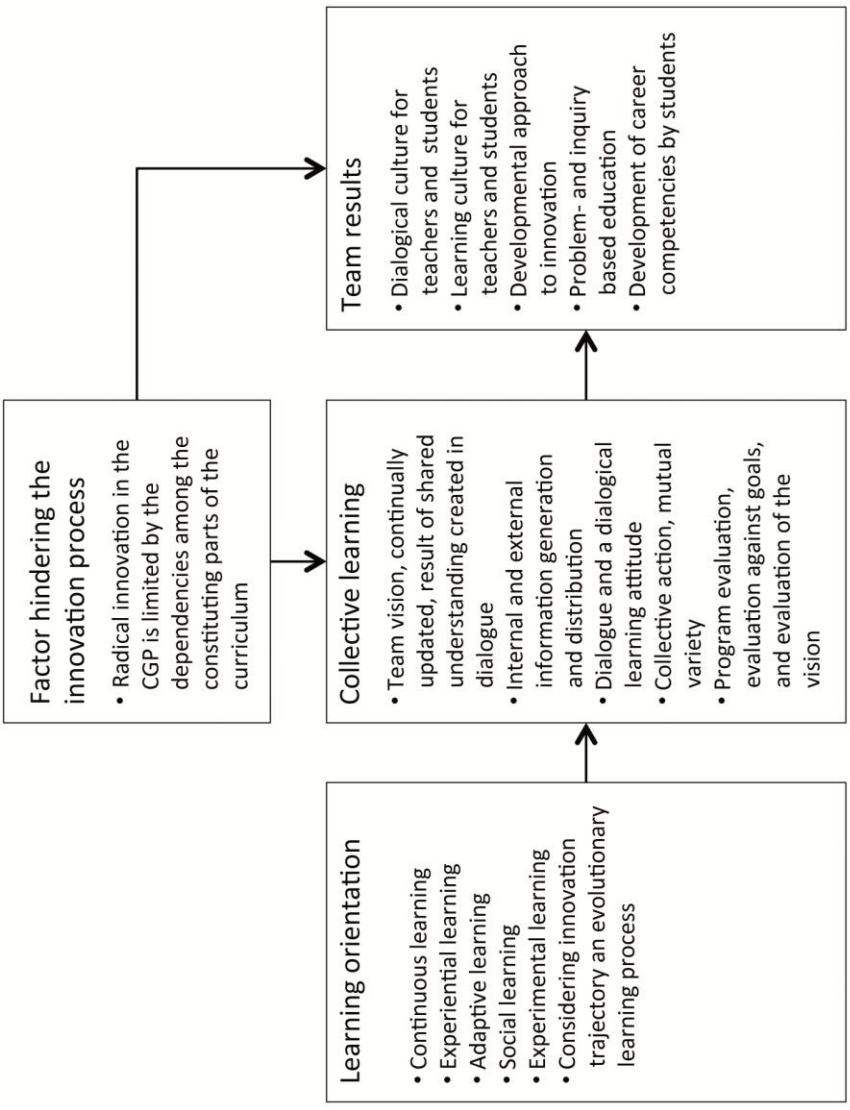

Figure 5.3. Interactions among Collective Learning and Team Results in Case 2. In addition to results for these core concepts, a supplementary result is depicted with respect to a factor which is perceived to be negatively influencing the relationship between Collective Learning and Team Results.

For students, the learning process is focused on their ambitions as expressed in their personal profile. During their studies, students are challenged and supported to learn about their identities and ambitions and the consequences of these for their personal learning trajectory. For the team, the learning process is focused by means of its CGP-vision, which is founded in a shared understanding as developed in group dialogue. In this learning process, students and teachers are encouraged to customize their programs and to undertake activities that match their personal situations. As a result, differences exist between students and among teachers. For students, variety is considered the basis of their personal profile, for teachers it is considered an important source of learning and innovation. In summary, the motto of Case 2 might be 'evolutionary developing via ongoing adaptation'. As in Case 1, teachers seem to be able to offer students a powerful learning environment, for they themselves operate in a powerful, experiential learning environment. In both learning environments, dialogue is considered a central focus. In dialogue with relevant others, both students and teachers learn to make sense of their experiences and steer their learning processes in accordance with the insights they've developed.

Case 3

A graphic representation of the results for Case 3 is provided in Figure 5.4, presented at the end of this section.

Collective Learning and Transformational Leadership in the innovation process. In terms of 'collective learning', the aspect *shared vision* plays an important role. The vision on the CGP is embedded in the academy's vision of education; both were developed during a recent and radical innovation project. In this project, aimed at the introduction of a new educational 'model', an academy-wide problem- and inquiry based curriculum is developed and implemented. At the start of the project, teachers from all three bachelor programs in the academy spent a week discussing and developing their individual and collective ideas about the new model. The underlying vision was explicitly addressed in the process. The outcome of that vision was taken on by the project group responsible for developing and implementing the educational model. The project group members were key people (though not the team leaders) from all three teams; they were guided by the academy's innovation project leader.

In the development of the CGP, teachers were regularly invited to share their thoughts and experiences with the project group and to give feedback on its output as well as the (perceived) feasibility of its plans. Furthermore, in translating the project group's ideas into concrete educational products, teachers were explicitly invited to participate. For example, motivated teachers were made responsible for designing specific parts of the curriculum. During a period of one year, they were assisted by experts to discuss their ideas, formulate a subvision and design 'their' part of the curriculum accordingly. As a result, the innovation project leader notes, the vision is shared by teachers from the academy and they are involved in the ongoing changes. He also notes that the vision was not unanimously supported from the start. Resistance mainly came from teachers who had been at the academy for many years and that held on to 'frozen ideas'. By bringing in new teachers who had experienced in practice that these 'frozen ideas' were no longer adequate, the situation changed. Their input led to an open discussion of teachers' resistance to change. In this discussion, criticism was taken serious and the potential loss teachers felt in response to the innovation process was

made explicit. Ultimately, the open conversation led teachers who at first resisted to accept the new educational model and the underlying vision.

Information is generated and distributed in various ways, though *dialogue* among team members is considered one of the central mechanisms. A basic premise in the academy is that teachers need to go through a learning process themselves before they are capable of adequately guiding students and teaching them relevant skills. Teachers need to be able to experience various ways of being guided in their own learning process. Such an approach to teachers' professional development requires intensive collaboration among teachers and a culture supportive of giving and receiving feedback. Teachers are supported in this process by means of schooling (at the level of the team, the academy and the educational institute) and close collegial collaboration. Prior to implementing the new educational model, teachers were trained with respect to their coaching, reflection and dialogue skills. The core training was offered by a leadings expert from outside the university. This training has initiated a change of culture from 'transferring fixed knowledge' to 'continuously creating knowledge in dialogue'. As a team leader points out, such a culture demands teachers to be 'open', which makes them more vulnerable; colleagues and students get to understand both their strengths and weaknesses. Knowledge exchange is actively stimulated and in the daily work situation, teachers are stimulated to share knowledge and experiences with colleagues, both formally and informally, at the team level, the academy level and at the university-level. Team meetings intended to facilitate the exchange of knowledge are organized on a regular basis. CGP-teachers indicate that they consult colleagues without hesitation when they have questions or lack specific knowledge. Furthermore, teachers are stimulated to develop themselves in areas that are less familiar to them. The model of 'organizing while learning' is considered the organizational answer to the model of 'learning to learn' which is central to students' learning.

With respect to *collective action*, participants in the interviews repeatedly indicate that teachers are provided with a certain amount of flexibility to design their own approach to the CGP. As in Case 2, within the boundaries set by the CGP-vision, teachers may choose their own methods and set their own schedule, facilitating the customization of the CGP to teachers and their groups. A CGP-teacher indicates that he strives for alignment by preparing lessons with the colleague with whom he is responsible for the CGP in a particular year of the curriculum. The innovation project leader notes that some CGP-teachers are uncomfortable with varying approaches among teachers, specifically when they feel that colleagues invest less time in the CGP than they themselves do. A CGP-coordinator associates part of the variation in teachers' approach with teachers' (lack of) competencies. As was discussed when speaking about the vision of the CGP, an important characteristic of the underlying innovation process is teachers' involvement. The process is founded in the collective actions undertaken by many teachers within the academy. Such an approach is contrasted by the innovation project leader with a top-down approach, which has led to disappointing results (lack of support from team members) in prior innovation projects.

Evaluation is done in various ways. Participants in the interviews repeatedly refer to the student evaluations done by the department for quality control. In addition, they indicate that they evaluate the CGP informally with colleagues, as well as with students. Moreover, students are formally invited to systematically discuss their feedback with staff members. Such

meetings are intended to create more insight into the mainly quantitative results obtained by the department for quality control, and into students' needs with respect to the CGP.

Most quotes on leadership come from the interviews held with the innovation project leader, a CGP-coordinator and a team leader. They emphasize the importance of managerial commitment to the innovation program. The innovation project leader points out that the attention paid to the process is waning now the new educational model is implemented and CGP-teachers feel they 'master' the system. As a result, the three teams within the academy, as well as CGP-teachers within the three teams now more frequently choose to follow their own approach to the CGP, which has led to a less consistent vision of the project. He emphasizes the importance of teams and managers keeping their attention focused on career guidance and the added value of this small scale, relatively expensive form of education. It would require that managers keep alive the discussion on the broader perspectives of learning, which are at the foundation of problem- and inquiry based education; this would prevent both managers and teachers from regressing to the ideas that were fundamental to the 'old', supply-driven educational model. He notes that under internal pressure (mainly financial and time pressure) and external pressure (shifts in the national political educational agenda) some managers and CGP-teachers tend to steer students primarily to the standard route through the curriculum instead of stimulating them to personalize their route. Again, it seems to be that decreased managerial commitment and time constraints can steer teachers away from working in line with the original team vision on the CGP.

The team leader describes his role in terms of 'transformational leadership'. He indicates the necessity of putting the innovation project on the team's agenda. Through his commitment to the CGP, the team leader supports the team in remaining focused on its development. As such, he seems to stimulate the team to include the development of CGP in its vision. Moreover, by portraying the positive effects that the innovation project might bring, and by involving teachers who are experiencing resistance to the changes, he seems to work on teachers' acceptance of the vision underlying the innovation process and the collective learning process. In describing his role, the team leader also indicates the need to facilitate teachers in their innovative activities, to allow them freedom to develop their own thoughts, and to support innovators in the face of critical others. While these task do not seem to be directly related to aspects of 'collective learning', they do contribute to teachers' (experiential) learning in the innovation process.

The innovation project leader also describes his approach in terms of 'transformational leadership'. He focused on creating a dialogical culture in the innovation project group, so that members could freely exchange ideas while striving to work towards a collective product building on the strengths of each of the three teams. As such, he contributed to the collective learning process by creating a culture favorable to knowledge exchange, dialogue, and collective action, and thus of 'collective learning'. He also notes that he continuously communicated to the group members his conviction that they were capable of delivering something 'beautiful' together, an act he considers to have contributed significantly to the group's success. As such, he might be said to have stimulated the team to formulate a vision that energized team members.

In addition, participants point to a number of factors they perceive to be limiting the innovation process and which seem to be related to the core concepts of collective learning, 'transformational leadership', or 'team results'.

First, the innovation project leader notes that, now the new educational model is completely implemented, some managers and CGP-teachers tend to change their approach to the CGP: from an active and (time) intensive career oriented approach to a monitoring system for tracking students' progress with respect to the general competencies associated with their bachelor studies. He attributes this change to time and financial restrictions felt by managers and CGP-teachers. A CGP-coordinator also indicates that time is a limiting factor. The innovation trajectory coincides with daily teaching activities; this combination of activities can generate too much time-pressure. She notes that CGP-teachers already say they experience time-pressure, this results in them taking a critical stance towards further change. In addition, she notes that teachers are not always compensated for their innovative activities, making the innovation trajectory partly dependent on teachers' willingness to innovate in their 'own' time. In this case it seems that decreasing managerial commitment and time constraints cause a number of teachers to pursue the team's vision less actively.

Second, participants emphasize the importance of culture for the success of the innovation project. They point to the necessity of having a dialogical culture based on open communication and feedback, openness to new ideas and close collaboration within the team. As we put forward in Chapter 3, it could be argued dialogue is the central element of 'collective learning'. While several participants indicate that generally such a culture is created in the course of the innovation trajectory, it is also noted that some teachers are not capable or willing to participate in open dialogues and in the process of exchanging feedback. A related comment is made by a CGP-coordinator; she signals a drawback of the extensive knowledge sharing within the team, specifically when it comes to collegial trainings. Such forms of training are critically dependent on teachers' ability and willingness to openly communicate. She, as well as other participants in the interviews, consider the presence of a dialogical culture as essential for social learning processes to succeed. The CGP-coordinator also points out that collegial training introduces the risk of developing a 'closed' system where the team's knowledge base is only fed from within. As such, she stresses the importance of generating knowledge externally as well as internally.

Finally, a CGP-teacher points out another organizational limitation: he signals that a large number of students in a class hinder teachers' ability to offer an inquiry-based program. Again, this might be understood as a form of structural inflexibility.

Result of the innovation process: relating organizational innovation to Team Results. Again, the learning of students is closely associated with the learning of teachers. The development of the CGP and the underlying educational model is a process which can be characterized as a collective learning process. Both developments result from extensive dialogue, aimed at creating a shared understanding and collectively translating this understanding into concrete 'products'.

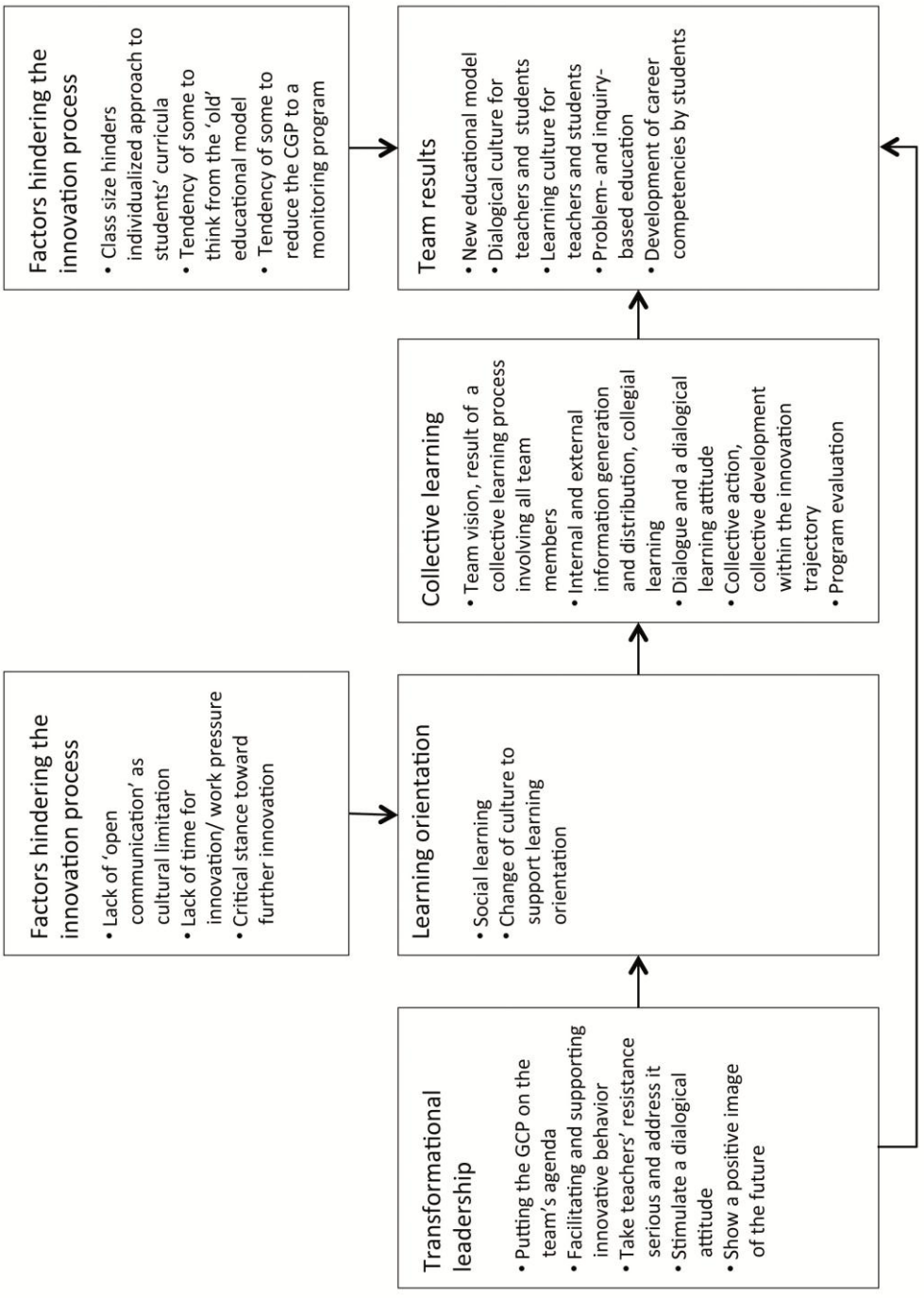

Figure 5.4. Interaction among Collective Learning, Transformational Leadership and Team Results in Case 3. In addition to results for these core concepts, supplementary results are depicted with respect to factors perceived to be negatively influencing the innovation process and which seem to be related to the core concepts.

In tandem with this process of collective learning, the team is facilitated in various ways so that it can undergo a culture change in order to create a 'learning culture'. Teachers, in turn, strive to provide students with a 'learning culture' as well. Such a culture is strongly associated with 'social learning' and therefore dialogue plays a central role in the learning processes of both teachers and students. Moreover, students and teachers need to learn to communicate openly and accept feedback. At the level of the individual teachers, a basic premise is that teachers themselves need to go through a learning process prior to guiding students' learning processes. Teachers' individual learning processes are supported by means of schooling, training and social learning within the team. For students and teachers, experiential learning is the central mechanism and a realistic work situation provides them with relevant practice. Students' learning processes are focused by means of personal learning questions (which are formulated in a personal education plan), the team's learning process is focused by means of a team vision. The team vision results from a collective learning process, which is explicitly addressed at the start of the innovation trajectory. Teachers seem to be able to offer students a powerful learning environment, for they themselves operate in a powerful learning environment. The motto of Case 3 might be described as 'shared understanding as a basis for collective development'.

Similarities and differences between the cases

By comparing the cases presented in the previous section (i.e., cross-case analysis) we aim to understand patterns, as well as cases' unique contribution to our insight into the dynamics between 'collective learning', 'transformational leadership' and 'team results'. First we address the similarities between the innovation processes in the cases. Next, we look at the similarities and differences in terms of 'collective learning' and 'transformational leadership'.

1. The innovation processes in the best practice cases

In each case the innovation process is designed as a collaborative, developmental learning process, which might be considered a collective learning process. Such a result is not surprising because the innovation requires a change in the principles of the educational model underlying the curriculum, and therefore requires third-order learning (see Chapter 2). This type of learning is of a social nature: it is based on dialogue in which space is made for multiple social realities, and in which a shared meaning around issues and new possibilities is constructed (Wierdsma & Swieringa, 2002; Wierdsma, 2004). Third-order learning might be arrived at through processes of collective learning. Indeed, in the cases the various aspects of 'collective learning' seem to be present. Conform the characteristics of third-order learning and 'collective learning', in each of the cases there is a strong focus on social learning, and the creation of a shared understanding. In Case 1 the learning process is supported by institutionalized forms of social learning, and by wide ranging processes of information generation and distribution in Case 1. In Case 2 it is supported by evidence-based research, and in Case 3 by a culture favorable of social learning.

The innovation processes are inspired and guided by team visions, which are developed within the teams. In two cases, teams strive for continuous adaptation, an approach which is consistent with the image of a learning organization. In the remaining case the continuous

approach is less evident, and interestingly the implementation of the CGP is followed by a decreased interest in the CGP.

In each of the three cases dialogue and a dialogical culture turn out to be at the core of the innovation process: dialogue and inquiry are ways to arrive at a shared vision regarding the innovation (process), interpret the information generated internally and externally, create a shared understanding, translate this understanding into collective action, and interpret outcomes of the team's actions. The aspect 'dialogue and inquiry' thus seems to be strongly related to all other aspects of the collective learning process. Such results are in line with the process model of 'collective learning' that we developed in the quantitative study; the model with 'dialogue and inquiry' at its core (see Chapter 3, Figure 3.3, Process model 1). In all three cases teachers are supported in developing the skills required for social learning.

Acknowledging the importance of dialogue and inquiry, participants repeatedly point to the necessity of team members having a dialogical learning attitude. Such an attitude allows for taking a vulnerable position by participating in open communication, respecting differing points of view and inquiring about those, enduring stress resulting from conflicting points of view, and engaging in a constructive dialogue aimed at creating a shared understanding based on the richness of ideas from within the team. This facet is not included in our theoretical framework (see Chapter 2); in the section 'Directions for future research' we will elaborate on its relationship to the theoretical framework.

In the two cases where the topic leadership is addressed there seems to be a direct relationship between 'transformational leadership' and innovation, as well as an indirect relationship via 'collective learning'. Through actions associated with a transformational leadership style managers stimulate collective learning processes, which, in turn, are likely to positively influence the teams' innovative performance. Managers support their teams in developing a vision, keeping it 'alive' and making team members feel committed to it. Furthermore, in assigning tasks to team members, managers try to align individual and team goals. When those are aligned, team members are more likely to actively contribute to realizing the team's vision. Managers' continuous commitment to the innovation process helps teachers to remain focused. Managers foster 'collective learning' by stimulating processes of dialogue and inquiry, and the creation of a shared understanding. Finally, they contribute to creating an environment supportive of social learning, for example by stimulating open communication, acknowledging teachers' vulnerability in social learning processes, influencing the development of a team's culture, and institutionalizing social learning processes.

In addition, we found a number of factors related to leadership and/or learning which participants perceive to have negatively affected the innovation process. Specifically, five types of factors are perceived as inhibiting the innovation process: misalignment between teachers' preferences or capabilities and the tasks assigned to them, a limited willingness or ability of managers to invest in the continuity of the Career Guidance Program/CGP in its current (extensive) form, lack of time/time pressure, resistance to change, and cultural limitations (e.g., a culture not supportive of social learning), and organizational limitations (e.g., structural inflexibility). We found that these factors were, to a certain extent, within managers' field of influence.

Overall, comparing our results with the results of the quantitative study by Kuijpers and Meijers (2012), we conclude that teachers in the best practice cases seemed to be able to have offered students a powerful learning environment, because they themselves operated within a powerful learning environment. These learning environments are shown to be supportive of learning processes based on interaction, specifically 'collective learning'.

2. Comparing Collective Learning in the best practice cases

Based on the content of the relevant quotes and the overlap between categories representing dissimilar aspects, some adjustments were made to the model of 'collective learning' as described in our theoretical framework (see Chapter 2). Prior to presenting the results of the cross-case analysis with respect to 'collective learning', we shortly discuss what adjustments were made (a more extensive discussion of the adjustments is presented in Appendix L). First, the categories 'information generation' and 'information distribution' were merged, because most quotes concerning information generation or distribution were in fact related to information exchange, implying both generation and distribution at the same time. These aspects of 'collective learning' showed to be interwoven and differed insufficiently to warrant distinctive categories. Second, the category 'dialogue and inquiry' was renamed as 'dialogue and a dialogical learning attitude', because quotes either referred to the process of dialogue itself (or the outcome of the process), or to the dialogical learning attitude deemed necessary for this process. Third, the category 'evaluation and reflection' was renamed 'evaluation', because no direct comments were made about reflection[15].

Table 5.2 presents an overview of the number of quotes identified per case for each aspect of 'collective learning'.

Table 5.2
Absolute and relative numbers of quotes per case relating to aspects of Collective Learning

	Case 1		Case 2		Case 3		Total	
Aspect of Collective Learning	Abs.	Rel.	Abs.	Rel.	Abs.	Rel.	Abs.	Rel.
Shared vision	18	15%	3	14%	12	17%	33	15%
Information generation and distribution	43	35%	8	36%	23	32%	74	34%
Dialogue and a dialogical learning attitude	27	22%	4	18%	11	15%	42	19%
Collective action	27	22%	3	14%	17	24%	47	22%
Evaluation	9	7%	4	18%	8	11%	21	10%
Total	124	100%[1]	22	100%	71	100%[1]	217	100%

[1] Due to rounding, percentages displayed do not add up to 100%.

Table 5.2 shows that, in terms of the quantity of the quotes collected in the interviews, the learning processes seem to be information-oriented. In all three cases information is generated and distributed extensively, formally and informally, internally and externally. Many quotes refer to forms of information exchange that focus on developing a shared under-

[15] As will be discussed in the subsequent section ('Forms of Collective Learning, Social Individual Learning and Transformational Leadership'), a fourth adjustment was made to the framework of analysis: a category 'learning orientation' was added, signifying a learning approach to the innovation process, or a focus on team(member) development as part of the innovation process.

standing, or stimulating social learning. In Case 1 participants in the interview stress that information is not only exchanged within the university, but also with external parties.

The team's vision on the CGP is in and of itself the result of a team process. Team members are actively involved in its design, as well of the design of the underlying educational model. Both seem to be the product of a shared understanding within the team. However, while a shared vision seems to be arrived at, team members do not always feel committed to the team vision. This observation will be elaborated upon in the subsequent section.

Dialogue and a dialogical learning attitude are considered core to the innovation process and the learning processes associated with it. In Case 2 the strongest focus on this aspect of the collective learning process is found. This might be understood from the inherently social nature of the bachelor program offered within the academy. Participants point to the fact that the methods of dialogue and inquiry are an important part of the curriculum, and that teachers are rather familiar with those. As a key aspect of the innovation process, social learning processes are institutionalized in ways they are institutionalized for students as well.

The aspect 'evaluation' is addressed least frequently in Case 1 and 3. This aspect seems to be an underexposed part of the collective learning process, a result we also found in the quantitative study (see Chapter 3). In both cases, evaluation predominantly refers to the output of the CGP. In Case 2 the innovation and learning processes are also evaluated, in order to stimulate continuous learning.

As is consistent with the image of the innovation project as a collaborative, developmental learning process, in Case 1 and 3 there is clearly a focus on the aspect 'collective action'. Quotes mainly refer to the collaborative nature of the development process, and the variety that can be found in teachers offering the CGP to students. Notably, in Case 2 this aspect of the collective learning process is referred to least frequently. While the CGP-coordinator repeatedly emphasizes team members' involvement in creating a shared understanding with respect to the innovation process (in Table 5.2 this can be seen from the focus on 'shared vision'), he does not indicate that they are involved in *designing* the CGP. He gives the impression that he develops a concrete CGP with a number of colleagues based on the shared understanding created within the team. Team members work with this CGP, collectively make sense of their experiences, and adjust the team's vision in response.

3. Comparing Transformational Leadership in the best practice cases

Prior to presenting the results of the cross-case analysis with respect to 'transformational leadership', we shortly discuss how the framework of analysis has been adjusted as a result of the process of coding the quotes collected in the interviews. A more extensive discussion of the adjustments is presented in Appendix L. We found it was often difficult to assign a quote to either 'individualized support' or 'intellectual stimulation', as one could argue that either or both dimensions were applicable. These dimensions seemed to be interwoven and we therefore placed relevant quotes in both categories. Within the subset of quotes for this combined category we identified two themes, which we described as 'acknowledging team

(members') strengths and supporting team (members') development' and 'fostering innovation'.

Table 5.3 presents an overview of the number of quotes identified per case for each of the dimensions of 'transformational leadership'. Participants predominantly mention facets of 'transformational leadership' related to the dimensions 'individualized support' and 'intellectual stimulation'. They point to specific ways in which innovation is fostered and team (members') development is stimulated as part of the innovation process. While little reference is made to the dimension 'initiating vision', participants in all three cases indicate that their teams have been empowered to create a team vision. In Case 1 there seems to be a relative strong orientation on the acknowledgment of team members' strengths and supporting team members' development. In Case 3 there seems to be a relative strong orientation on supporting the team in developing a team vision.

Table 5.3
Absolute and relative number of quotes per case relating to Transformational Leadership

	Case 1		**Case 2**		**Case 3**		**Total**	
Dimension of Transformational Leadership	Abs.	Rel.	Abs.	Rel.	Abs.	Rel.	Abs.	Rel.
Initiating vision	2	5%	0	0%	2	11%	4	7%
Individualized support and intellectual stimulation								
– Acknowledging team (members') strengths and supporting team (members') development	9	24%	0	0%	3	17%	12	21%
– Fostering innovation	27	71%	0	0%	13	72%	40	71%
Total	38	100%	0	0%	18	100%	56	100%[1]

[1] Due to rounding, percentages displayed do not add up to 100%.

Interestingly, in both cases quotes for 'fostering innovation' are predominantly identified in interviews held with managers; teachers and coordinators rarely refer to it. some facets of 'fostering innovation' (carefully listening to team members' ideas with respect to the innovation process, helping team members to clarify their personal ideas about the innovation process, and accepting experimental behavior) are only mentioned in Case 1. In this case a broader range of activities related to 'transformational leadership' is identified than in Case 3.

Forms of Collective Learning, Social Individual Learning and Transformational Leadership

In this section we address the question what forms of Collective Learning, Social Individual Learning and Transformational Leadership can be identified in the development of the CGP in the best practice cases (research question 4).

1. Collective Learning

Within each (main) category of 'collective learning' (see Table 5.2) we clustered the quotes that showed content-based resemblance. We labeled the resulting sub-categories and recorded the number of quotes associated with each sub-category. Results, presented in Figure 5.5[16], will be discussed in this section. For each sub-category an illustrative quote is given in Appendix M (Table M1)[17].

Shared vision

With respect to 'shared vision', we identified five sub-categories: (1) the importance of a shared vision, (2) presence of a shared vision, (3) indicating that team vision is developed in a dialogue between team members (4) embeddedness of the team vision in the organization's vision, and (5) lack of agreement or commitment to the vision.

The importance of working from a vision is emphasized by the team leader and the innovation project manager in Case 1. The former stresses that it is important that team members agree on the team's vision with respect to CGP and operate within the boundaries set by it. The latter indicates that a vision on CGP is required to keep it a priority worth investing in.

In each of the cases participants point to the existence of a shared vision within the team, specifically with respect to the CGP. In Case 3 the team leader and innovation project leader indicate that team members support this vision because it was developed in the team (instead of imposed) and because teachers recognize themselves in the vision. On the other hand, the CGP-coordinators in Case 1 and 3 and the innovation project manager in Case 3 also mention a lack of agreement with or commitment to the CGP vision by team members. Participants emphasize that a vision that is developed by a selection of team members is not necessarily supported by all team members. Also, a participant indicated that newcomers to the team do not necessarily support the vision developed within the team – still, CGP-tasks are assigned to them, leading to a lack of commitment to the vision.

Participants in all three cases emphasize that the team vision is developed in a dialogue between team members; in two cases they indicate that this development is a continuous process. In Case 1 and 3 participants mention that this vision is embedded in the overall vision of the university.

Information generation and distribution

Participants in all three cases point to information generation and distribution *within* the team. In this category we identified six sub-categories: (1) structured collegial knowledge exchange, (2) personal deliberation/ collegial consult, (3) (sub-)team meetings/ information meetings, (3) information distribution via offering schooling/ trainings, (4) information generation via participation in schooling/ trainings, (5) information generation via hiring new staff, and (6) information distribution via documentation. The third and fourth sub-aspects are also referred to as a means to exchange knowledge with parties *outside* the team.

[16] While the number of quotes is low for various sub-categories, we decided to include those for two reasons. First, the interviews were not organized to structurally question participants on the aspects of 'collective learning'. If this would have been the case, numbers might have been higher. Second, the sub-categories discerned seem to represent conceptually different facets within the overarching main category.

[17] A complete overview of all quotes identified in the interviews is available on request with the researchers.

Aspect of Collective Learning	Sub-category
1. Shared vision (33)	1.1 Emphasizing the importance of a shared vision (2) 1.2 Indicating the presence of a shared vision (9) 1.3 Indicating that team vision is developed in a dialogue between team members (14) 1.4 Indicating that the vision is embedded in the organization's vision (2) 1.5 Indicating a lack of agreement or commitment to the vision (6)
2. Information generation and distribution (74)	2.1 Structured collegial knowledge exchange (13) 2.2 Personal deliberation/collegial consult (11) 2.3 (Sub-)team meetings/ information meetings (17) 2.4 Information distribution via documentation (handbook) (1) 2.5 Information generation via hiring new staff (2) 2.6 Information generation via participation in schooling/trainings(8) 2.7 Information distribution via offering schooling/trainings (9) 2.8 Information exchange with students (1) 2.9 Information exchange with other studies within the university (6) 2.10 Information exchange with experts within the university (4) 2.11 Information exchange with parties outside the university (2)
3. Dialogue and a dialogical attitude (43)	3.1 Emphasizing the importance of dialogue and a dialogical learning attitude (4) 3.2 Indicating that diverse and/or conflicting ideas are discussed (7) 3.3 Indicating that shared understanding is created in dialogue (24)
4. Collective action (53)	4.1 Indicating individual approaches as a result of linking up with the teachers (3) 4.2 Indicating individual approaches as a result of linking up with the students (3) 4.3 Acknowledging differences in individuals' approaches (8) 4.4 Indicating acceptance of differences in individuals' approaches (3) 4.5 Indicating acceptance of differences provided team goals are met (6) 4.6 Indicating negative perception of differences in individuals' approaches (6) 4.7 Indicating innovation is a product of joint development within the team (12) 4.8 Indicating cooperation and systematic feedback within the team (14)
5. Evaluation (21)	5.1 Emphasizing the importance of evaluation (1) 5.2 Indicating program results are evaluated (5) 5.3 Indicating results are evaluated against vision/goals (4) 5.4 Indicating results are evaluated based on students' feedback (4) 5.5 Indicating results are evaluated by a committee external to the team (7)
Residual category	
6. Learning orientation (25)	6.1 Learning approach to the innovation process (15) 6.2 (Collective) development of team members as part of the innovation process (10)

Figure 5.5. Aspects of Collective Learning, the sub-categories of quotes identified for each aspect, and the number of quotes (in brackets) identified for each aspect and each sub-category. In addition to our theoretical framework the residual category Learning Orientation (aspect 6) is added. This category includes quotes that are related to Collective Learning, but that cannot be clearly assigned to one of its aspects.

Structured collegial knowledge exchange and personal deliberation/ collegial consult can both be considered forms of small scale information exchange via social interaction. The former category is addressed repeatedly by the team leader, the innovation project leader and the CGP-teacher in Case 1. They emphasize information exchange via intervision groups within the team. In such groups, team members come together to discuss the tasks they performed and the problems they encountered, in order to develop their expertise and improve the quality of their work. Additionally, they mention forms of peer coaching, such as a

senior teacher coaching a junior teacher. The latter category, addressed by various participants in Case 1 and 3, contains forms of informal knowledge exchange between colleagues, such as personal deliberation and collegial consult. Participants indicate that CGP-teachers informally exchange information with other CGP-teachers, the CGP-coordinator, or their team leader. Teachers approach their CGP-coordinator or team leader specifically when things are unclear. In Case 3, the innovation project leader attributes the increased level of collegial consult to a change in the team culture as a result of several interventions (e.g., schooling aimed at improving communication).

Next to small scale information exchanges, in all cases team meetings and information meetings are commonly organized within (parts of) the teams to exchange ideas and information, or to instruct team members. Topics for team meetings vary from presenting (new) policy, exchanging information and experiences, collecting ideas from team members, evaluation and reflection, building a vision, to adjusting the current vision. Moreover, in Case 1 and 3, different participants indicate that information is exchanged via schooling and trainings. Knowledgeable and experienced team members organize schooling and trainings within and outside the team. Teachers new to the team or new to a specific subject, such as CGP, participate in schooling/ training offered within and outside the team so that they are prepared for their tasks. The innovation project leader in Case 3 describes how new ideas also enter the team when new staff is employed (even though they may not be have been explicitly employed because of these ideas). Such new ideas might counterbalance the established ideas within the team and stimulate innovation and change. Finally, in Case 1, the CGP-coordinator indicates that information is also distributed within the team in a coded way, via a CGP-handbook which is available to all CGP-teachers. This form of information distribution differs from all previous forms in that it is limited to making information available (as opposed to exchanging information), and does not require direct social interaction.

Participants in all cases point to information generation and distribution with parties *outside* the team. Managers and CGP-coordinators refer to the exchange with: (1) students, (2) other programs, (3) experts within the university (e.g., educationalists and research groups), and (4) parties outside the university. Knowledge exchange with parties outside the university is only addressed by the innovation project leader in Case 1, who refers to exchanges with other universities, the actual work field and scientific researchers.

Dialogue and a dialogical learning attitude

With respect to 'dialogue and a dialogical learning attitude', we identified three subcategories: (1) the importance of dialogue and a dialogical learning attitude, (2) discussing diverse and/or conflicting ideas, and (3) creating shared understanding in dialogue.

Participants in Case 1 and 3 refer to the necessity of a dialogical learning attitude, both for the innovation process itself as for the situation that results from its implementation (the new status quo). With respect to the change process, an innovation project leader promotes opportunities and hereby urges team members to contribute to the change process. With respect to the new status quo, managers and CGP-coordinators emphasize the importance of open communication in which problems are discussed openly and conflicts are not avoided. Open communication requires that team members let go of any resistance they might feel to frankly discuss their experiences and difficulties and to accept the vulnerability that

open communication implies. Within their teams, various participants of Case 1 and 3 recognize a dialogical attitude and approach. They indicate that diverse and sometimes conflicting ideas are discussed. Team members have the opportunity to openly express their ideas, even when those counter the ideas generally accepted. Differences of opinion are not avoided and conflicts are not considered problematic; differences are accepted from a point of view that right or wrong do not exist, and deviating ideas are acknowledged for their potential value.

In all three cases, multiple quotes were identified relating to the creation of a shared understanding by means of a dialogue. A central theme in such dialogues is 'shared vision'. In each of the innovation projects, dialogue is used as a method to develop a shared vision, to specify concrete actions based on that vision, to discuss the feasibility of the vision and the concrete actions resulting from it, and to reduce individual resistance to the team's vision. Another theme in the dialogues aimed at creating a shared understanding is intervision. In Case 1, the team leader and the CGP-teacher indicate that via intervision a shared understanding is created with respect to CGP.

Collective action

In the set of quotes related to 'collective action' a specific theme was identified: individual teachers' approaches to work within the context of a team vision. Within this theme we found six sub-categories: (1) individual approaches as a result of linking up with the teachers, (2) or with students, (3) acknowledgment of differences in individuals' approaches, (4) acceptance of differences in individuals' approaches, (5) acceptance of differences provided team goals are met, and (6) negative perception of differences in individuals' approaches.

Participants in all three cases indicate that teachers teach their own groups in their own ways, resulting in different approaches within the team. A main reasons for a teacher to differ in his/her approach from that of colleagues is that no person or group is ever the same. In linking up with his/her own person (in term of competencies and interest) and with the students, each teacher develops a unique approach. The resulting differences between teachers are acknowledged by various participants in all three cases. The CGP-coordinators in Case 1 and 3 indicate that they accept those differences, for they rely on individual teachers' expertise to deliver a CGP program (or part of it, such as the assessment) of sufficient quality. One of them points out that students encounter many different teachers during their studies and that it is just this variety that guarantees a complete program. In Case 1 and 3 a number of quotes were identified in which participants in various functions indicate that they accept differences between teachers' approaches, *provided that team goals are met*.

While participants say that they accept the differences on some points, accepting differences with regards to other points were sometimes considered problematic. The innovation project leader and the CGP-teacher from Case 1 and the CGP-coordinator from Case 3 both argued that such differences reduce the cohesion intended in the curriculum, generate uncertainty, and lead to criticism when teachers experience too high a workload and perceive colleagues as investing less time or energy in CGP than they themselves do. Moreover, the CGP-teacher states that it is important that students experience a sense of unity within the team with respect to CGP.

Next to the larger theme of teachers' individual approaches to work, two types of actions were discerned that involve teachers physically working together: (1) joint development, and (2) cooperation. Participants in Case 1 and 3, predominantly managers and CGP-coordinators, indicate that CGP (and often the underlying educational model) is a product of joint development within the team. Team members are involved in all parts of the innovation process and are therefore committed to its results. The innovation project manager in Case 3 describes this process as creating 'meaningful change'. Such cooperation leads, among other things, to togetherness, ownership and support. Cooperation is not only restricted to the conceptual side of the innovation process. Participants in Case 1 and 3, again predominantly managers and CGP-coordinators, indicate that teachers also cooperate on a daily basis, such as in observing each other's classes and providing feedback, assessing each other's CGP-students and subsequently providing collegial feedback on the way the students were guided in their development process, and preparing CGP-classes together. Such forms of cooperation are intended to align individual teachers' approaches, to improve the performance of individual teachers, and to improve the level of quality offered to students by the team.

Evaluation

With respect to 'evaluation' we identified five sub-categories: (1) the importance of evaluation, (2) evaluation of program results, (3) evaluation of results against vision/goals, (4) evaluation of results based on students' feedback, and (5) evaluation by a committee external to the team.

The importance of evaluation is referred to by the innovation project manager of Case 1, who indicates that evaluation can be used to keep the vision alive by referring to the progress that has been achieved with respect to it. In all three cases participants, managers and a CGP-coordinator, indicate that program results are evaluated within the team. In Case 1 and 2 results are evaluated against the goals derived from the team vision. Students' feedback is used as a source of information for evaluation. In Case 1 and 3, a committee external to the team (department for quality control) supports the evaluation process by collecting and interpreting students' feedback and presenting it to the team.

Considering the innovation trajectory a learning process

A number of quotes were identified that seemed to be associated with team level learning, but that could not clearly be related to one of the aspects of 'collective learning'. Two types of quotes were recognized. First, different participants in all three cases indicate that a learning approach to the innovation process was chosen within the team. They point to the (developmental) *process* nature of the innovation trajectory, as opposed to a one-shot operation. In line with this, they indicate that the trajectory encompasses experimenting, pilots, learning from experience, and continuous adjustment. Second, various participants in all three cases indicate that the (collective) development of team members is considered part of the innovation process. Such development relates to a wide variety of topics, including mastering practical skills (e.g. coaching), developing a learning attitude, improving communication, and changing the organizational culture. In the section 'Directions for future research' we will elaborate on the nature of the topics in this residual category, and on the relationship between 'collective learning' and 'learning orientation'.

2. Social Individual Learning

In coding quotes it proved difficult to clearly distinguish between individual and collective forms of social learning, for it was clear they are deeply interwoven in the cases. Such results are in line with the strong correlations we found in the quantitative study between 'individual learning in interaction' and 'collective learning' (see Chapter 4, Appendix H, Table H1 and H2). In the theoretical framework (Chapter 2), we defined 'social individual learning' as a form of learning characterized by a shared process with individual results. It is considered a way for individual teachers to improve their own performance by interacting with and learning from colleagues. We defined 'collective learning' as a form of learning characterized by a shared process with shared results. In many of the relevant quotes the (shared) nature of the learning process is evident, but the results of the process are difficult to assess as being either individual or shared. More specifically, we found the results of teachers' personal learning in social interaction exceeded the individual level and encompassed a shared, or collective, component. The individualistic nature of a large part of teachers' jobs makes that teachers often work on their own while achieving team goals. Consequently, improving individual teachers' performance led to improved team results, which might be considered a shared result of the learning process. This holds true for all three forms of 'social individual learning' distinguished in the theoretical framework.

In the interviews it was emphasized, for example, that the use of feedback ('learning from feedback') is integrated within the functioning of the team in order to align the activities of teachers or to assure a minimum level of quality in teachers' individual performance. In such a case, the use of feedback might be considered part of the collective learning process, more than it being an individual learning processes. Likewise, participants indicated that when teachers approach colleagues with questions about (or experiences with) their CGP classes ('learning from knowledge sharing'), their aim might be to align their classes with those of colleagues. Such an exchange of information is likely to lead to collective results in the form of harmonized behavior within the team, or an altered shared understanding. With respect to 'learning from collaboration', all relevant quotes showed close resemblance to 'collective action'. We were therefore unable to clearly discern between the aspect of 'social individual learning' and 'collective learning'.

Based on the collective component present in the quotes originally assigned to 'social individual learning', we decided to assign the quotes to 'collective learning', mostly to the aspect of 'collective action'. As such, in the present study we found no obvious examples of 'social individual learning' and we are therefore unable to answer the question what forms of 'social individual learning' can be identified in the process of developing, implementing and continuing CGP. In the section 'Directions for future research' we will elaborate on the relationship between 'social individual learning' and 'collective learning'.

3. Transformational Leadership

We clustered the quotes related to 'transformational leadership' that showed content-based resemblance, labeled the resulting sub-categories and recorded the number of quotes associated with each sub-category. Results, presented in Figure 5.6, will be discuss in this section. In Appendix N (Table N1), an illustrative quote is given for each sub-category.

Initiating vision

As was noted before, relatively little reference is made to this dimension. Within the set of relevant quotes we identified two sub-categories: (1) manager stimulates team members to think about a vision, and (2) manager portrays a positive image of a future based on the vision.

The first set encompasses quotes by two managers in Case 3. One points out that the project manager has portrayed a positive image of the future in order to inspire team members in the process of finding 'common ground'. He strongly associates this act with the success of the innovation project. The other manager notes that he addressed team members' resistance to change by sketching for them the potential positive outcomes that the innovation project might bring. The second set of quotes is derived from the interview with the (former) team leader in Case 1. She indicates that she stimulated team members in collectively formulating team goals, as well as ways to achieve those goals.

Dimension	**Sub-category**
1. Initiating vision (4)	1.1. Manager stimulates team members to think about a vision (2) 1.2. Manager portrays a positive image of a future based on the vision (2)
2./3. Individualized support & intellectual stimulation (52)	*Fostering innovation (40)* 2.1 Manager's involvement in/ commitment to the innovation process (23) 2.2. Manager actively influences team culture (2) 2.3. Manager is sensitive to problems team members experience with the innovation (2) 2.4. Manager shows appreciation of and offers support to team members in the innovation process where necessary (4) 2.5. Manager listens carefully to ideas of team members with respect to the innovation process (3) 2.6. Manager stimulates team members to think along about the innovation process (3) 2.7. Manager helps to clarify team members' personal ideas about the innovation process (2) 2.8. Manager accepts experimental behavior by team members (1) *Acknowledging team (members') strengths and supporting team (members') development (12)* 2.9. Manager acknowledges and utilizes the strengths of the team (members) (5) 2.10. Manager supports team (members') development (7)

Figure 5.6. Dimensions of Transformational Leadership addressed by participants, the sub-categories of quotes identified for each dimension, and the number of quotes (in brackets) identified for each dimension and each sub-category.

Fostering innovation

Within this theme (as a subset of the dimensions 'individualized support' and 'intellectual stimulation') we identified eight sub-categories: (1) manager is involved in/ committed to the innovation process, (2) manager actively influences team culture, (3) manager is sensitive to problems team members experience with the innovation, (4) manager shows appreciation of and offers support to team members in the innovation process where necessary, (5) manager listens carefully to ideas offered by team members with respect to the innovation process, (6) manager stimulates team members to think along about the innovation

process, (7) manager helps to clarify team members' personal ideas about the innovation process, and (8) manager accepts experimental behavior by team members.

Various participants in Case 1 and 3 point to (the importance of) managers' involvement in, or commitment to the innovation process. They relate managerial commitment to the priorities set within the team. When the manager is committed to the CGP, he/she keeps it on the agenda, organizes it, keeps team members focused and makes resources available for developing, implementing and sustaining the CGP. In Case 1, the innovation project manager and the CGP-teacher indicate that an (unanticipated) change of team leader during the innovation process led to a decreased focus on the CGP, because of changed priorities. In Case 3, the manager was also replaced during the innovation process. The CGP-coordinator notes that the current manager seems to be less involved. Interestingly, he points to a positive relationship with innovation.

The manager's involvement and commitment also relates to his/her influence on team culture. The innovation project manager in Case 3 mentions how he stimulated the open discussion of ideas and thoughts during the innovation process, the academy director in Case 1 emphasizes the importance of managers setting the right example[18]. On a more personal level, managers show various types of behaviors supportive of innovation. The academy director in Case 1, for example, indicates that he accepts experimental behavior by team members. The team leader in Case 1 indicates that she carefully listened to their ideas with respect to the innovation project, and in response stimulated them to think along with her about the innovation process involved. Such a managerial approach is confirmed by a CGP-teacher working under the team leader's supervision. The team leader in Case 3 acknowledges his own skepticism about the CGP and indicates that his ideas are not constructive enough for the innovation process. In order to support the innovation process, he participates less actively and gives team members the freedom to develop the CGP according to the team's vision. The team leader in Case 1 indicates that she helped team members to clarify their personal ideas about the innovation process. Specifically, in a dialogue, she asked team members with deviating ideas about their points of view. Predictably, this led to team members having a better understanding of their own ideas. Furthermore, the team leaders in Case 1 and 3 mention that they are sensitive to the problems team members encounter in the innovation process. They listen to their arguments and show understanding for their points of view. Also they show appreciation and support for team members involved in the innovation process.

Acknowledging team (members') strengths and supporting team (members') development
Within this theme (as a subset of the dimensions individualized support and intellectual stimulation) we identified two sub-categories: (1) manager acknowledges and utilizes the strengths of the team (members), and (2) manager supports team (members') development (7).

The team leader in Case 1 and the CGP-coordinator in Case 3 indicate that team development as well as the development of individual team members is supported. Such support is

[18] This type of behavior might, in an expanded eight factor model of transformational leadership (see for example Leithwood, Leonard & Sharratt, 1998), alternatively be attributed to the dimension 'Manager provides appropriate models for staff to follow'.

provided by managers recognizing and utilizing the team's and individual team member's strengths in achieving team goals and discussing each teacher's personal contribution to the team. Moreover, the team leader indicates that she engaged team members in a discussion about their professional development and facilitates such development by means of schooling, providing feedback, and helping teachers to reflect on experiences they have gained during work; as well the CGP-coordinator indicates that he stimulates collegial learning[19]. The act of acknowledging team members' strengths and supporting their development is predominantly self-assessed by the team leader in Case 1. In Case 3 only one reference is made to this theme.

5.4 CONCLUSION AND DISCUSSION

In the present study we tried to better understand the core concepts in our theoretical framework, as well as their interrelationships. Using a case-study design, we first studied on case-level the connections between 'collective learning', 'social individual learning' and 'transformational leadership' in daily practice, specifically in educational innovation processes where a career guidance program (CGP) is successfully developed and implemented (research question 3). Second, combining results for all three cases, we explored what is behind the abstract concepts of social individual learning, collective learning and transformational leadership in daily practice (research question 4). As such, we tried to map the concepts' variety and richness. We studied the innovation processes of three academic departments that were shown to be successful in an earlier quantitative study by Kuijpers and Meijers (2012).

Conclusion: answering research question 3

Within-case analysis. In Case 1 continuous learning is emphasized because the team's goal is considered a moving target which requires continuous adaptation. Social forms of learning (e.g., intervision, peer coaching, feedback and knowledge exchange) are explicitly stimulated and a dialogical culture is created in order to support such learning. Dialogue, inquiry, open communication, and teachers' dedication in sharing experiences, thoughts and feelings are considered conditions for creating a shared understanding. Knowledge is exchanged within the team, within the university and with external stakeholders. The former team leader's transformational leadership style was supportive of the learning approach. She supported team members' personal development and team development as important ways to successfully realize the innovation. Dialogue and inquiry were central to her approach. In this case, there seems to be a direct relationship between 'transformational leadership' and innovation. Replacement of the team leader who led the team at the start of the innovation process with a team leader who doesn't have as strong a transformational leadership style seems to have led to a decreased interest in social learning and innovation. The limitations to the innovation process are its high costs, the time pressure perceived by CGP-teachers, and the misalignment between teachers' capabilities/ intrinsic motivation and the tasks they are asked to do.

[19] This type of behavior might, in an expanded eight factor model of transformational leadership (see for example Leithwood, Leonard & Sharratt, 1998), alternatively be attributed to the dimension 'Manager builds a productive school culture'.

In Case 2, there is an explicit focus on creating a shared vision regarding the CGP as well as on the underlying educational philosophy. The vision is continually updated in response to the evolving shared understanding within the team. As such, the development of the CGP is considered an ongoing process, based on teachers' experiences and the meaning they collectively attach to those experiences. Team meetings are regularly held to facilitate the creation of a shared understanding. Teachers' dialogical and coaching skills are developed in order to support this process. The method of evidence-based development and learning is applied: in research groups and teachers can experiment with new ideas with respect to the CGP in a systematic and controlled way. Internal or external experts are consulted if the team is confronted with questions which they cannot answer. Teachers are provided with a certain amount of flexibility to design their own approach to the CGP, which facilitates customization of the CGP among teachers and their groups. Moreover, it allows for experimentation with alternate ways to realize the team's ambitions, thereby increasing the team's behavioral repertoire. Evaluation is considered an essential part of the ongoing learning process that is associated with the development of the CGP. In Case 2 leadership is not addressed.

In Case 3, there is also an explicit focus on creating a shared vision on the CGP as well as on the underlying educational model. Teachers from three affiliated bachelor programs are stimulated to be actively involved in the innovation process, both in creating a shared understanding and in designing concrete educational products related to that understanding. As a result teachers are involved with the ongoing changes and support the underlying vision. Resistance to change is taken serious and is openly discussed, often leading teachers to accept the new educational model and the underlying vision. Dialogue is considered a very important mechanism in the innovation process, and therefore teachers are trained with respect to their coaching, reflection and dialogue skills. As a result, the academy's culture has changed from 'transferring fixed knowledge' to 'continuously creating knowledge in dialogue'. Teachers' professional development is based on intensive collaboration among teachers (e.g., learning from feedback), requiring open dialogue. Some teachers are not capable of or willing to participate in such dialogue. Teachers are stimulated to share knowledge and experiences with colleagues at the team level, the academy level and the university-level. As in Case 2, teachers are provided with a certain amount of flexibility to design their own approach to the CGP. Teachers actively evaluate the CGP, using students' feedback as an important source of information. The team leader and project leader describe leadership styles as transformational. They indicate the necessity to put the innovation project on the team's agenda, to create a dialogical culture, to involve teachers who are resistant to change, to facilitate innovation, and to inspire teachers by portraying the positive effects that the innovation project might bring. Since the new educational model is completely implemented and managers are replaced, some teachers and (new) managers tend to take a less active approach to the CGP as a result of time and financial restrictions.

Cross-case analysis. Overall, the innovation processes are designed as processes of collaborative, developmental learning. The cases show many commonalities. This might be understood from the fact that the CGP innovation requires third-order learning (see Chapter 2), which is strongly associated with collective learning processes (Wierdsma & Swieringa, 2002; Wierdsma, 2004). The aspects of 'collective learning' can indeed be identified in each of the three cases. In the two cases were leadership is addressed there seems to be both a direct relationship between 'transformational leadership' and innovation, as well as an indirect

relationship via 'collective learning'. Two additional factors seem to influence the dynamics of 'collective learning', 'transformational leadership' and 'team results': a learning orientation and organizational conditions which can be more or less supportive of 'collective learning' and innovation. Both are, to a certain extent, within managers' field of influence. These factors will be addressed in the section 'Directions for future research'. Comparing our results to the results of the quantitative study by Kuijpers and Meijers (2012), we conclude that teachers in the best practice cases seem to be able to offer students a powerful learning environment, because they themselves operate in a powerful learning environment.

A summary of the results of the cross-case analysis is presented in Figure 5.7. Using the case description of the three cases, in the concluding chapter (Chapter 7) we will formulate a revised conceptual model.

Conclusion: answering research question 4

Forms in which Collective Learning manifests itself. With respect to collective learning processes, we developed a number of insights. First, they might be characterized best by the aspect 'dialogue and inquiry', because this aspect is strongly related to all other aspects of 'collective learning'. Dialogue and inquiry are ways to arrive at a shared vision, interpret information, create shared understanding, translate this understanding into collective action, and evaluate results. Such result is in line with the process model of 'collective learning' which we developed in Chapter 3 (i.e., the model with 'dialogue and inquiry' at its core, influencing the other factors of 'collective learning'). Shared understanding is created in an open dialogue that is both respectful (dialogical attitude) and challenging (conflicting ideas); it often relates to the team's vision or to daily operations (intervision). Dialogue and inquiry require team members demonstrating a dialogical learning attitude, which allows for participation in open communication. In each of the three cases, team members are explicitly trained in this aspect.

Second, the team's vision is in and of itself a product of a collective learning process: it is formed by team members in a dialogue aimed at create a shared understanding. The intended result, a shared vision with respect to the CGP, is recognized in all three cases, though not all team members are necessarily committed to the team's vision. In two cases teams explicitly worked on continuous adaptation, making the innovation process an ongoing effort; an approach which is consistent with the image of a learning organization. In the case where the continuous approach is less evident, the implementation of the CGP is followed by a decreased interest in the CGP.

Third, collective learning processes appear to be information-oriented: in all three cases, information is generated and distributed extensively, formally and informally, mostly within the team, but also with parties outside the team (other programs and educational institutions, and with internal and external experts). In the cases the aspects 'information generation' and 'information distribution' are difficult to indicate, because most quotes relate to an information exchange, implying both generation and distribution at the same time. Knowledge is specifically exchanged via structured collegial knowledge exchange, personal deliberation, team meetings and schooling. Information exchange is often associated with developing a shared understanding, or stimulating social learning.

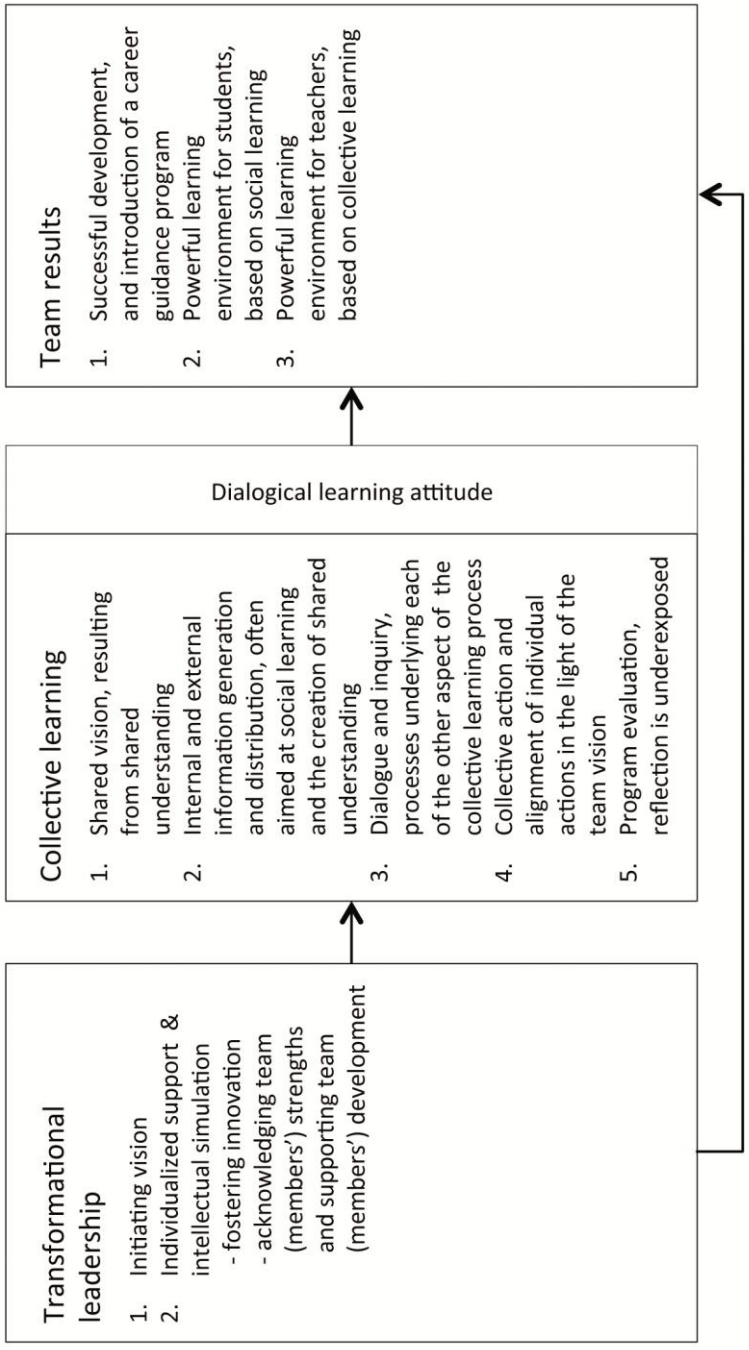

Figure 5.7. Tentative ordering of the results of the cross-case analysis, displaying relationships among Transformational Leadership, Collective Learning and Team Results as found in the best practice studies relating to the innovation project CGP.

Fourth, 'collective action' does not necessarily require teachers to perform their tasks (e.g., teaching the CGP) the same way, or to actually work together (e.g., teaching a group of students together); in two cases teachers have the freedom to individualize their approach to the CGP within the boundaries set by the vision. It does, however, require them to strive for the common outcomes indicated in the team's vision. Teachers' individual approaches then become aligned with respect to the results and become of a 'collective nature'. The systematic use of feedback might help to align teachers' individual contributions to the team. Furthermore, in all cases teachers are actively involved in the design of the CGP and in two cases they are also actively involved in its development.

Finally, the aspect 'evaluation and reflection' seems to be an underexposed aspect of the collective learning process; a result which is in line with results of the quantitative study (see Chapter 3). Program results are evaluated – often based on students' feedback – and systematically collected by an (external) department for quality control. No direct references are made to the act of reflection (it is only addressed implicitly in the form of intervision), and evaluation mainly concerns the output of the CGP. In one case the development process itself is also explicitly evaluated..

Forms in which Social Individual Learning manifests itself. In the cases it is difficult to clearly discriminate between 'social individual learning' and 'collective learning' (specifically the aspect 'collective action'). In the theoretical framework (see Chapter 2), 'social individual learning' is defined as a form of learning characterized by a shared process with individual outcomes, whereas 'collective learning' is defined as a form of learning characterized by a shared process with shared outcomes. In many of the relevant quotes, the shared nature of the learning process is evident, but the result of the process is difficult to assess as either individual or shared. The individualistic nature of teaching means that teachers often work alone on achieving team goals. However, when they work from a common vision or towards common goals, teachers' actions might be considered to part of the collective vision. Furthermore, collegial interaction aimed at optimizing teachers' individual performance (e.g., asking for feedback) in the cases results in improved team performance. For those reasons, learning processes originally defined as 'social individual learning' seem to exceed the individual level, and we conclude that, in the cases, the individual and collective level of learning are strongly interwoven. The strong relationship between ‘social individual learning’ and ‘collective action’ confirms results of the quantitative study (see Chapter 4); in structural model 1 a high factor correlation was found between 'individual learning in interaction' and the second order construct 'collective learning', and in structural model 2, high factor correlations were found between 'individual learning in interaction' and the four sub-constructs of 'collective learning'. In the section 'Directions for future research' we will reflect further on the relationship between both forms of learning.

Forms in which Transformational Leadership manifests itself. Each of the discerned dimensions of 'transformational leadership' can be identified in the two cases where leadership is addressed. The dimensions 'individualized support' and intellectual 'stimulation' seem to be strongly interwoven; a result which is in line with the high correlations we found in the quantitative study in the scales measuring these dimensions (see Chapter 4). Within the subset of quotes for these categories we identify two themes: 'fostering innovation' and 'acknowledging team (members') strengths and supporting team (members') development'.

Most reference is made to the former category. Relatively little reference is made to the dimension 'initiating vision'. Participants in all three cases emphasize that the team's vision is created in a dialogue in which team members actively participate. Such a process of vision development addresses the 'empowerment' associated with 'transformational leadership' (Ten Bruggencate, 2009). This aspect of 'transformational leadership' is intended to "inspire teachers to devote themselves to innovations, develop themselves, and be optimistic with respect to the results of innovation" (Geijsel et al., p. 136). In the cases the aspects of innovation and development are repeatedly addressed. Managerial support for innovation is referred to in the form of managerial commitment, dialogue with team members on the innovation process (addressing ideas, thoughts and problems), showing appreciation of innovative ideas, offering support in the innovation process, accepting experimental behavior, and influencing team culture. Managerial support for development is referred to as managers acknowledging the strengths of the team and its members and supporting the development of the team and its members. Theoretically, such behavior is aimed at giving teachers the feeling that the manager "stands behind them, respects their opinions, and supports them when problems arise ... [so that] they dare to reveal their vulnerability and take some initiative on behalf of an innovation" and to provide teachers with "financing, time, space and social stimulation required to develop themselves professionally and implement innovations" (Geijsel et al., 2001, p. 136).

Contribution of the study

Results of the present study contribute to the theory about organizational learning in schools. First, we have created a deeper understanding of the collective learning concept, by studying how it occurs in educational innovation projects in the context of higher vocational education. Results provide practice-based examples for each of its aspects, and help us to better understand the relationships between the various aspects. Second, where results of Study 1b showed *that* 'collective learning' is related to 'transformational leadership', results of the present study show *how* they might be related to a concrete educational innovation project. Finally, results show how collective learning processes might contribute to realizing innovation based on third-order learning. As such, they suggest that 'collective learning' and innovation might be positively related.

The insights obtained in the present study might help practitioners striving to realize educational innovation in designing the innovation process. Results show that, when third-order learning is required, the innovation process might be designed as a collaborative, developmental learning process, specifically a collective learning process. Dialogue and inquiry seem to be at the core of this process; they are at the foundation of the process of collective sense making which is required for each of the other aspects of 'collective learning'. A transformational leadership style might support the innovation and collective learning process. In the best practice cases, managers inspired and supported teams to develop a shared vision and to keep it 'alive' when the team threatened to lose its focus or motivation, aligned individual and team goals, stimulated processes of dialogue and inquiry as well as the creation of a shared understanding, and created an environment supportive of social learning. Managerial commitment to the innovation process seems to be an important condition for collective learning processes to endure.

During the innovation process the importance of evaluation and reflection likely needs to be emphasized and articulated to the teams, as this aspect of the collective learning process seemed to be underexposed. Evaluation is intended to make the team explicitly reflect on the results achieved and the way they were achieved. By evaluating team results, specifically in the light of the team's vision, the learning cycle is closed and a new one initiated (Castelijns, et al., 2009). Process evaluation is important for team members so they may learn how the functioning of the team may be improved (Verbiest, 2004) and how the learning process may be handled more effectively in the future (Castelijns et al., 2009). Acts of evaluation support the development of 'learning skills', which are closely associated with organizational learning and learning organizations (Wierdsma & Swieringa, 2002). Reflection helps teams and their members to understand their professional knowledge and their actions better (Loughran, 2002; Van Woerkom, 2011). Through reflection they become conscious of what they have unconsciously learned (Wierdsma & Swieringa, 2002). Since learning in teacher teams is often implicit and a byproduct of working (see Chapter 2), reflection is considered an important facet of the learning process.

Methodological evaluation

A number of critical observations can be added to the research method used in this study, as well as to the results obtained. In this section we will address the ones we deem most important, and, where relevant, we will present suggestions for future research based on our concerns with the present study.

First, we have tried to understand the CGP innovation process based on interviews held with team members after the CGP was implemented. The study's design was based on our intention to look into the learning processes occurring in *successful* innovation processes. Since the success of the projects was assessed afterwards, we studied projects of innovations that were already implemented. Likely, team members did not fully recall all aspects of the innovation process, distorting the picture that was sketched. Another concern with respect to the participants is that team members might have addressed their *own* contribution to the process in particular. We tried to address this concern by interviewing various team members per case, specifically team members that had different roles in the process. However, we are not sure that the resulting picture is complete. In order to address both concerns in future case studies, additional research methods might be used to obtain data. As such a more complete understanding of the collective learning process might be constructed. In longitudinal research, for example, team members could log their individual and team activities during the innovation process.

Second, most relevant quotes obtained for 'transformational leadership' are identified in interviews held with managers. While they describe facets of their own approaches in terms of 'transformational leadership', non-managing team members barely mention it in relationship to the innovation project. This might suggest that teachers do not experience their managers' approaches as transformational, or that they do not note its (intended) effects. It is difficult to draw a conclusion based on our data, as the majority of the interviews were held with team members in a management position with a very limited number of non-managing teachers participating in the interviews. Moreover, in the interviews with the latter group, the focus was on the content of the CGP and participants did not always clearly

address the questions related to (transformational) leadership. In order to gain a better understanding of the way team members perceive their managers' approach, for future research, a larger number of team members would need to be interviewed. In addition, in these interviews the subject leadership would have to be addressed more explicitly.

A third critical observation relates to the way in which the data were gathered. In the interviews that form the basis for the case study, participants are asked about the content of their academy's CGP and the factors that have contributed to its success. Interviewees are thus not systematically questioned on the contribution of the various aspects of 'collective learning', 'social individual learning' and 'transformational leadership' (as identified in Studies 1a and 1b). Results might have been different if they were systematically questioned about those aspects. For this reason, the nature of the present study should be seen as explorative. The observation that, in the present study, 'social individual learning' could not be distinguished from 'collective learning' might relate to this concern. While participants in the interviews repeatedly emphasize that the innovation process is founded in social learning, they do not clearly distinguish between individual and collective forms of social learning. Since the interviews are not designed to study the differences between the concepts of social individual learning and collective learning, results are not specific enough to discriminate between both of these. Future research might focus at studying the difference between 'social individual learning' and 'collective learning' in concrete innovation projects (see also the section 'Directions for future research').

Fourth, the data collection over the cases is imbalanced, as the number of participants varies from two in Case 2, to seven in Cases 1 and 3. Consequently, the range of the interviews in terms of the background/ function of interviewees is larger in Case 1 and 3 (including managers, teachers, a CGP-developer, a CGP-coordinator and students) than in Case 2 (including the CGP-coordinator and one student). If we would have been able to talk to more people in Case 2, the resulting picture we drew from the research might have been different; also in such a case, results would have been more comparable to the other two cases. As a result of the limited data collection in Case 2 we were not fully able to achieve our research goals. We intended to study which aspects of 'transformational leadership' could be identified in the CGP innovation processes. Also, we intended to create a better understanding of the relationships among 'social individual learning', 'collective learning' and 'transformational leadership'. The data collected for Case 2 did not help us to gain a better understanding of the concept of transformational leadership in an educational innovation process. Moreover, they did not provide us with insight in the three-way relationship between 'collective learning', 'transformational leadership', and 'team results'. Consequently, results with respect to these relationships are limited in Case 2. In addition, the insights obtained into the factors hindering the innovation process might be limited in this case as well.

Fifth, one of the goals of the analyses was to obtain insight into the forms in which each of the aspects of 'collective learning' manifests itself in the context of an educational innovation project. Many of the quotes we identified as being related to those aspects did not say much about the forms in which they appeared. For example, participants stressed the relevance of aspects of 'collective learning' for the innovation project, or they indicated their absence in the process. In order to create a better understanding of the richness of the col-

lective learning concept, future research might focus specifically on identifying the forms in which the aspects of the collective learning process appear in innovation projects.

Sixth, while results of the present study seemed to support our hypotheses that 'collective learning' and 'transformational leadership' are positively related to organizational innovation, we have to be careful in interpreting those results. Only case studies were included that showed above average success in their innovation trajectory; we did not compare the learning and leadership of innovatively successful teams with that of less successful teams. Various aspects of 'collective learning' and the dimensions of 'transformational leadership' may or may not be found in the latter teams. Cases were originally selected for a follow-up study aimed at creating more insight into the relationships found in the quantitative study by Kuijpers and Meijers (2012). To that end best, practice cases were studied. Interestingly, the team that, in the study by Kuijpers and Meijers, showed least success in developing and implementing the CGP had since dissolved. The development of the CGP in this team was highly dependent on two people; in other words it was not a full team effort and once those two people left the team, the team dissolved. Such a result is consistent with our hypothesis that 'collective learning' and teams' innovative performance are positively related (Hypothesis 5). However, in order to qualitatively test our hypothesis, further research is required, which would include teams that showed above and below-average success in their innovation trajectories.

Finally, the cross-sectional nature of the present study can be considered a limitation. To really take into account the *process* nature of 'collective learning', longitudinal research should be done. In future research, methods might be considered in which an innovation trajectory of a team is followed over time and where participants are repeatedly questioned (at various moments in time) about the core concepts of collective learning and transformational leadership, as well as their mutual relationship and their relationship with 'team results'.

Directions for future research

Results of the present study lead us to make a number of suggestions for future research. First, in order to study the relationship between 'collective learning', 'transformational leadership' and 'team results' further, additional case-study research could be carried out. We advise that in such research teacher teams are included that successfully introduced an educational innovation as well as teams that were less successful at it. By studying the collective learning processes occurring in both teams insight might be obtained in how 'collective learning' and 'team results' are related. Possibly, collective learning processes in teams that successfully developed an innovation are different from processes in teams that have less successfully developed an innovation. Results might thus contribute to a better understanding of the relationship between 'collective learning' and 'team results'. In addition, the relationship between 'transformational leadership' and 'collective learning' might be studied further in such a research design.

Second, the three-way relationship between 'collective learning', 'transformational leadership' and 'team results' is more complex than we assumed. We for instance found a number of, mainly organizational, conditions that participants perceived as hindering the

innovation process and the underlying learning processes (i.e., misalignment between teachers' preferences or capabilities and the tasks assigned to them, a limited willingness or ability of managers to invest in the continuity of the CGP, time pressure, resistance to change, structural inflexibility, and cultural limitations). In the best practice cases these factors showed to be related to the concepts of collective learning and transformational leadership. Likely such relationships can also be found in other (educational) innovation projects. For example, when teachers do not experience an ongoing project as a priority of their managers, they might not be motivated to be involved in its development. This might be specifically true if the learning process associated with it exposes them to less convenient feelings inherent to significant changes, such as ambiguity and conflict. Teachers who encounter too much time pressure, or too many organizational or cultural limitations, might not be willing to invest their time and energy in the learning process. When teachers cannot act on their preferences, this can harm their enthusiasm and commitment to the team vision, the driving force of the collective learning process. When they aren't asked or able to use their personal capabilities, this might limit their self-efficacy[20] (Bandura, 1977). As people are more likely to participate in behaviors they believe will result in success and less likely in behaviors they believe will result in failure (Ormrod, 2008), not using their capabilities may limit their motivation for the CGP. It might also reduce their openness to others – an attitude required for processes of collective learning – for openness implies taking a vulnerable position and making personal shortcoming visible to others. Such an argument corresponds with earlier research that has shown that teachers' with higher levels of self-efficacy are more open to new ideas and organizational changes (see Runhaar et al., 2010) and that occupational self-efficacy is positively related to work-related learning (Deci & Ryan, 1985). In our literature study (see Chapter 2) we found that the organizational context might both facilitate and hinder collective learning processes; in the present study both effects were indeed found. We therefore suggest that in future research attention is paid to organizational factors which could influence 'collective learning', or its relationship to 'transformational leadership' and 'team results'. In our revised conceptual model (see Chapter 7) this potential influence of inhibiting or stimulating factors is taken into account.

Third, in all three cases we studied, reference was made to a 'learning orientation' with regard to the innovation process. Such orientation is characterized by two facets: the acknowledgment of the innovation process as a learning process, and a focus on staff development as part of the innovation process. An interesting question following from that is what the relationship is between this 'learning orientation' and the collective learning concept.

The first facet of 'learning orientation' is an organization's acknowledgement of the innovation process as a learning process. In the cases, the innovation process was described as a learning process associated with social learning, experiential learning, continuous learning, adaptive learning, and experimental learning. In the present study 'collective learning' is conceptualized as a form of learning that is related to each of these forms. It is considered an inherently social process, in which team members collectively make sense of their experiences, and translate their shared understanding into collective action. Ideally, it is a continuous process (in which evaluation and reflection form the start of a new learning cycle), which has the potential to increase a team's ability to adapt to internal and external variety (see

[20] Self-efficacy is the belief that one is capable of performing in a certain manner to attain a certain set of goals (Ormrod, 2008).

Chapter 2). Experimenting with certain actions may be considered a method for practicing various approaches, and in reflecting upon the experiences gained, team members might choose to enlarge the team's behavioral repertoire. As such, the various forms of learning indicated under the heading 'learning orientation' seem to be compatible with 'collective learning', though the quotes in which they were identified could not specifically be assigned to any of its aspects. The collective learning concept thus seems to be broader than we thought it to be in our operationalization (see Chapter 3). Future research might focus on understanding more fully the relationship between 'learning orientation' and 'collective learning'; this might lead to the concept being expanded. Alternatively, it might be that the acknowledgement that innovation processes, such as the development of the CGP, are learning processes (of a social, experiential, adaptive and continuous nature) is a necessary condition for arriving at 'collective learning'. This might for example stem from the fact that this acknowledgment creates the right mindset within teams and their leaders, or because it leads them to arrange an environment which is supportive of such learning.

The second facet of 'learning orientation' is an organization's focus on staff development. In the cases we found that the team members' development was stimulated as part of the innovation process, because it was deemed conditional to the success of the learning processes underlying the innovation project. Through team member development, managers strived to create an environment supportive of social and experiential learning. The goal of staff development is "to bring about changes in the patterns of thinking and the teaching behaviours of the teachers" (Van den Berg et al., 1999, p. 339, referring to Roelofs, 1993). It may therefore be considered an intervention supportive of educational innovation. Future research might take into account organizational interventions that are focused on team members' development in the context of 'collective learning'.

Fourth, we found indications that a dialogical learning attitude may play an important role in collective learning processes. In each of the three cases it was considered a condition of the learning process underlying the innovation process, and teachers' dialogical learning attitudes are therefore actively developed. In future research the relationship between the concepts of collective learning and dialogical learning attitude might be explored further. In order to distinguish between individual level and team level facets of learning, we suggest for now that the aspect 'dialogue and inquiry' of 'collective learning' be considered to concern the processes of dialogue and inquiry taking place in the team under study, and that 'dialogical learning attitude' be considered part of an additional concept. In the cases we found that teachers' attitudes towards the learning process is relevant, as well as their ability to engage in social learning processes; we therefore suggest that both facets are included in this additional concept. Then, we think it would be interesting to look at the relationship between processes of collective learning occurring in teacher teams, teachers' individual abilities and competencies with respect to social learning, the organizations' 'learning orientation' and teams' innovative performance. Based on the results of the present study, it might be hypothesized that teachers' abilities and competencies with respect to social learning, as well the organizations' 'learning orientation' have a positive effect on 'collective learning', which, in turn, has a positive effect on teams' innovative performance. Quantitative research might be applied to test this set of hypotheses.

Fifth, we learned that the difference between 'social individual learning' and 'collective learning' is more complex than we assumed. We found that, contrary to our theoretical framework (see Chapter 2), results of 'social individual learning' are not necessarily restricted to the individual level, and results of 'collective learning' are not necessarily restricted to the team level. Specific ways of learning (e.g., learning from feedback, learning from knowledge sharing, or learning from observation) might improve teachers' individual performance, and might, indirectly, also improve the team's performance. This is specifically true when the team's performance is partly dependent on the activities teachers undertake individually, such as teaching their own groups. When teachers undertake such learning activities to improve their own performance outside of their considerations for the team they are working in – for example to improve their career prospects – the goal is solely individualistic. In the cases we saw, however, teachers also undertook these activities in order to contribute to the team goal by improving their own performance. The same learning could then lead to a different type of outcome: in the first case we would refer to it as 'social individual learning' and in the second case to 'collective learning'. As such, the boundaries between 'individual results' and 'collective results' become blurred.

This effect is strengthened by the fact that social interaction is likely to result in a change in the mental maps of both the teacher who has initiated the learning processes and the teacher with whom it is undertaken. For example, when teachers give feedback to colleagues, they are confronted with their own standards (which function as a frame of reference on which they base their feedback). Such a confrontation might lead them to reflect on those standards. Moreover, in providing feedback, teachers observe colleagues while those are in the process of working. Such observations might lead them to reflect on their own behavior, or to adopt new ways of working. Also, in discussing the results, teachers may develop a shared understanding, which might also be considered a collective result. In the same way, 'collective learning' is also likely to result in changes in teachers' individual mental maps, and therefore the results cannot be said to be restricted solely to the team level. Consequently, the nature of the outcome of the learning process does not clearly discriminate between 'social individual learning' and 'collective learning'. The commonalities between 'social individual learning' and 'collective learning' are depicted in Figure 5.8.

At this point we would like to argue that specific ways of learning cannot be labeled 'social individual learning' or 'collective learning' beforehand (i.e., based on the method). It seems to be the learner's intend which is decisive. 'Collective learning' might be said to occur when teachers use forms of social learning primarily to align or improve their own performance in order to contribute to developing the team's collective competence. 'Social individual learning' might then be said to occur when teachers use forms of social learning solely to improve their own performance, without taking teams they are working in into consideration. In such a case the team's collective competence might still increase; this is however not certain, and teachers might not really care whether it does or not (Wierdsma & Swieringa, 2002).

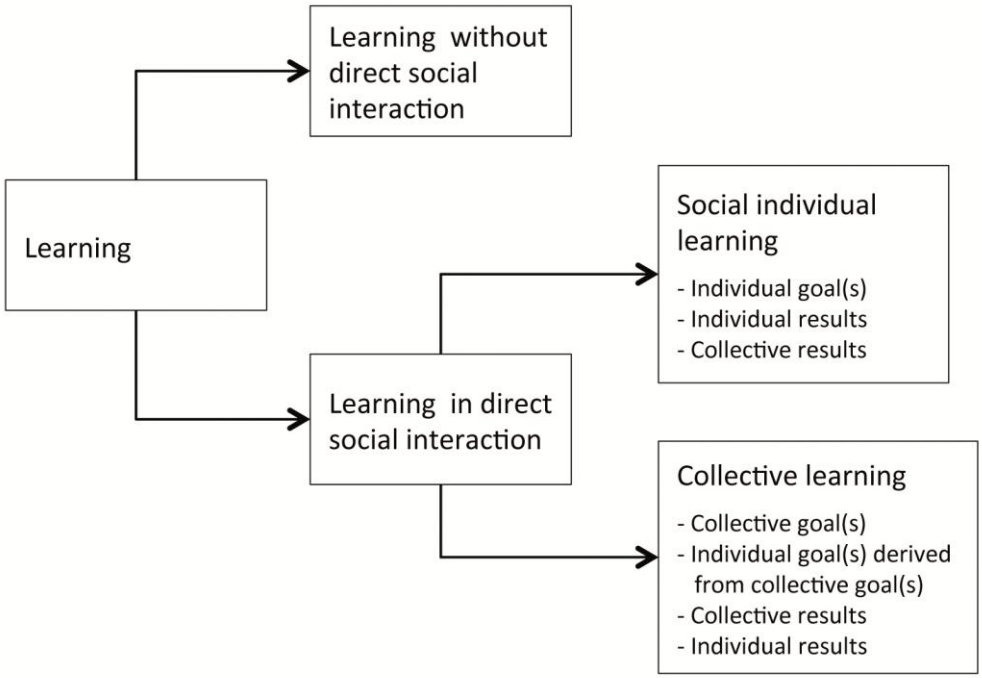

Figure 5.8. Comparing Social Individual Learning and Collective Learning.

Future research might focus on designing distinctive measures for 'social individual learning' and 'collective learning', using the learner's intend as a distinguishing criterion. However, based on our literature study we think such research might be hindered by the fact that this intend is difficult to ascertain. Teachers are increasingly expected to collaborate and participate in collective learning processes (see f.i., Verbiest, 2002, 2004; Verbiest et al., 2005; Molenaar, 2010; Brouwer, 2011; Goes-Daniëls, 2011; Truijen, 2012), while individual learning is more likely to occur in higher vocational educational institutions (Wierdsma & Swieringa, 2002). As a result, teachers might be inclined to overestimate the amount of learning they undertake from a collective perspective and/or underestimate the amount of learning they undertake from an individual perspective. This potential limitation should be considered when designing instruments for measuring the concepts of social individual learning and collective learning.

Sixth, taking into account the variety in teachers' approaches to the CGP, an interesting question is whether this variety justifies the use of the term '*collective* action' (as the behavioral component of the collective learning process). Verbiest (2004, p. 116) emphasizes that, in striving to realize common goals, teachers in a team may act differently. Some participants indeed indicated that they accept differences as long as team CGP-goals are met by all team members. Variety in teachers' approaches might be related to the fact that teachers often work alone in complex, vague, unstable, value-laden and unique situations (Verbiest, 2004), where they have to deal with a variety of student needs and responses and unexpected classroom events (Runhaar et al., 2010). Such situations require personal involvement and unique approaches (though, in the course of their careers, many teachers will tend to simplify complex situations and standardize them accordingly; see Weggeman, 2000 and Wanrooy, 2001). At the same time, the fact that teachers often work on their own might

lead them to reject colleagues' ideas, because they want to invent everything themselves (Wanrooy, 2001). Such an attitude comes at the cost of teacher collaboration and 'collective learning'. Future research might further explore the nature of 'collective action', delving into the tension that might exists between individual approaches and collaboration.

Seventh, in reflecting on the similarities between the cases we noted that our results correspond well with Verdonschot's (2009, 2011) theory on design principles. Verdonschot identified eleven design principles (see Appendix O), reflecting factors that enhance learning in innovation practices. Results of the case study, with respect to 'collective learning', 'transformational leadership', and the factors hindering the innovation process, might be understood in terms of these design principles (see Appendix O, Figure O1, for a tentative description). It might be that 'collective learning' and 'transformational leadership' are mechanisms for effecting the design principles, an idea that could be further explored in future research.

Finally, in each case participants indicated that they obtained information from internal as well as external sources. People from within the teams and external to the teams (e.g., colleagues from other teams, internal and external experts) were involved in the processes of having dialogues aimed at creating a shared understanding or shared capabilities. As such, teams seem to have utilized bonding connections (e.g., within the team), bridging connections (e.g., within the organization) and linking connections (e.g., with external experts) (see De Jong, 2010). Teams in our case study differed in the extent to which they utilized the different types of bonding. While bonding and bridging connections were found in all cases, linking connections were only indicated in one case. In the context of networks, De Jong (2010) found the combination of social learning processes and linking connections to be positively related to networks' knowledge productivity, or their ability to realize specific improvements and innovations as well as to develop sustainable capabilities. Future research into 'collective learning' might take into account the types of connection utilized by teams, the influence of these connections on the collective learning process, and ultimately the influence on teams' innovative performance. When in such research the type of bonds teams utilize are shown to be of relevance for the collective learning process, the collective learning concept might be expanded to encompass this facet.

6 The relationship between collective learning and innovation: a game simulation: empirical study 3

> What is it that makes organizations successful? Besides knowledge and good judgment, a shared sense of purpose and optimism is important to their success. On the contrary, fights for leadership, for instance, can do a lot of harm. This is ... [an] argument in favor of simulation games. They test not only the knowledge and intellectual skills of participants but also their capacity for collaborative action (Hofstede, De Caluwé & Peters, 2010, p. 833).

The present study's focus on 'collective learning' in teacher teams comes from the hypothesized expectation that this form of learning contributes to teams' general and innovative performance. In Study 1b we found that many teachers consider themselves unable to assess both types of team performance, which resulted in a large number of missing values as to the performance dimensions. Hence, the hypothesized relationship between 'collective learning' and team performance could not be tested in this study. In Study 2 we found that, in the best practice cases, each of the aspects of 'collective learning' was addressed by respondents describing their academy's innovation trajectory with respect to the development, implementation and continuation of the Career Guidance Program. Results of the case study support the hypothesized positive relationship between 'collective learning' and teams' performance, specifically their innovative performance. In order to study this relationship further, a simulation game (based on the Knowledge game developed by Kessels (1998)) is applied. Using this game, a teams' behavior in terms of 'collective learning' can be assessed and that can be directly related to a team's general (i.e., financial) and innovative performance. As such, we aim to create a better understanding of the relationship between 'collective learning' and 'team results'.

6.1 STUDYING RESEARCH QUESTIONS 5 AND 6

In the game simulation, five groups representing teacher teams involved with different bachelor studies are invited to participate in a market simulation, each team operating as a production company. During the simulation, teams' behaviors in terms of 'collective learning' are observed by an external observer. Additionally, teams are requested to assess their behavior with respect to 'collective learning'. The teams' financial position, which is considered a result of their efficiency and innovativeness, is used as an outcome measure. By comparing teams' collective learning behaviors with their performance, we studied the following research question.

Research question 5: How are Collective Learning and Team Results (i.e., Team Performance and Innovativeness) related in the context of a game simulation where teacher teams compete in producing and designing products?

As was already argued in Chapter 2, game simulation does not mean that our hypothesis that 'collective learning' has a positive effect on 'team performance and innovativeness' can be accurately *tested*. However, as is depicted in Figure 6.1, we do expect a positive relationship between both these items and will study to what extent a positive relationship can be seen in the game simulation.

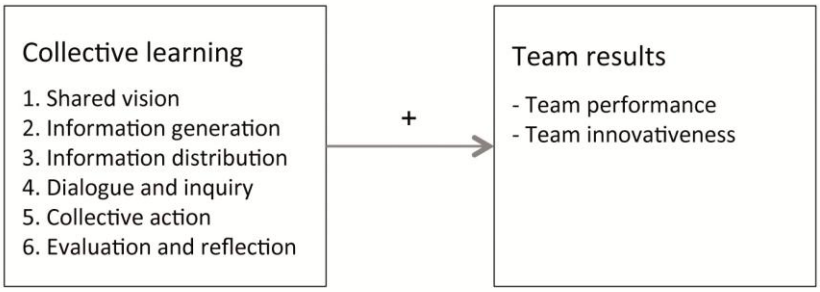

Figure 6.1. Expected relationship between Collective Learning and Team Results.

In pondering the collective learning concept, an interesting question might be: when can it be said to occur? Do all team members need to agree on the extent to which each of its aspects are addressed in the work situation before we can speak of 'collective learning'? In conducting the analyses for Study 1 we found a reasonable amount of variation in teacher teams with respect to teachers' individual perceptions of the various aspects of 'collective learning'. (This variation was not taken into account any further, because an individual level of analysis was chosen). A portion of that variation could be attributed to the general nature of the statements posed in the questionnaire. Statements were presented as "within our team, we...". In responding to those statements, teachers might have had different frames of references; they might for instance address different activities undertaken within the team or refer to different time slots or different sub-parts of the team. Within the experimental setting created in Study 3, we narrowed down teachers' frames of reference by limiting team size, and by specifying the range of activities to be performed and the time slot associated with those activities. Such a setting creates the opportunity to study the extent to which team members equally assess the level of 'collective learning' demonstrated when undertaking a fixed set of activities within a restricted time period. Moreover, these assessments can be compared to the overall scores provided by the teams. We will reflect on the relationship between teachers' individual scores[21], as well as the relationship between individual and team scores, thereby striving to find an answer to the following research question.

Research question 6: How are team members' perceptions and teams' perceptions of the collective learning process related when teacher teams compete in producing and designing products?

[21] In the current study we try to measure teachers', teams' and observers' perception of the collective learning process. Therefore, the term 'perception' might be preferred. However, since teachers', teams' and observers' perception are quantified, we will use the term 'score' (instead of 'perception'). The scores refer to the quantified perceptions.

By answering this question we are trying to create a better understanding of the collective learning concept.

6.2 THE KNOWLEDGE GAME

The Knowledge game as an exploration of the corporate curriculum[22]

As was discussed in Chapter 1, our society is gradually moving towards a knowledge economy; an economy in which the application of knowledge is the main means of production (Kessels, 1998). In such an economy, successful organizations have the ability to contribute to knowledge generation and application, requiring their daily operations to be designed in a way that supports 'knowledge productivity' (Kessels, 1996b; 2001b). Knowledge productivity is the dominant economic factor in a knowledge society (Kessels, 1998). It entails "identifying, gathering and interpreting relevant information, using this information to develop new skills and to apply these skills to improve and radically innovate operating procedures, products and services" (Keursten, Kessels & Kwakman, 2003, p. 892, see also Kessels, 1996, 2001a). The importance of such knowledge development increases the demand for a corporate curriculum (Kessels, 1996; Kessels, Van Lakerveld & Van den Berg, 1998; Van Lakerveld, 2005; Stam, 2007). This is an organizational plan for learning, aimed at developing the organizational competencies needed to be knowledge productive. It involves transforming the daily workplace into an environment where learning and working integrate (Keursten et al., 2003), such that a powerful learning environment is created. This 'corporate curriculum' serves seven related learning functions, as described in Kessels (1996b, 2001a).

The Knowledge game (Kessels, 1998) is a simulation game designed to discover and discuss these learning functions. In the game a 'micro-economy' is simulated based on the following four factors: capital, material, human resources and knowledge acquisition. During the game, teams are invited to develop, produce and sell products to the market. To this end, the market presents them with product models for which there is a temporary demand. The raw materials used to produce the products are represented by Chinese 'Tangram' (puzzle) pieces in various shapes and sizes. Using these pieces, teams need to reproduce the product models and offer them to the market. In order to be able to buy raw materials (variable costs) and pay for the labor costs incurred by the team members participating in the game (fixed costs), teams need to borrow money from the bank against a fixed interest rate. The facilitators of the game act as the marketplace and the bank. The market price of a specific model (i.e., team revenues) decreases each time the model is offered to the market. Ultimately, costs will exceed revenues for this model, forcing teams to focus on producing alternative product models. As such, teams need to find out how to produce in a fast and cost effective way. Teams design strategic plans to analyze and develop the various learning functions associated with the corporate curriculum and learn how to accelerate learning within and among their teams. Teams that are capable of transforming their learning into knowledge productivity will perform better in a competitive marketplace. An essential insight for participants is to see how learning and knowledge production can be transformed into economic success. The main objective of the simulation is to transfer the learning experiences from the game setting to the day to day work setting. The game, lasting two to two-

[22] Description of the Knowledge game is based on Kessels (1998).

and-a-half hours, is made up of three production rounds. During the second round, the market starts to signal consumers' need for innovative products, to be designed and developed by the teams. When teams present an innovative model to the market, competing teams are allowed to copy their design. In such a case, the innovator receives a bonus for each imitation that is offered to the market. At the end of each round, the teams' financial positions are assessed and communicated back to the teams by the bank. Production rounds are alternated with reflection rounds, during which teams reflect on their learning functions and knowledge productivity. The game can be played by three to seven teams, each team consisting of four to ten members, with a maximum of 70 participants taking part.

The Knowledge game as laboratory for Collective Learning

In the present study, the Knowledge game is employed to study the extent to which collective learning processes occur in teacher teams. Learning processes are very likely to occur, because a game simulation is first and foremost a form of communicating and learning. Participants explore each others' ideas, beliefs and understandings. They predominantly do so by exploring, in an accelerated way, a simulated reality and by experimenting with it. Moreover, collective learning processes are likely to occur because teachers involved in a team learn collectively about their work and their collaboration. Through 'collective learning', they develop collective sense making and collective mental models. As such, the game simulation is an activity that fits well with the theory on the learning organization (De Caluwé & Stoppelenburg, 2011).

The goal the Knowledge game is being used to achieve in the present study differs from the goal it was originally designed to achieve. The setup of the simulation was kept the same for the production rounds, but tasks during the reflection rounds were modified to address 'collective learning' instead of the seven learning functions of the corporate curriculum. The micro-economy created within the simulation formed the work environment in which teams' learning behavior with respect to 'collective learning' could be studied. Although the Knowledge game presents teams and their members with conditions unlike their daily work situation, there are a number of fundamental similarities. First, like educating students for a certain amount of time (e.g., a semester, a year), the tasks the teams are confronted with in each round eventually form a whole. Second, the continuation of the game during the three rounds resembles the ongoing educational process, in which teachers accumulate experiences that they take with them to the next period(s). Third, team results are dependent on the contribution of each team member, making the results sensitive to both synergetic effects and the influence of the 'weakest link'. One form of synergetic effect was illustrated in Study 2, where it became clear that innovation is enhanced as a result of shared understanding created within teams. The influence of the 'weakest link' is felt when interrelated task are distributed over the team, such as when different teachers teach the same course (e.g., mathematics) at increasing levels during the course of the curriculum. Fourth, the quality of teams' products is externally assessed, similarly the quality of education is ultimately assessed by the real-world field of work. Also, market demands vary over time, like the demands present within contemporary and continually developing industries, forcing teams to continually align their 'products' with 'the market'.

Because of the similarities between the tasks assigned to teacher teams in daily practice and the simulation, we think the Knowledge game offers these teams a work environment in

which learning processes that resemble the 'real' learning processes might occur. In this way the simulation creates an opportunity for us to observe these learning processes and to study their relationship with 'team results'. An important advantage of the simulation is that it creates an identical situation for five different teams, making it possible to compare teams' behaviors and their results. Another important advantage is the limited time span in which multiple learning cycles (consisting of planning, acting and reflecting) present themselves. An advantage from the perspective of the teams themselves is that participating in the simulation presents them with direct feedback on their results. Feedback in educational processes often takes longer to get and often manifests itself in a different part of the educational system than from where the actions originated. As a result, teachers lose the ability to see the consequences of their actions (Senge, 1990), reducing the learning effects associated with experiential learning. Senge refers to this phenomenon as 'the delusion of learning', a learning problem specifically associated with this form of learning. By limiting the time and space in which tasks are worked on in the simulation, teams receive direct feedback on their actions. As Senge (1990) points out, this helps them to see patterns and to learn to reinforce or change those more effectively. In the section 'Methodological evaluation' we will elaborate on the emphasis that is given to the aspect of 'evaluation and reflection' within the game simulation.

6.3 RESEARCH DESIGN

Selection of the teacher teams

In the starting phase of Study 1, provisional scales for 'collective learning' and 'transformational leadership' were created, based on an exploratory factor analysis. These scales were used to calculate team average scores for each of the teams participating in the quantitative study. Team average scores could theoretically fall within the range 1.0 to 4.0, though both extremes were not found in the sample. As a form of feedback, each team was provided with the team and sample average scores (along with the standard deviations). Based on these preliminary results, five teacher teams were selected and invited to participate in the Knowledge game: the highest scoring team in the sample – with a score over 3.0 on each aspect of 'collective learning' (Team 1) –, a team with a score between 2.5 (scale average) and 3.0 on each aspect (Team 2), a team with scores close to the sample average (Team 3), and the two lowest scoring teams in the sample. The team leaders of the latter two teams declined participation. The leader of the first of the lowest-scoring teams, who was recently assigned to the team, emphasized that the team had other priorities, given the team's current "arrogant and unproductive culture". The other lowest-scoring team leader considered participation in the Knowledge game a useful intervention in the change process the team was involved in, especially in light of negative evaluation they had received by the Dutch-Flemish accreditation committee about their program. However, for pragmatic reasons, the team was unable to participate at the day and time the Knowledge game was organized, and it proved unfeasible to find an alternative date in which all teams could participate. Two other teams from the sample were therefore invited: a relatively low-scoring team (though scoring significantly higher than the two teams that declined participation) (Team 4), and a team scoring slightly over the scale average (2.5) for most aspects of 'collective learning' (Team 5). Both team leaders agreed to participate. The teams' scale averages for each of the aspects of 'collective learning' are presented in Appendix P (Table P1).

Team leaders from the five participating teams were asked to participate in the Knowledge game themselves and to select four colleagues to make up a team that would more or less reflect the teacher team. The aim of choosing this type of group composition was to have groups in the simulation that would roughly correspond with the team average scores provided in Table P1 (Appendix P). In practice, however, groups were formed based on teachers' interest in participation and their availability in terms of their class schedules. As a result, the game teams were not necessarily a representative selection of the teacher teams and the patterns shown in Table Q1 did not automatically apply to the game teams. Observation during the game was therefore considered particularly relevant to assess the level of 'collective learning' taking place within each game team. In teams 1 and 3 four teachers participated and in teams 2, 4 and 5 five teachers did. Team 1 was composed of two female and two male participants; Team 2 of two female and three male participants; Team 3 of three female participants and one male participant; Team 4 of two female and three male participants and Team 5 of three female and 2 male participants. The total number of participants was 23.

Observation guidelines

In order to study the game teams' behaviors in terms of 'collective learning', each team was assigned an observer. Next to the observation by the observers, all teams were videotaped for future reference. The observer's main task was to score the team's behavior with respect to the four aspects of 'collective learning': 'shared vision', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'. He/she had received an observation form on which three behavioral indicators were listed for each aspect (see Appendix R, Table R1). These indicators were taken from Study 1. The indicators included in the observation form were selected because they specified observable behavior and, as a set, generally covered the content of the aspects as envisioned in the theoretical model. Observers scored each of the twelve indicators with +1, 0, or –1, where score '+1' is defined as 'this behavior characterizes the group', score '0' is defined as 'this behavior does not characterize the group, but neither does the opposite behavior', and score –1 is defined as 'this behavior does not characterize the group, the opposite behavior explicitly does'. Additionally, the observers were asked to write down and describe things they noted about their groups that might be relevant from a perspective of 'collective learning'. During the reflection rounds, observers stimulated group members to fill in their individual reflection forms, collected those and subsequently asked the group to fill in the (overall) team reflection form.

Each observer was given instructions by one of the researchers one week before the simulation. They were informed about the way the game works and their role during the game rounds and reflection rounds. Moreover, the theoretical model of 'collective learning' was explained to them, the observation list was handed out, and a fixed set of examples (+1 examples and –1 examples) was provided and discussed for each of the indicators on the list (see Appendix S, Table S1). Based on observers' feedback, the original observation list was slightly modified in order to take out some ambiguities.

Reflective questions

Game simulation accelerates reality whereas learning requires time for slowing down; time in which participants (i.e., teachers) are able to take some distance and reflect on what they've experienced (Argyris, 2004; De Caluwé & Stoppelenburg, 2011). Therefore, production rounds were alternated by reflection rounds, in which team members were asked to grade their team's learning process with respect to four aspects of 'collective learning' ('shared vision', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection') on a scale ranging from one to ten. The description of these aspects as they were presented to the team members are shown in Table 6.1. Scores were first to be assigned by team members individually, and subsequently (after handing in the individual forms to the observer) as a team. No instructions were given on how the teams were to come up with team scores, for we considered this part of the aspect 'evaluation and reflection' and we wanted to see how teams handled this part of the learning process on their own. Individual and team scores of 'collective learning' were collected to provide insight into the level of 'collective learning' as perceived by the team members, and to explore the extent to which 'collective learning' in a team was experienced as a collective phenomenon.

Table 6.1
Description of the four aspects of Collective Learning as provided to the team members for their self- and team-assessment during the reflection round

Aspect of Collective Learning	**Description of the aspect**
Shared vision	Within our team we have a shared idea about the goals we want to achieve, the desired development of the team and the problems we need to solve.
Dialogue and inquiry	Within our team we are open to each other's ideas and respect those, even when they strongly diverge. By posing the 'why-question' we try to learn from each other's ideas and achieve a better group result, despite of the role or position of the person bringing the ideas forward.
Collective action	By bringing into line our own actions with the team, our activities and work approaches are better aligned. We support each other in executing our own tasks and in solving the problems we encounter along the way.
Evaluation and reflection	By explicitly considering the results achieved and the way we achieved those, we try to improve the learning and working processes within our team. We assess whether we have achieved our goals and which actions or factors have contributed to that result. Knowledge and insights gained during the game are discussed and exchanged.

Analyses

The relationship between 'collective learning' and 'team results' (i.e., 'team performance and innovativeness') is studied by comparing teachers' and teams' self-assessment of 'collective learning' with teams' financial performance.

Calculating teams' financial results. Per game round and over the whole game, the teams' financial results are calculated as follows. Teams borrow money from the bank ('loan granted') in order to buy raw materials, which they use to assemble products. Money is borrowed against a 10% interest rate ('interest'). The products assembled by teams are offered

to the market, and sales lead to an improved cash position of the teams. Because teams are only provided with rough sketches of product models (see Appendix Q, Figure Q1, for an example), the production of existing product models requires a certain amount of innovation. Innovation starts as soon as teams need to figure out how to assemble the product models presented on the market in the most cost-effective way, thereby organizing their work efficiently. As such, innovation underlies a team's ability to successfully sell products to the market and it improves a team's cash position. Teams are stimulated to use 'free' cash to repay their loans ('loan repaid'). The bank also offers them a 10% interest rate ('interest') on a positive bank balance. Teams are also confronted with labor costs incurred by the team members participating in the game ('tax'). Per game round, for each team member a fixed amount needs to be paid to the bank. At the end of each round, this financial aspect is taken into account when calculating teams' resulting financial position ('balance'). Finally, teams introducing new product models to the market receive royalties ('royalty') when other teams copy their innovations. Royalties are calculated once, at the end of the game, as 30% of the turnover resulting from sales of innovative products. Overall, efficiency and innovativeness both translate into financial success, and teams' financial results (operationalized as their balance total and royalties) reflect their ability to efficiently design and produce new or existing product models.

Assessing the level of Collective Learning. Per game round, for each teacher and each team a score is calculated for the perceived level of 'collective learning'. Such a score is calculated as the average (individual or team) score on the aspects of 'collective learning' as presented in Table 6.1. Moreover, for each team an 'average team score' is calculated, reflecting the numerical average of team members' individual scores of 'collective learning'. Individual scores and team scores range from one to ten. Scores '1' and '2' are referred to as very low, scores '3' and '4' as low, scores '5' and '6' as intermediate, scores '7' and '8' as high, and scores '9' and '10' are considered very high scores.

Studying the relationship between Collective Learning and Team Results. In order to study the relationship between 'collective learning' and 'team results' at the team level, the level of 'collective learning' per team (as perceived by teams and their members) and the team's financial performance during the game are graphically displayed. In addition, team descriptions (based on team scores and observer scores of 'collective learning', teams' financial results and the video recordings) are used to interpret this relationship. Next, results are compared over the cases in order to check whether a pattern can be found in the relationship between 'collective learning' (as perceived by teams) and 'team results'. In addition, observer scores are compared to a team's performance.

Studying the relationship between team members' perceptions and teams' perceptions of the collective learning process. Next, in order to study the extent to which team members assess the level of 'collective learning' equally and the extent to which these assessments correspond with team scores, a number of measures for the variance present in teams is calculated for each aspect of 'collective learning'. For each team, average scores (the mathematical mean of team members' individual scores) are calculated, as well as the minimum and maximum scores, as well as the range. The range of teachers' individual scores and team scores will be studied and compared, and team scores will be compared to the team's average scores.

6.4 RESULTS

Results per team

In this section team members' individual scores and team scores of 'collective learning' (Appendix U) are compared to the teams' financial performance, and their relationship is interpreted based on the team descriptions as provided in Appendix X. A specification of individual and teams' scores of each of the *aspects* of 'collective learning' specifically is provided in Appendix T (Tables T1 – T5), an overview of teams' financial results is presented in Appendix W (Table W1).

Team 1

Results are depicted in Figure 6.2. and show the team's assessment of 'collective learning' to its financial performance; results partially confirm our expectation that these variables are positively related. The team assessed the level of 'collective learning' as 'high' to 'very high', and reported experiencing an increase in 'collective learning' in the course of the game. In the first round, the team invested in raw materials and successfully produced a number of existing products. Such a result is in line with our expectations – that teams that learn collectively obtain positive team results. However, team members decided not to repay the loan at first, which resulted in a negative balance. Their earnings remained in cash form and were not formally recorded. In the second round, the team started by successfully selling existing and new products to the market and fully repaid its loan, resulting in a positive balance. Royalties show that the teams' innovations were successfully copied by other teams. Up to this point, results seem to confirm our expectations that 'collective learning' is positively related to 'team performance and innovativeness'.

Subsequently, however, the team was confronted with a lack of raw materials and chose to stop producing products. Team members got involved in a dialogue where they discussed the values underlying the principle of 'maximizing revenues' and concluded that they had generated enough income. Notably, this development coincides with a relatively large spread in teachers' individual assessments of 'collective learning'. The team started to strive for a goal team members described as 'dematerialization', but quickly noticed that this goal could not be pursued within the context of the game. In response to the game facilitator's suggestion to collaborate with other teams at the end of the round, team members tried to sell sustainable raw materials to other teams as a contribution to their vision of 'dematerialization'. However, other teams refused to collaborate, which resulted in members no longer being actively involved in the game. In their final reflection, those team members indicated that they were unable to get any form of 'self-reward' from the game, because their team goal and the game's actual goal were at odds.

Despite not producing any products in the third round, this team still perceived high levels of 'collective learning'. Such result might be seen as shared discontent with the game's goal. In other words, the team's view of the situation was unanimous (implying a 'shared vision'); this shared understanding was created in response to reflecting on the purpose of the game (implying 'dialogue and inquiry' and 'evaluation and reflection'), which led to all team members stopping with the production of products ('collective action').

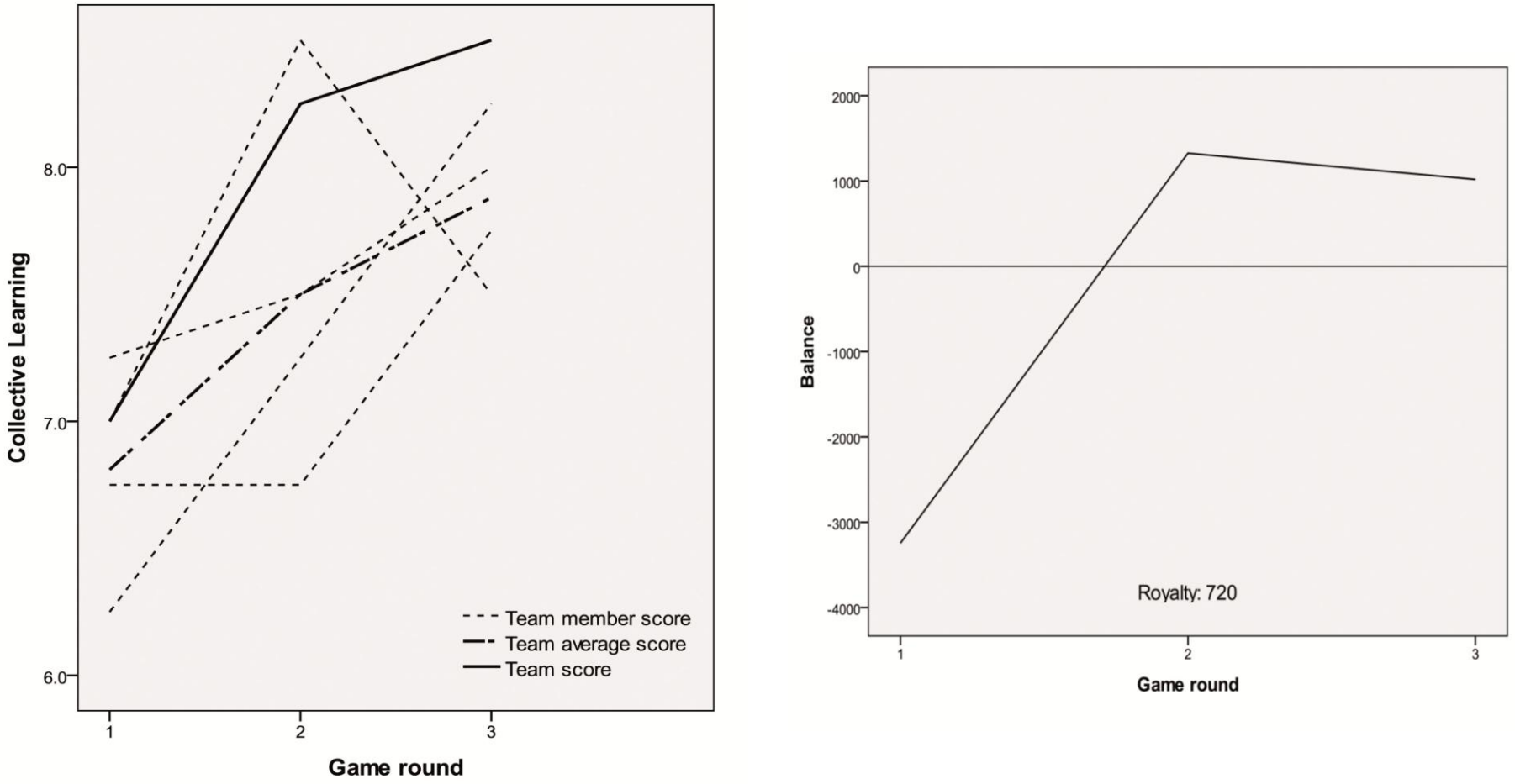

Figure 6.2. Results of Team 1. The figure on the left displays individual team members' assessment of Collective Learning, the average of their assessments, and the team's self-assessment. The figure on the right displays the team's financial performance as measured by its balance total.

However, because the team changed its goals and with that the output it was originally striving for, learning processes no longer translated into financial success in this round. Such a result seems to imply that the relationship between 'collective learning' and 'team results' is more complicated than we assumed. Interestingly, in the third round, the observer only identified counteractive behavior on all indicators of 'collective learning'. Likely, she translated the team's refusal to participate in the game 'as it should' (i.e., by developing and producing products) into negative scores on the behavioral indicators. The divergence between the team's and the observer's perception of the collective learning process in the third game round seems to stem from the fact that they had developed a different frame of reference. As such, results seem to imply that the assessment of 'collective learning' is dependent upon the assessor's frame of reference.

Team 2

The results of Team 2, depicted in Figure 6.3, are generally in line with our expectation that 'collective learning' and 'team results' are positively related. The team reported that it experienced its level of 'collective learning' as developing positively from 'intermediate' to 'high' in the course of the game, a development which is also reflected in the observer's scores.

Teachers' individual assessments show most variety in the first round, but increasingly converged as the game progressed. Such progress coincided with a positive development of the team's financial results. In the first round, the team invested in raw materials, but was not yet able to produce products cost-efficiently or conform to market standards. With respect to the latter, team members realized that they have not communicated with the market sufficiently in the first round and decided to appoint a 'liaison' who continuously informed the team on the status of each of the product models. Because no products were sold to the market at that point, the team ended the first round with a negative bank balance.

In the second round the team produced a number of existing products (though not in a cost-efficient manner), and was subsequently able to repay part of its loan. In this round, team members focused solely on imitating existing product models (without explicitly agreeing on such a strategy). Once again confronted with changing market demands, team members tried to design new products but did not succeed at it. At the beginning of the third round, team members decided to start focusing solely on producing existing products. In this round the team had the highest production level and was able to achieve a positive bank balance. Finally, looking at teachers' individual assessments of the collective learning process, a convergence of their scores can be noted over the course of the game.

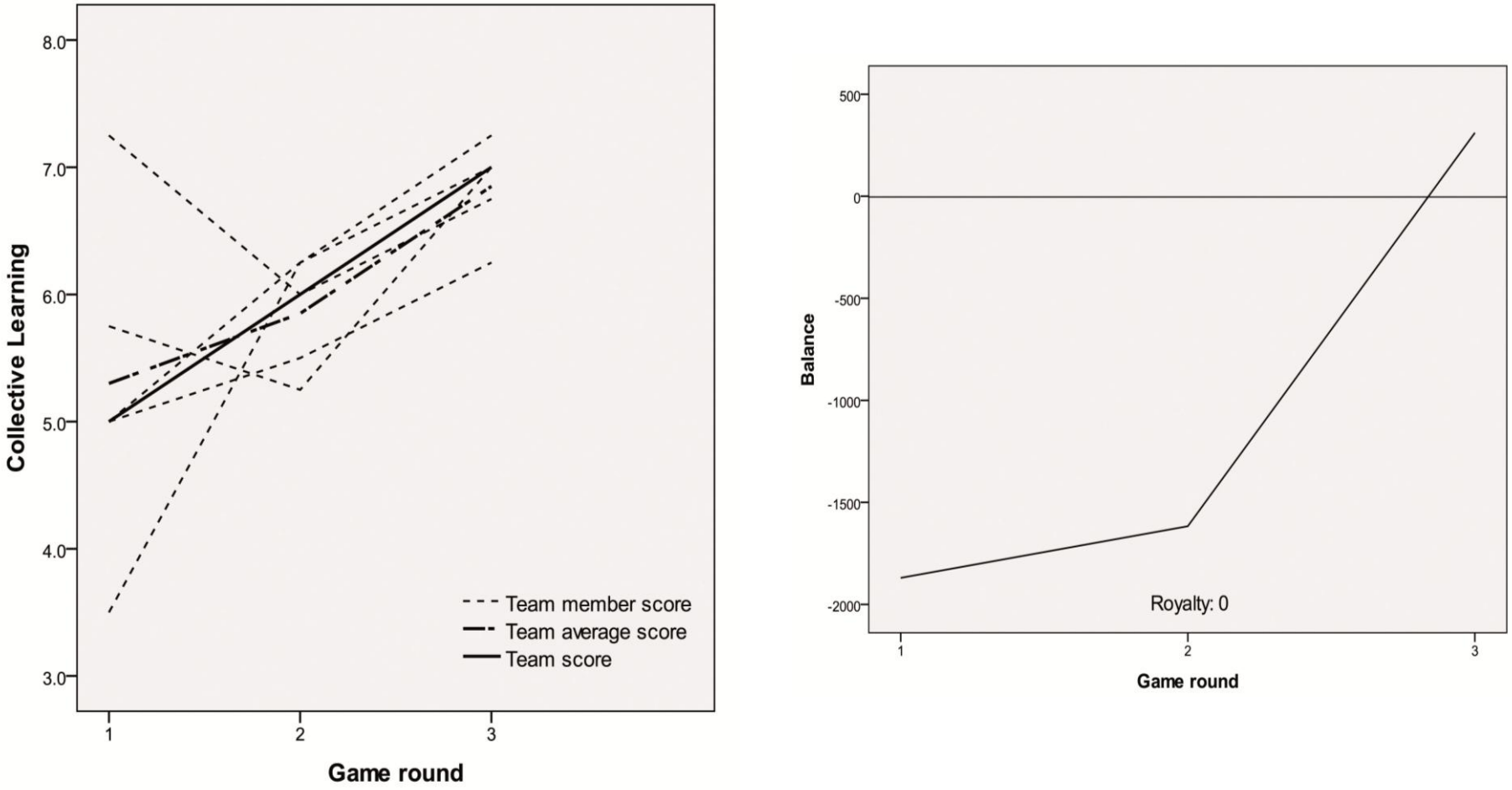

Figure 6.3. Results of Team 2. The figure on the left displays individual team members' assessment of Collective Learning, the average of their assessments, and the team's self-assessment. The figure on the right displays the team's financial performance as measured by its balance total.

Team 3

The results of Team 3, depicted in Figure 6.4, are not clearly in line with our expectations that 'collective learning' and team performance are positively related. This team assessed the level of 'collective learning as 'high' and noted an increase during the game. We note that teachers' individual assessments of the collective learning process varied most in the first round, but converged in the course of the game. In the first round, team members tried to understand the market's product design by comparing sketches of products with a sheet of paper that showed images of the raw materials available. Using this strategy, the team was not able to produce any products in the first round. Inspired by other teams' approaches, in the second round, the team altered its strategy and was then able to successfully produce and sell products. In addition, the team came up with a radically new product which the market readily accepted. Consequently, this team was able to repay its loan and ended the round with a positive bank balance.

In the final round, team members tried to come up with other radical innovations. However, they did not succeed at developing and commercializing one specific innovation. Consequently, the team generated no income in this game round, and its bank balance decreased. Notably, such change was not reflected in a decreased level of 'collective learning', neither in the eyes of the team members, nor in the eyes of the observer. Both still perceived the level of 'collective learning' as developing positively. While we expected the increase in 'collective learning' to coincide with an improvement in financial results, this was not the case. Perhaps, time was the constraining factor; the team's strategy might have translated into financial and/ or innovative success if team members would have had more time to work on their innovations.

Team 4

The results of Team 4, depicted in Figure 6.5, are generally in accordance with our expectation that 'collective learning' and 'team performance and innovativeness' are positively related. The team predominantly experienced high levels of 'collective learning' in the first two rounds. In the first round, the team was quickly able to produce and sell a number of existing products to the market. However, because the team heavily invested in raw materials, it ended the round with a negative bank balance. In the second round, the team increased its production and also successfully introduced a number of new product models on to the market. As a result, the team was able to repay its loan and generate savings, and ended the round with a positive bank balance.

When the team became aware of its financial advantage over the other teams, it decided to slow down on production. In the third round, the members, convinced that they had already won the game, only continued to produce products in order to finish the team's inventory of raw materials. When team members considered the result to be disappointing, they tried to pursue a more proactive strategy. However, confronted by a scarcity of resources, disagreement regarding the strategy arose in the team and two sub-teams were formed, each pursuing its own goal. Such development is reflected by a decreased level of 'collective learning', assessed by individual teachers, the team, and the observer.

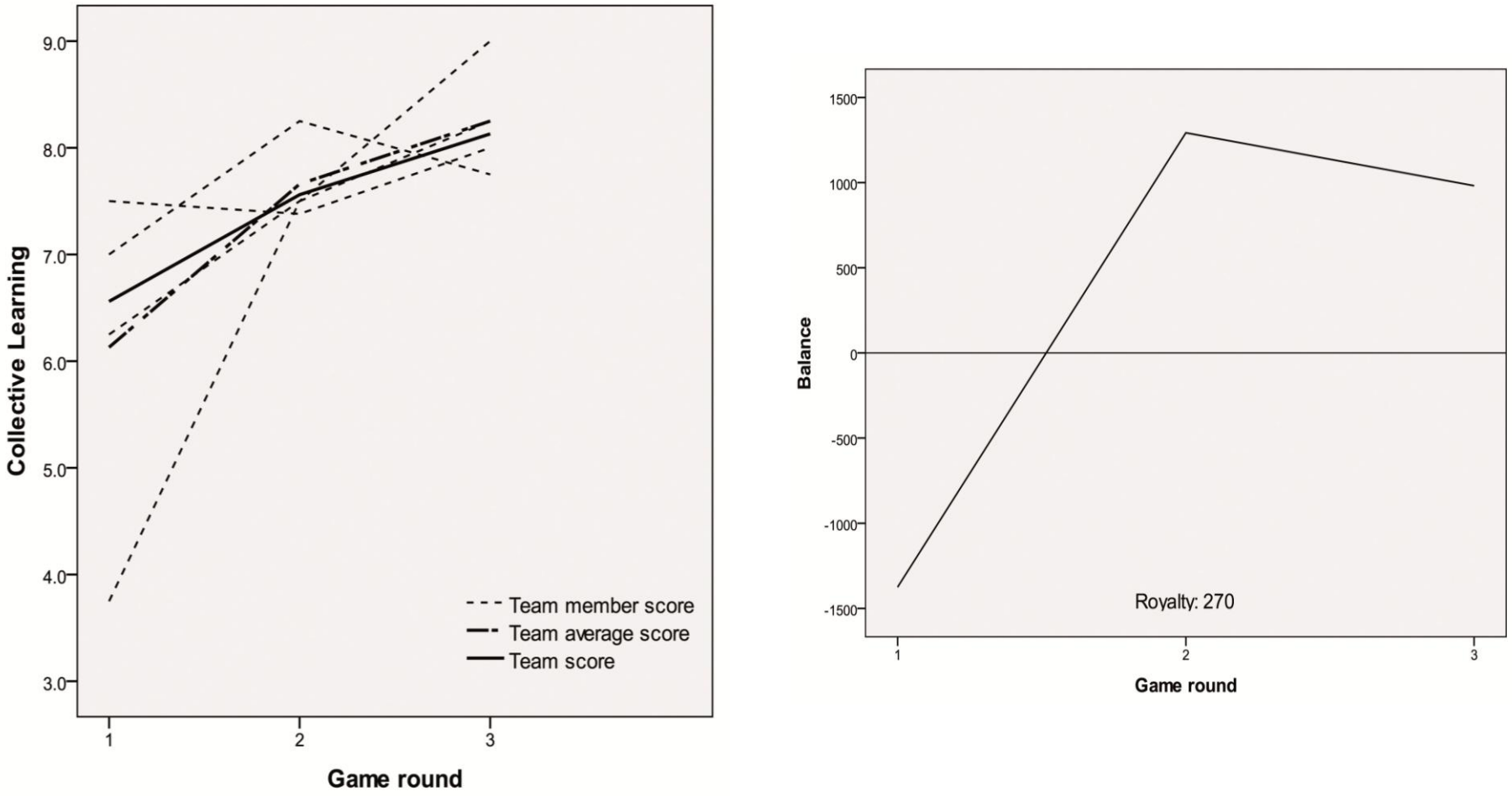

Figure 6.4. Results of Team 3. The figure on the left displays individual team members' assessment of Collective Learning, the average of their assessments, and the team's self-assessment. The figure on the right displays the team's financial performance as measured by its balance total. With respect to the final game round, the team's residual cash is included in its balance.

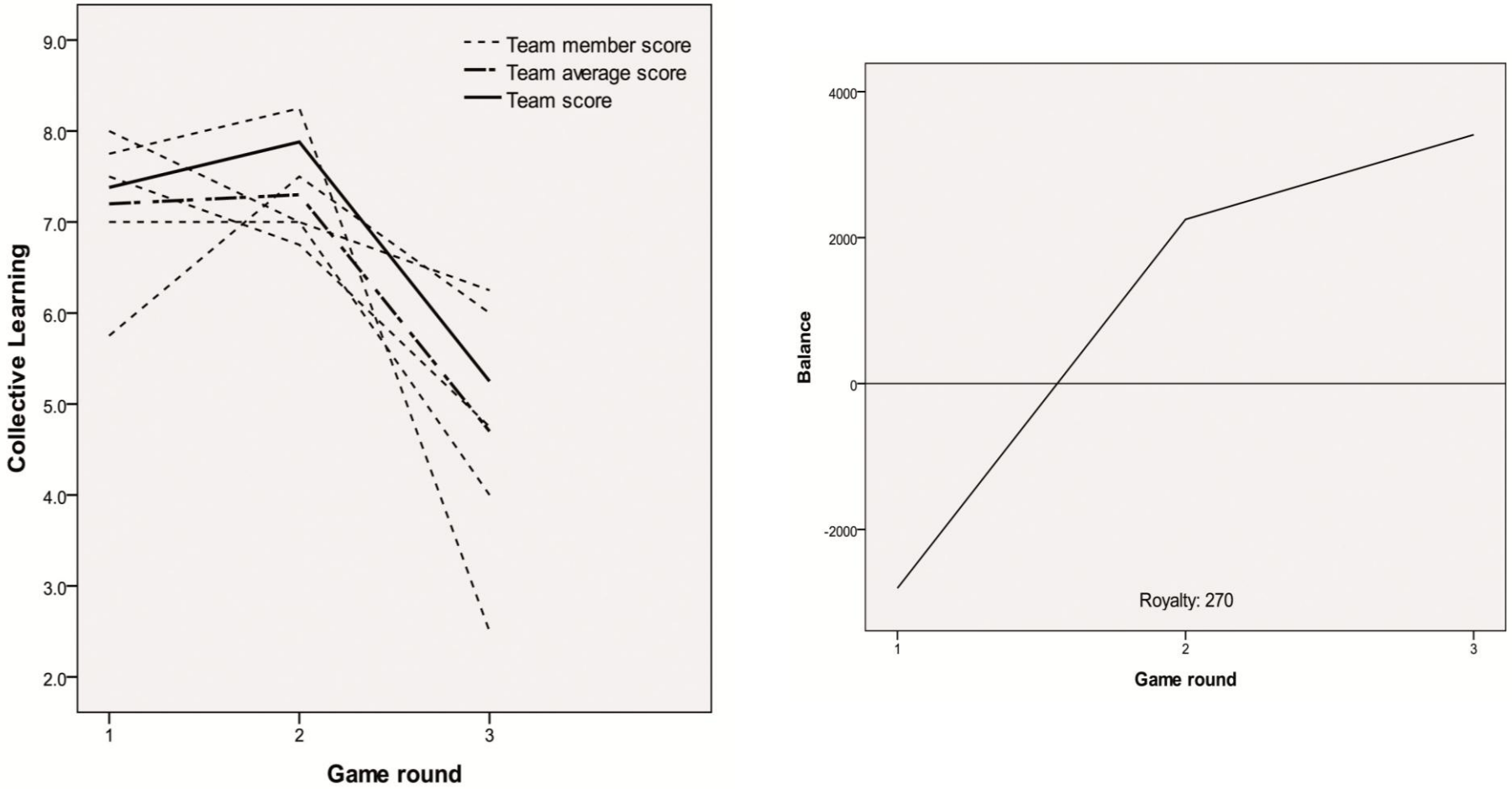

Figure 6.5. Results of Team 4. The figure on the left displays individual team members' assessment of Collective Learning, the average of their assessments, and the team's self-assessment. The figure on the right displays the team's financial performance as measured by its balance total.

Moreover, teachers' individual scores show most divergence in the this round. Conform our expectations, this reduced level of 'collective learning' in the final round coincided with significantly lower financial and innovative performance.

Interestingly, the team's strong financial performance in the first and second round did not coincide with high scores of 'collective learning' determined by the observer. Likely, the divergence resulted from the fact that team members assessed the result of the learning process, whereas the observer assessed the process. Within the team, tasks were divided up (based on the implicit vision to maximize income) and teachers predominantly worked alone. Since such an approach immediately led to financial success, the teachers did not seem to see the need to work actively on creating a shared understanding with respect to the team's tasks. This might explain why the observer noted very little behavior that is positively associated with 'dialogue and inquiry' and 'collective action'. Likely, the team perceived the effective cooperation, the exchange of information, and the positive team results as indicative of 'collective learning'.

Notably, in the second round, when the team was most successful financially, the observer assessed team members as actively working on creating a shared vision and team members indicated that they increasingly became aware of the team vision that was implicitly guiding their actions. Such results might indicate that a shared vision is an important means by which to connect teachers' individual efforts and foster a team result.

Team 5

The results of Team 5, depicted in Figure 6.6, are partially in accordance with our expectation that 'collective learning' and 'team performance and innovativeness' are positively related. Results show that this team won the game. In line with our expectation, the winning team consistently demonstrated 'collective learning' throughout the game, as assessed by both the team and the observer. Interestingly, however, this team only showed strong financial and innovative performance after two game rounds. In the first two rounds, the team was not able to successfully produce any products, leading to a negative bank balance. Together team members tried to design existing products, shifting their focus to an alternative design where they did not succeed or where a product they put together turned out to already have been assembled by a competing team. Once the team succeeded at assembling a product 'on paper', it was confronted by a material shortage and changed market demands and was therefore unable to successfully produce the product.

In the course of the second round, team members became more emotional and some started to question the team's strategy. Not surprisingly it was in this round that the largest divergence between teachers' individual scores of 'collective learning' could be seen. At the end of the second round, the team decided on an alternative strategy and actively pursued product innovations in the third round. The team was highly successful with this approach and was therefore able to repay its loan and generate savings. The team ended with the most positive bank balance of all teams.

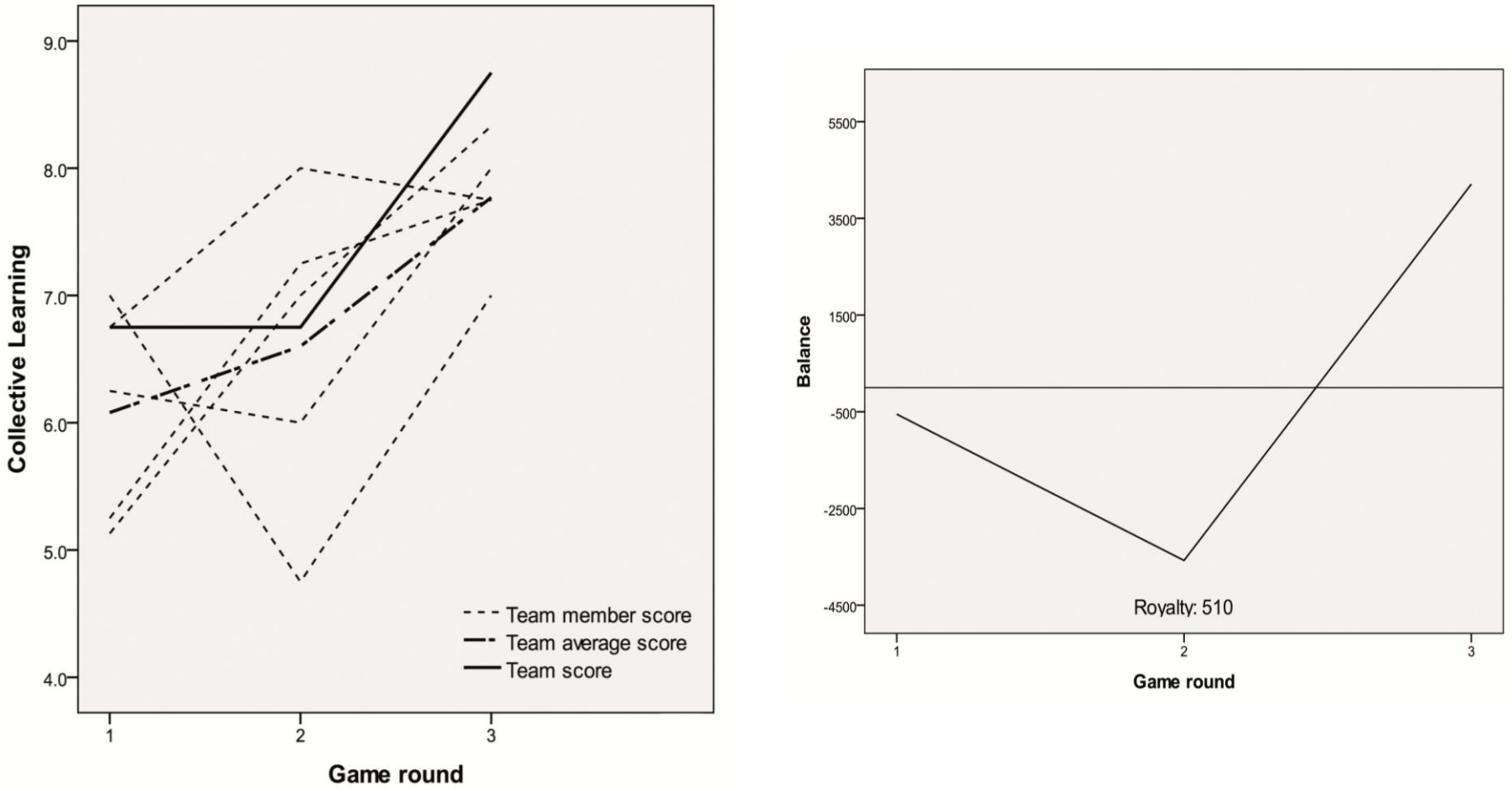

Figure 6.6. Results of Team 5. The figure on the left displays individual team members' assessment of Collective Learning, the average of their assessments, and the team's self-assessment. The figure on the right displays the team's financial performance as measured by its balance total.

In sum, contrary to our expectations, in the first two round the team's 'collective learning' does not coincide with financial success. It should be noted that the aspect of 'shared vision' was scored relatively low by the team in the first and second round (see Appendix T, Table T5). Likely, the constantly shifting team focus (i.e., the specific product to be assembled) led to a sense of a lack of efficiency. Moreover, the team seemed to be insufficiently in touch with its environment, in that changes in market demands were not noticed in a timely fashion. Once the team decided on a 'fixed' goal and took a more active role on the market, it became highly successful.

Notably, in the first and the second round the team perceived the level of 'shared vision' to be relatively low and in the third round it perceived it to be at a high level (see Appendix T, Table T5). In addition, the team also indicated strong growth towards 'collective learning' in the second to the third round. For this team it might be true that the 'shared vision' formed the foundation of 'collective action'. Indeed, the observer first noted an increase in the level of 'shared vision', and subsequently an increase in 'collective action'.

Overall results

Overall results are summarized in Figure 6.7. Based on these results we try to understand how 'collective learning' and 'team results' (i.e., team performance and innovativeness) are related (research question 5). While team results do not unambiguously confirm our expectations that 'collective learning' and 'team results' are positively related, a positive relationship between 'collective learning' as perceived by the teams and 'team results' seems likely. In looking at overall results, we notice a number of issues that might be relevant for better understanding this relationship.

First, an interesting observation is that the team that consistently demonstrated 'collective learning' throughout the game (both in the ideas of the team and the observer), ultimately showed strong innovative and strongest financial performance. Furthermore, we can see that a team's perception of its own collective learning processes are frequently positively related to its financial performance: when teams perceive the level of 'collective learning' as increasing, financial performance (in terms of teams' balance) often increases as well. Such results are in line with our expectations that 'collective learning' and 'team results' are positively related. Just one team assessed the level of 'collective learning' as decreasing during the game. This team (Team 4) decided to slow down its activities in the third round. When results proved to be disappointing, the team disintegrated and consequently team members perceived a negative development with regards to 'collective learning'. While the balance of this team still increased during the third round (indicating production), the production level significantly decreased (as can be seen from 'loan repaid' in Appendix W, Table W1). As such, conform our expectation, the decline in 'collective learning' seems to coincide with a decline in team performance. In Figure 6.7 this can be seen by the fact that the team's positive line in the 'financial results graph' becomes less steep.

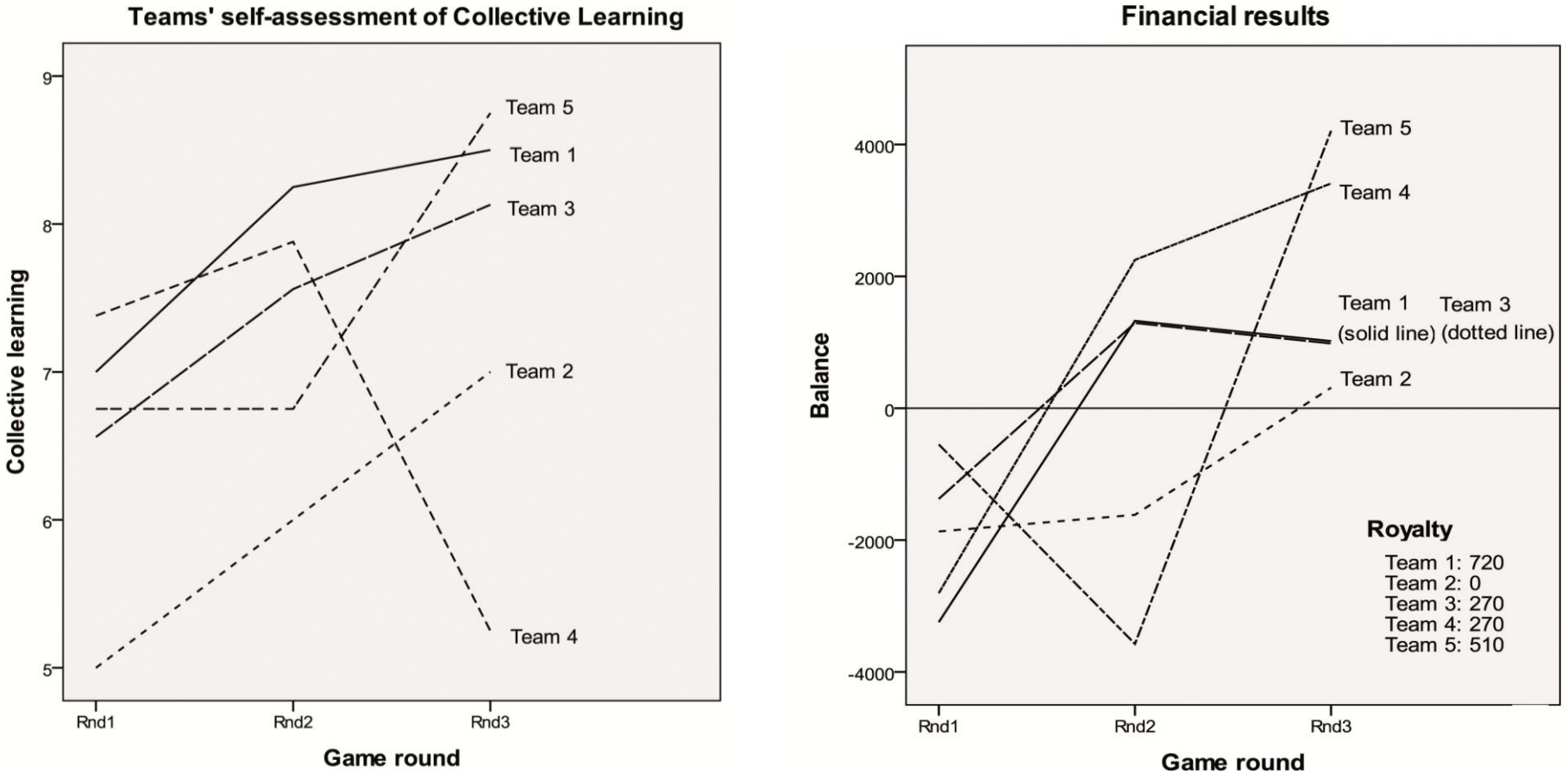

Figure 6.7. Overall results. The figure on the left displays the teams' self-assessment of Collective Learning, the figure on the right displays teams' financial performance as measured by its balance total.

In addition, we can see in Figure 6.7 that the two teams that perceived their level of 'collective learning' to be highest in the first round (Teams 1 and 4) showed the strongest improvement with regards to their financial result from the first to the second round (i.e., steepest positive line in the 'financial results graph' in Figure 6.7)[23]. Results for both teams are in line with our expectation that 'collective learning' and 'team results' are positively related. As will be explained below, for both teams this pattern did not continue from the second to the third round.

Three situations could be found where a teams' perception of the collective learning process was not positively related to their financial performance. Two teams decided to pursue a radically different strategy in the third round (Teams 1 and 3), and, as a result, stopped producing products. This might explain the fact that the teams' financial performance did not improve, while teams indicated an increasing level of 'collective learning'. As such, results for these teams are difficult to compare to the results of the other teams. They do seem to imply, however, that the relationship between 'collective learning' and 'team results' is more complicated than we assumed. Likely, team learning processes will only result in improved performance if performance standards are in accordance with the team's goals. The third exception was found in the team that was not yet able to successfully produce products in the first and second round (Team 5). The team perceived the level of 'collective learning' as remaining stable from the first to the second round, while its balance position deteriorated. Such a result stems from the team's investment in raw materials in the second round, the fixed cost the team is confronted with.

Second, we found that a team's positive perception of the collective learning process did not necessarily imply direct innovative or financial success. Two teams that perceived high levels of 'collective learning' in the first game round (Teams 3 and 5) were not immediately able to successfully produce products. Likely, these teams needed time to acquire 'subject matter expertise' (Kessels, 2001a), or knowledge directly related to the work goals. Another explanation might be that these teams communicated insufficiently with the market at the start of the game. While both teams proved able to assemble products, market demand had ceased by the time they finish their designs. Both arguments may be true at the same time. Indeed, team members from the teams in question suggested both arguments. Initially, teams may be unable to produce successfully, because they lack subject matter expertise and because a teams' communication with the market is limited, they may not notice that there is no longer market demand for the product models they are trying to assemble. It may be noted here too that that another team that perceived the level of 'collective learning' to be 'high' did not show positive financial results in the first round. The situation for this team (Team 1) was different, however. While the team was able to successfully produce products in the first round, its financial success did not show on the balance sheet, because the team chose not repay its loan and keep the turnover as cash (see Appendix W).

With respect to a team's ability to come up with new product designs, there is some indication that a team's perception of its collective learning process is positively related to its innovative performance (measured by a teams' income from royalties). The most innovative team (Team 1) first perceived a high level of 'collective learning' (and generally each of its

[23] It can be noted that the relatively negative bank balance at the end of the first round reflects the teams' relative high investment in raw materials.

aspects, see Appendix T, Table T1), and, later on, a very high level. The team's average score of 'collective learning' is 7.9. The least innovative team (Team 2) first perceived the level of 'collective learning' (and each of its aspects, see Appendix T, Table T2) to be 'intermediate', and later on 'high'. The team's average score of 'collective learning' is 6.0. The three remaining teams (Teams 3, 4, and 5) mostly perceived the level of 'collective learning' to be 'high'[24]. The teams' average score of 'collective learning is 7.4, 6.8, and 7.4, respectively. Notably, Team 5, which has the second-highest score in terms of income from royalties, indicated a very high level of 'collective learning' in the final game round. Since this team only started to produce and innovate in the final round, its strong performance coincides with a high perceived level of 'collective learning'. Such a result is in line with our expectation that 'collective learning' are 'team innovative performance' are positively related.

With respect to the observers' perceptions of the collective learning process it can be noted that perceptions are mostly in accordance with a team's financial results (which is measured by their 'balance'). Except for Team 3, the round in which teams show strongest financial performance (see Appendix W, Table W1) coincides with the round in which the observer identifies most types of behavior positively associated with 'collective learning' (see Appendix V, Table V1 – V5). However, since in two teams (Teams 2 and 5) observer results between the second and the third round only differed marginally, such result should be carefully interpreted. In Team 3 the observer noted most types of behaviors positively associated with 'collective learning' in the final round. Here, team members actively pursued a strategy of radical development, which did not directly translate into financial success. Notably, one team (Team 4) showed strong financial performance, while the observer did not identify behavior positively associated with 'dialogue and inquiry' and 'collective action'. As was explained before, it may be that the team members assessed learning outcomes, while the observer assessed the learning process.

Observers' perceptions were not consistently in accordance with a team's ability to develop successful new products. For the most innovative team (i.e., the team with highest income from royalties, or Team 1), the observer identified only a moderate level of 'collective learning' in the round where the team developed product innovations. Moreover, she also noted some counteractive behavior in this round. Clearly, such a result is not in line with our expectation that 'collective learning' is positively related to 'team innovativeness'. On the other hand, for the team that had second-best innovative performance (Team 5), the observer identified all types of behavior considered indicative of 'collective learning' in the final game round, where the team was involved in innovation. Moreover, the team that came up with the most radical innovation (i.e., a 3-dimensional product, developed by Team 3) did not, according to the observer, show any behavior counteractive of 'collective learning' during the game. Such a result is in line with our expectations. For the two remaining teams, no clear relationship between the observers' assessments and teams' innovative results was found.

[24] Team 4 scored 'collective learning' and each of its aspects at an intermediate level in the final game round. As was discussed before, this relative low score is associated with subgroup formation in the team.

Collective Learning: Agreements between team members' and teams' perception of Collective Learning

In studying the agreement between teachers' and teams' perception of the collective learning process, we intend to answer the question how team members' perceptions and teams' perceptions of the collective learning process are related (research question 6). Results for teachers' individual scores and team scores of 'collective learning' are presented in Appendix T (Tables T1 – T5), and in Figures 6.2 – 6.6.

Overall, results show that team scores fall within a smaller range than individual scores do. Teachers' individual scores show that individual teachers perceived the level of the aspects of 'collective learning' to vary from a very low (score '0' or '1'), to a very high (score '9' or '10'), depending on the specific aspect and the game round that was being assessed. Most scores indicate an intermediate level (score '5' or '6'), or a high level (score '7' or '8'). Scores within teams tended to vary (sometimes considerably), though predominantly they converged during the game. Team scores show that teams generally perceived the level of the aspects of 'collective learning' to vary from intermediate to very good, once again depending on the specific aspect and the game round that was being assessed. As with individual scores, most team scores indicate an intermediate level (score '5' or '6'), or a high level (score '7' or '8'). An interesting observation is that, in some teams, team scores exceeded all individual scores. In the videos we saw that team scores were frequently determined in the course of a dialogue. Team members tried to reach agreement by exchanging arguments in favor of their own assessment of 'collective learning'. It's clear too that team members were open to each other's arguments and were willing to adjust their assessment in order to reach agreement in the form of a team score.

With respect to the *development* of 'collective learning', interestingly, positive assessments seem to be favored over negative assessments. Teams predominantly indicated the level of 'collective learning' (and each of its aspects) increased from one round to the next, while, occasionally, one or more team members perceived the level as decreasing. The video showed that teachers readily accepted the 'positive' examples of 'collective learning' provided by other team members. On the other hand, in the team where members almost unanimously indicated decreasing levels of each of the aspects of 'collective learning' from one round to the next, team scores reflected this perceived negative development. Overall, team members tried to come to a collective assessment of 'collective learning'. When team members perceived the development of the collective learning process differently, a positive development was reflected in team scores.

Values for the variance measures, describing the variance in teachers' individual assessments of 'collective learning' in teams, are presented in Appendix Y (Table Y1). Interpreting the range, which is the difference between the highest and the lowest score reported in a team for a specific aspect of 'collective learning', we can see that individual scores within teams often vary. Team members only fully agreed once (i.e., range = 0). While the range is often small, occasionally, large deviations are found. Sixty-seven percent of the time, an aspect was scored (in total that is sixty times: five teams scoring four aspects of 'collective learning' during three rounds), whereby the range was either one or two points, indicating that individual scores vary little. Large deviations can mainly be observed in the first round; in teams,

teachers' scores tend to converge during the game. Such a result might be related to the fact that the joint discussion and interpretation of experiences and results helped teachers within the teams to develop a shared understanding. At the same time, however, large deviations between teachers' scores can occasionally also be observed in the second and third round (see Appendix T, Tables T1 – T5). In these cases, the team may have been divided into a 'group' of one or more low-scoring teachers and a group of one or more high-scoring teachers. Such deviation may be explained by the fact that two sub-groups were formed within the team and that one sub-group was more or less excluded from the mainstream learning process. A clear example of this is provided by the range in teachers' individual scores of 'shared vision', 'dialogue and inquiry', and 'collective action' in the final game round in Team 4 (see Appendix Y, Table Y1). Another clear example of this can be found in the range of teachers' individual scores of 'shared vision' in the second game round in Team 5. As discussed before, the videos made of both teams showed that the teams fell apart into two sub-groups in the respective game rounds. In both teams, several team members were disappointed by the teams' performance and started to criticize the team's vision and/or work approach.

In comparing team scores to the team average scores (see Appendix Y, Table Y1), for each of the aspects of 'collective learning' we can see that the team score can often be obtained by rounding the average score (see also Figures 6.2 – 6.6). Such results imply that team scores and average scores often deviated less than one point from each other. Team scores can often be obtained by rounding *up* the teams' average score. It seems that team members positively reinforced each other's assessment. The observation that team scores resemble the average of teachers' individual scores is in line with the way team scores were commonly determined (i.e., in a dialogue aimed at achieving consensus). In ten situations (17% of the times) a scored aspect deviated by one point or more. But for one exception, team scores provide a more positive image of the aspects of 'collective learning' than average scores do.

The largest deviance between team scores and the team average scores can be observed for Team 5. In the final round, the team's score of 'evaluation and reflection' exceeded the average score by three points. Such results stem from the fact that the team won the game, a result which was announced prior to the final reflection round. Furthermore, it can be noted that three times a relatively large deviance with respect to 'evaluation and reflection' was present in the first round (Teams 2, 3, 4). This relatively large deviance can be understood from the specific nature of 'evaluation and reflection'. In the first reflection round, when teachers first scored this aspect individually, no results with respect to the team's performance were known as yet. As such, the question as to whether the team explicitly considered the results achieved and the way they were achieved in order to improve learning and working processes within the team (part of the description of 'evaluation and reflection', see Table 6.1), was perceived as irrelevant by some teachers. This explains the low individual scores that are provided by some of the teachers within Teams 2, 3, and 5. Colleague teachers within the same teams provided a higher rating and, in a group discussion, convinced their team members that the level of 'evaluation and reflection' should be rated higher than the they perceived it to be. The teachers giving the higher-ratings based their assessments on the criterion that knowledge and insights gained during the game were discussed and exchanged (also part of the description of 'evaluation and reflection', see Table 6.1), or on the fact that results obtained *during* the game round were discussed. Interestingly, Team 2

scores the aspect of 'evaluation and reflection' in the first round considerably lower than might be expected on the basis of the average score (3.0 and 4.2, respectively). The video shows that the high-scoring teachers were convinced by the arguments of the low-scoring teachers. One of the high-scoring teachers acknowledges that she did not score her own performance as 'low' in general. She was, however, willing to listen to the arguments made by the other teachers and to change her opinion with respect to the team's behavior.

6.5 CONCLUSION AND DISCUSSION

Conclusion: answering research question 5

In this chapter we first studied the relationship between 'collective learning' and 'team financial and innovative performance' (research question 5), expecting a positive relationship between these aspects. We did not find strong financial and innovative team performance in all cases where teams' or their observers perceived a high level of 'collective learning'. However, a positive relationship between 'collective learning' and 'team results' seems likely. When teams perceived an increase or decrease in the level of 'collective learning', often their financial performance increased or decreased in accordance. Moreover, teams often showed their strongest financial performance in the game round where their observer identified most types of behavior positively associated with 'collective learning'. We also found indications that a teams' ability to design successful new products might be related to its perception of the collective learning process. The team that perceived its level of 'collective learning' to be highest showed strongest innovative performance, and the team that perceived its level of 'collective learning' to be lowest, showed the weakest innovative performance. No clear relationship was found in the other teams.

We did not find strongest innovative performance (as measured) in all cases where observers identified most types of behavior positively associated with 'collective learning'. Interestingly, the winning team excelled in the final round, where their team's innovative capabilities played a central role. In this round, both the team members and the observer indicated high levels of each of the aspects of 'collective learning'. Overall, we found 'team performance and innovativeness' to be most strongly related to a teams' own perception of the collective learning process, and not to the observers' perceptions.

We also found indications that the relationship between 'collective learning' and 'team performance and innovativeness' is more complex than we originally assumed it to be. Based on our findings and additional theory, we can formulate a number of assumptions about 'collective learning', and its relationship with 'team performance'.

First, teams may need time to develop collective learning processes. One team indicated a strong development in the area of 'shared vision' in the course of the game. It might be that, as suggested by Castelijns et al. (2009), the team's vision is in and of itself the result of a learning process, and thus takes time to develop. This team also indicated a strong development in the area of 'collective action' during the game. The observer noted an increase in 'shared vision', followed by an increase in 'collective action'. Conform our theoretical framework (see Chapter 2), in this team a 'shared vision' seems to have formed the founda-

tion of 'collective action'. It is likely that as a result of the multiple connections between the various aspect of the collective learning process, teams that need time to arrive at a shared vision also need time to develop their collective learning processes.

Second, there might be a delay between 'collective learning' and a team's performance. While some teams were involved in 'collective learning' from the start, it took them some time to design products that conformed to market specifications. Such result might imply that teams are able to start with their collective learning processes right away, but that it takes them time to align their performance with their environments. In one of the teams that showed delayed success, the communication with the market was initially limited, which seemed to lead to an internally focused group dynamic. This team's collective learning process might be considered restricted. Perhaps, the internal focus provides an explanation for the absence of positive financial results at the start of the game.

Third, a certain amount of existential threat might function as a catalyst between 'collective learning' and innovation. The winning team only started producing products in the third, and final game round. In this round, the team excelled at bringing innovations to the market place. Such a result might be understood using the theory describing the 'learning functions of the corporate curriculum' (Kessels, 2001a; Kessels & Keursten, 2011), specifically the concept of 'creative turmoil'. Creative turmoil, as one of organizations' learning functions, "brings the dynamics that push towards radical innovation and leaving traditional paths behind. [It] requires a certain amount of existential threat. It should really matter, to surmount, or to lose" (Kessels, 2001a, p. 504). At the end of the second round, team members started to say that they did not deem the team to be proficient at playing the game and what the teachers expressed became increasingly value-laden. One team member noted that the team would be destroyed, demonstrating that at least on some level an existential threat was felt by its members. In the final round, the team adopted a different strategy, successfully developed and marketed various innovations, and ultimately won the game. Possibly, the team's weak financial position at the end of the second round and the team's reflection on it created the creative turmoil responsible for the team's outstanding performance in the final round. Reflecting on this situation, we think that creative turmoil might specifically function as a catalyst between 'collective learning' and *radical* innovation. Such an idea is also inspired by the observation that the team that came up with the most radical innovation (i.e., a 3-dimensional product) consequently assessed its level of 'collective learning' as 'high', and that it did not show any behavior that would be counteractive to 'collective learning' during the game.

Fourth, in order to generate 'productive results' via 'collective learning', the work context should offer potential for the team's vision to be realized. One team set aside the simulation game's goal after two rounds and team members chose not to participate in the production process anymore. Because the team's vision conflicted with the task to produce products, team members adhered to another strategy. When this strategy proved unsuccessful, they no longer actively participated in the game simulation. Because the team's and the simulation's goal could not be united, team members lacked a sense of receiving 'self-reward' from the game. Such a result seems to imply that, in order for 'collective learning' to lead to 'productive' results (as defined by the team's work environment), the work context should offer potential for the team's vision to be realized.

Fifth, emotions may play an important role in the learning process. In the team described above, team members' decision to stop active participation in the game simulation might be understood from the theory describing the 'learning functions of the corporate curriculum'. As Kessels (2001a, p. 504) points out: "Affections, affinities, and emotions play an important role in knowledge work. I cannot be inventive in a domain for which I am not motivated. What is meaningful work for me and how do I become committed? Finding out what emotional and affective drives employees have and how they can regulate these will probably be an important aspect of human resource development in a knowledge economy". In two other teams the relevance of the emotional and affective component of the learning process also became evident. Confronted with disappointing team results, disagreement arose in the teams, and team members' expressions became increasingly value-laden. In one of those teams, the effect was that the members became less close, and that team members started to blame one another for the team's result. The importance of the role of emotions is also illustrated in the team that only successfully sold its first product to the market in the third game round. The team's first successful transaction generated a lot of positive energy and stimulated team members to be actively involved in designing products and selling those to the market.

Sixth, people's frame of reference might influence their perception of 'collective learning'. At one point, for the team described above, the team's and the observer's assessment of the collective learning process strongly diverged. The team assessed the level of 'collective learning' to be 'high', while the observer only identified counteractive behavior. The video showed that team members showed various types of behavior positively associated with 'collective learning'. It might be that the observer assessed the team's behavior from a different frame of reference. Likely, she interpreted the behavior through the lens of the simulation's goal (e.g., producing products and selling those to the market) and translated that team's perceived non-compliance into negative scores of 'collective learning'.

Finally, 'shared vision' and communication might be important ways of bringing teachers' individual efforts together into a team result. In one team we found a strong division of tasks, based on the (initially implicit) vision to maximize income. Still, the team perceived the level of 'collective learning' to be high. This team was immediately successful from the start, aligning individual team members' tasks by means of communication. In Chapter 5 we already found that 'collective learning' might be present even when teachers frequently work alone. In that case however, teachers' activities should be connected by a shared vision. In line with this result, in the round where this team was most successful, the observer identified all three types of behavior positively associated with having a 'shared vision'.

Conclusion: answering research question 6

In addition, we studied the relationship between team members' scores and team perception of the collective learning process (research question 6). First, we found that while individual teachers' scores within teams tended to vary, they converged over the course of the game for the most part. Such a result might imply that, during the game, teachers were involved in a process of collective sense making, in that they developed a shared understanding of words, concepts and thoughts. Through the game simulation, mental models were made explicit and became open to discussion. As a result, teachers' perception of the learn-

ing process was a product of a shared understanding, which was created by working together during the game rounds and reflecting on the results. The development of a shared frame of reference can indeed be considered one of the basic functions of a game simulation (De Caluwé & Stoppelenburg, 2011).

Secondly, we found that team scores fell within a smaller range than individual scores did. Such results seems to suggest that individual teachers' negative perceptions were offset when a set of individual scores needed to be translated into a team score.

Thirdly, we found that in some cases team scores exceeded all individual scores within a team. Interestingly, we also found that, except for one team, all teams indicated the level of each of the aspects of 'collective learning' to increase from one round to the next, while occasionally, individual teachers perceived the level of one or more of those aspects as decreasing. Both results might suggest that team assessments tend to be more positive than individual teachers' assessments of 'collective learning'. At the same time, in one team, individual teachers' scores almost unanimously indicated decreasing levels of each of the aspects of 'collective learning' from the second to the third round, a tendency which was reflected in the team scores. While team scores seemed to be more positive than individual scores, a general negative perception at the level of the individual teachers was thus still reflected in team scores.

Contribution of the study

The present study is based on the premise that it is promising for educational institutions (specifically for Universities of Applied Sciences), to support and facilitate individual and collective work-related learning in order to be able to cope with the fast-paced changes and increasing complexity of their contemporary work environments. One of the underlying assumptions is that 'collective learning' contributes to the performance and innovativeness of teacher teams in universities. In this chapter, we reported on the results of a game simulation, where teacher teams were confronted with the task of performing both efficiently and innovatively in a competitive environment. Results provide us with more insight into the relationship between 'collective learning' and a team's general and innovative performance. They lend support to the belief that Universities of Applied Sciences, like other organizations operating in the contemporary knowledge economy, should consciously work on turning the day to day work environment into a learning environment (Bolhuis & Simons, 1999; Kessels, 1996, 2001a), where 'collective learning' is stimulated. By using a game simulation, we were able to create a common work environment for various teams and study them while performing comparable tasks in a restricted time period. As such, we could compare their behavior and their performance. As is suggested by De Caluwé and Stoppelenburg (2011), the simulation indeed seemed to have evoked processes of collective learning, making it an interesting research method to study this specific form of learning. By using multiple sources (i.e., the video recordings, team members', team and assessors' scores of 'collective learning, and a range of performance and innovation indicators), we were able to create a detailed description of the (learning) processes taking place within the teams during the game simulation. The rich variety of data has facilitated our understanding of the relationship between 'collective learning' and 'team performance'. Moreover, the multi-sourced data have supported us in better understanding the collective learning concept. By allowing for a compari-

son between the different perspectives, we could study the relationship between team members' individual assessments and teams' assessments of 'collective learning' when undertaking a fixed set of activities in a restricted time period.

With respect to the practical relevance of the study we would like to dwell upon four issues: the process of 'collective learning', the nature of a team vision, the role of emotions, and the role of 'creative turmoil'.

When 'collective learning' is considered a way to realize innovations, it is important that team members strive to develop a shared vision with respect to the team's work processes, that they are involved in processes of dialogue and inquiry, that they act collectively, and are able to mutually reflect on the outcomes and the way those outcomes were achieved. We argue that a team's vision might develop over time and that it is in and of itself the result of a collective learning process. Furthermore, we argue that the results of collective learning processes might take some time to manifest themselves. Likely, teams first need to focus on setting up and settling their own working processes before they can successfully respond to their environments. Teams' performance with respect to 'collective learning' should therefore be assessed over an extended period of time. At the same time, it is important for teacher teams to experience success along the way, for this seems to stimulate teachers' motivation for participating in the work/ learning process. An important aspect of the learning process is the act of evaluation and reflection. By discussing team performance and the underlying processes, team members develop a shared understanding that underlies their collective action. Since in the simulation moments of evaluation and reflection are built in, teams automatically went through processes of evaluation and reflection. As such, this aspect of 'collective learning' was more overtly present than it likely is in everyday practice (see also Chapter 3 and 5). Given the processes of collective sense making that we observed during the reflection rounds, we think it might be advisable for schools to build in moments of evaluation and reflection for their work teams.

Moreover, we argue that the vision on which teams' work processes are based upon should be compatible with personal beliefs, should match a team's capabilities, and should be feasibly achieved provided the teams' environment. When a team's shared vision does not comply with the above criteria, team members may not be motivated, or unable to accomplish the goals implied by the vision. In the case study (Chapter 5) we also found the former two arguments to be of relevance in an innovation project aimed at developing and implementing a career guidance program in Universities of Applied Sciences.

Next, we argue that emotions may play an important role in collective learning processes. Teachers should be able to emotionally come to terms with the team's vision, and potential concerns should be addressed. As we found in the case study, if resistance is present processes of dialogue and inquiry might reveal that.

Finally, we argue that 'creative turmoil' might stimulate innovation. The team that found itself in an impasse was triggered to innovate when team members experienced and discussed the presence of an existential threat. In creating a vision for organizational change or innovation, a sense of urgency might contribute to the stimulation of radical innovation.

Critical reflection on the measurement instrument and suggestions for improvement

Critical reflection on the measurement instrument reveals a number of concerns. Since the game simulation was applied to the context of 'collective learning' for the first time, the present study using the game might be considered a pilot. Therefore, for the most part, concerns will be translated into suggestions for improvement.

First, two of the theoretically discerned aspects of 'collective learning', 'information generation' and 'information distribution' were not explicitly addressed. However, results do seem to suggest the potential relevance of the information generation and distribution: the teams that initially chose to limit their communication with the marketplace found themselves confronted with the fact that they assembled products for which the market no longer showed interest. Therefore, in future research, we would recommend explicitly addressing these aspects of 'collective learning' in the game simulation.

Second, in the current setup, the insight gained with respect to teams' production level during the three game rounds was somewhat restricted. Teams that successfully sold products to the market may have chosen not to use the resulting income to repay their loans to the bank and keep their turnover as unrecorded cash. As a result, it was not possible to completely understand from the financial data what the teams' production levels were during each of the game rounds. The fact that one team finished the game with 1000 monetary units of cash showed that some teams indeed choose not to use the income received to repay their loans. In the present study, this problem was addressed by looking back at the video-recordings of each of the teams. However, the videos did not provide all of financial information; they only showed whether teams had successfully offered products to the market. In future research, we would recommend not only recording the amount of loan repaid per game round, but also the amount of money generated from selling products to the marketplace.

Third, in the current setup of the game simulation, the insight gained with respect to the innovative behavior of teams is somewhat restricted. The 'royalty' of a team (only) indicates the amount of income generated as a result of other teams copying the team's designs. As such, it does not only reflect the team's ability to generate innovative products, but also a competitor's ability to copy the new designs. A team that creates difficult, but innovative designs in practice could be considered innovative, while the 'royalty' score would not indicate it to be so. In order to better understand the relationship between 'collective learning' and teams' innovative performance we would recommend not only recording the royalties generated by teams, but also the number of innovations they successfully introduced to the market place in each round.

Fourth, we noted that high team scores with regards to 'collective learning' did not consistently coincide with observers identifying many types of behavior positively associated with this form of learning. It might be that teams assessed the level of 'collective learning' from the situation as it was (e.g., 'shared vision': we are working towards the same goal, 'collective action': we are all focused on this particular goal), while the observers' behavioral indicators were more focused on the process. For example, team members might have perceived a high level of 'shared vision', because they were working toward the same goal,

while the observer did not notice how they were actually trying to reach agreement on this goal. Likely, team members supported the goal which was introduced by the game facilitator (e.g., produce products and sell those to the market), and did not need to discuss this in order to reach agreement. It can be noted that in several teams team members started to explicitly work on creating a shared vision once the teams' 'natural' approach no longer led to satisfying results. Likewise, a distribution of tasks might have led teachers to work independently on realizing team goals. As long as such an approach was successful, team members might not (yet) needed to deliberately align their activities, to discuss their problems with others, or to give each other advice. From the videos we saw that tasks were often distributed amongst team members initially and that teachers were able to collaborate without explicitly addressing 'collective action' as a concept. In terms of learning, they seemed to become more active when they encountered difficulties, such as unsatisfying results. In conclusion, team scores might be a reflection of the situation as-it-was, while observers' scores may have been measuring the process which was underlying a possible change. As such, team scores and observer scores should not be expected to reflect the same results. In the present study we addressed this concern by interpreting the results using a small 'case description' for each team as it was constructed based on the video-recordings. In future research we may decide to alter the teams' or observers' measurement instrument in order to align their assessments.

Methodological evaluation

An important methodological concern that we identified relates to the study's ecological validity. For a research study to possess ecological validity, the methods, materials and setting of the study must approximate the real-life situation under investigation (Brewer, 2000). As was explained in this chapter, the work situation created in the knowledge game reflects a number of important similarities as compared with the teachers' day-to-day work situations. Those commonalities strengthen the study's ecological validity. However, the tasks that needed to be performed by the teacher teams during the game differ substantially from the tasks they perform in practice. Moreover, teachers performed their tasks under intense time pressure, which created an 'extreme' situation. As such the research design may limit the study's ecological validity. An illustration of this might be that in the setup of the game simulation, the aspect of 'evaluation and reflection' might be more strongly addressed by teams than it would be in the day-to-day work situation. Indeed, during the reflection rounds, the teams' attention was explicitly focused on this aspect of the collective learning process. Results are therefore not indicative of the amount of 'evaluation and reflection' that teams undertake by themselves in their actual work situations; this point should be taken into account when interpreting the results. While the game simulation has increased our understanding of 'collective learning' and its relationship to team's performance, in future research this relationship might be further explored by studying 'real life' work and innovation processes.

Another methodological concern we identified relates to the number of teams participating in the game simulation. In the present simulation, five teacher teams participated. Such a number might be considered limited when the study aims to find patterns between 'collective learning' and 'team results' in general. In a future study we recommend that such a game simulation be expanded to include a larger number of teams. In such research, the

suggestions provided in the section 'Critical reflection on the measurement instrument and suggestions for improvement' might be taken into account.

While we found indications that 'collective learning' is related to a teams' ability to design successful new products, we do not exactly know how these two things are related. We found that both a relatively high level of 'collective learning' coincided with strong innovative performance and that a relatively low level coincided with weak innovative performance. However, we cannot be sure about the underlying causal mechanism. It might be that improved processes of collective learning build a team's innovative capacity; in that case, increasing levels of 'collective learning' would likely be followed by stronger innovative performance. It might also be that the innovation process and the collective learning process coincided. In that case they were likely to develop simultaneously. Provided that our premise is correct that 'collective learning' stimulates innovation in University of Applied Sciences teacher teams, we think it is worthwhile to study this relationship further. We advise longitudinal research, where a team's level of 'collective learning' and its innovative performance are assessed over time, and where their causal relationships are studied.

We started the present study expecting to find that 'collective learning' and 'team results' are positively related. The conclusion that such relationship is likely is based for the most part on the observation that increasing levels of 'collective learning' generally coincide with increasing performance levels. It could be argued, however, that an alternative, underlying factor (e.g., prior experience with game simulations) might explain the increase in 'collective learning' and/or 'team results'. Then, the improvement in 'team results' would not follow from the improved collective learning process. While we are unable to exclude this possibility as an alternative explanation, the one team that noticed a decrease in the level of 'collective learning' showed a significant decrease in productivity and innovative performance at the same time. Such a result is in accordance with our expectations. In future research, the game simulation may be repeated on a larger scale, so that patterns in the relationship between 'collective learning' and 'team results' can be studied further.

Finally, in selecting teacher teams for participation in the game simulation we tried to assemble a group composed of teams with low, intermediate, and high scores of 'collective learning' in the quantitative study (Study 1a). Team leaders of the five participating teams were asked to assemble a game team made up of five team members, such that it would more or less reflect the teacher team with respect to the scores of 'collective learning'. We expected that this design would lead to teams demonstrating varying levels of 'collective learning' during the game simulation. Originally, we intended to compare the teams' behavior and performance during the game simulation with their scores in the quantitative study. However, because groups were composed differently (based on teachers' motivation and availability), game teams were not necessarily representative of the teacher teams, therefore the scores of the quantitative study did not necessarily apply. Since we were unable to assess the extent to which each of the game teams was representative of the teacher team with respect to 'collective learning', we decided not to study the relationship between teams' results in the quantitative study and the game simulation.

Directions for future research

In the present study we related team behavior in terms of 'collective learning' to 'team results'. While results have provided us with a number of important insights, they also raise questions that remain unanswered.

A set of questions that we ponder relate to how to measure 'collective learning'. If team members themselves are used as informants of the collective learning process, how should the variety between individual scores be treated? Sometimes the assessment within a team shows opposite perceptions, each represented by one or more team members. Could this possibly indicate that teams form sub-groups, which themselves are able to go through mini-cycles of 'collective learning'? If so, the relevant unit of analysis is to be determined by the smallest groups in which day-to-day activities are performed. A related point is that our study showed that teachers within teams might also perceive the *development* of 'collective learning' differently. While some experienced a positive development from one round to the next, others experienced a negative development in the same round. Again, this might be related to the formation of sub-groups. In future research, it might be interesting to study a team's learning processes over time, using both the team level and the sub-team level as a unit of analysis when sub-groups are formed. The processes taking place at both levels might then be compared and their influence on team performance studied.

Another interesting question relates to team scores. Taking the variance within teams into account, what is the value of team scores? In the present study we found that teacher scores often converged over time, and that the average of teachers' individual scores within a team, when rounded up, often resembled the team score. However, exceptions to this rule were also found. In future research, it might be interesting to look into the way team scores are determined. Alternatively, might 'collective learning' be best assessed by someone outside the team? The underlying question here is whether insiders in the process or the learners themselves (i.e., the teachers in the teams) are best able to assess the level of 'collective learning'. If, like in the present study, team members, teams and observers assess the level of 'collective learning', the question remains how differences in those assessments should be treated. Using comparable measurement instruments for observers, team members, and the teams, it might be interesting to study the differences in assessments, and to question each type of assessor and his/ her perception. Such research might reveal the source(s) of divergence and contribute to our understanding of 'collective learning'. In the present study we found that team scores might deviate from the observers' perception, sometimes even significantly. For now, these questions remain unanswered, thus indicating the need for further research.

Another question that remains is when we can determine that 'collective learning' actually occurs. Do all aspects of 'collective learning' need to be addressed before we can speak of 'collective learning'? If so, who should assess the level of each of the aspects of 'collective learning' present in a team: the team itself, or an external observer? And, if both assessments are available (as in the present study), but show conflicting results, should the team's or the observer's assessment be decisive? In Chapter 7 we will elaborate on collective learning processes and to what degree they are actually achieved.

7 Conclusion and discussion

> Formal organizational systems and informal processes, when aligned, can encourage, enhance, capture, and amplify individual learning, thereby creating an organizational learning system (Koslowksi, Chao & Jensen, 2010, p. 371).

In this thesis we presented and discussed the results of three studies we conducted on the topic of collective learning. Our research was initiated in response to the findings of Kuijpers and Meijers (2012) that, generally, Universities of Applied Sciences in the Netherlands have not yet been able to successfully develop and implement a career guidance program (CGP). The CGP has been introduced in many universities to create a career-related learning environment where students can gain real-life work experience (practice-based), are provided with opportunities for a dialogue in which experiences they have had are connected to their future and career wishes (dialogical), and where they increasingly have the chance to influence the course of their own studies and career progress (inquiry-based). The educational model underlying the CGP is designed to support knowledge development and transfer in the contemporary knowledge economy, and differs fundamentally from the model that has been dominant in the no-longer existent industrial society (see Chapter 1). Because such radical organizational innovation requires work-related learning processes (see Chapter 2), our attention was drawn to work-related learning processes within educational innovations. Specifically, we focused on two 'social' types of learning: 'social individual learning' (characterized by individual outcomes), and 'collective learning' (characterized by collective outcomes). We also focused on 'transformational leadership', because this leadership style is associated with large-scale innovations that lead to complex transformations in the culture of organizations (Van den Berg et al., 1999). Its importance is repeatedly emphasized for the educational sector (e.g., Leithwood, Jantzi & Steinbach, 1998; Van den Berg, et al., 1999; Geijsel et al., 2009; Ten Bruggencate, 2009; Molenaar, 2010), specifically with respect to school development (Verbiest, 2009).

We studied 'social individual learning', 'collective learning', their relationship, and their relationship to 'transformational leadership' in the three academic departments identified by Kuijpers and Meijers (2012) as 'best practice cases'. In their study, these departments demonstrated above average success in developing and implementing a CGP. We also studied the interrelationships in a larger set of teacher teams, using a quantitative research design. We used a sample of 495 teachers, each teacher being a member of one of the 36 teacher teams included in the research, to test a set of hypothesized relationships between 'collective learning', 'social individual learning' and 'transformational leadership'. Finally, using a game simulation, we studied the relationship between teams' collective learning processes and their general and innovative performance. In this chapter we recapture the studies' objectives, research questions and hypotheses, present the conclusions, reflect on the studies' limitations, and explore new directions for future research.

7.1 OBJECTIVE AND RESEARCH QUESTIONS

Educational institutions operating in a knowledge economy are faced with two important challenges: they will need to radically change their educational systems to meet the demands inherent in a knowledge economy and they will need to develop their own adaptive capabilities in order to be able to continuously adjust to their dynamic environments (see Lagerweij & Lagerweij–Voogt, 2004). Both challenges might be addressed by means of 'organizational learning' (e.g., Boyce, 2003; Kezar, 2005; Collinson et al., 2006; Schechter, 2008; Zhao & Ordóñez de Pablos, 2009). This concept has been studied from various perspectives, resulting in a rich theoretical basis for researchers and practitioners. At the same time, it is a complex, multifaceted concept, that leaves room for further research (Kozlowski et al., 2010). In a literature study we found 'organizational learning' to be increasingly associated with 'collective learning', specifically when learning is aimed at developing an organization's capacity for adaptive learning. However, we did not find the term 'collective learning' to be operationalized for the educational sector. At the start of the first empirical study (Study 1a) we therefore focused on defining the collective learning concept – specifically in contrast to the closely related concept of social individual learning – and on designing and testing a measurement instrument to be used for survey research. In the second part of the quantitative study (Study 1b) we tested a number of hypotheses regarding the relationships between 'collective learning', and the concepts of social individual learning, and transformational leadership. We formulated these hypotheses based on our literature study (see Chapter 2).

'Collective learning' is considered a form of learning that has the potential to achieve third-order change, where learners question the validity of activities, relationships, and meanings posed by the context in which they operate and the interactions in which they are involved (Wierdsma & Swieringa, 2002; Wierdsma, 2004). The change from a dominant industrial educational model to an educational model that is suited for a knowledge economy might be said to require third-order change. We therefore expected to find evident examples of 'collective learning' in innovation projects where teacher teams successfully developed and introduced innovations related to this radical change. In the second empirical study (Study 2) we studied three such projects (i.e., the best practice cases identified by Kuijpers and Meijers, 2012). In order to better understand the concepts of collective learning and social individual learning, we used a case study design to explore what is behind these abstract concepts in daily practice. Furthermore, we looked into the transformational leadership concept, particularly in relation to 'collective learning', 'social individual learning', and 'team results'. Because this leadership style is associated with innovation and school development, we expected to find it in the innovation projects we studied. By using a qualitative research approach we tried to better understand the relationships that we found in the quantitative study (Study 1).

In order to study the relationship between 'collective learning' and teams' general and innovative performance, in the third empirical study (Study 3) we applied a game simulation (based on the Knowledge game by Kessels (1998)) to explore these relationships. Furthermore, we used this context to study the relationship between team members' perceptions and teams' perceptions of the collective learning process.

7.2 MAIN CONCLUSIONS

In the first study we designed, optimized and tested a measurement instrument for 'collective learning' for quantitative research (Study 1a, Chapter 3). Based on our literature study we defined 'collective learning' as:

> *the work-related learning processes that arise when the members of a collective collaborate and consciously strive for common learning and/or working outcomes. Such learning may result in changes in long-term skills, knowledge, attitudes and learning abilities, or in changes in work processes or work outcomes, signifying development and change respectively.*

We conceptualized it as an experiential learning process consisting of the aspects 'shared vision', 'information generation', 'information distribution', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'. Next, we designed a measurement instrument, consisting of factors measuring the various aspects of 'collective learning'. Using multilevel confirmatory factor analysis (MCFA), we optimized and tested this instrument based on a sample of 495 teachers involved in 30 different bachelor programs in Dutch institutions for higher vocational education. As such, we addressed the following research question:

Research question 1: How can the hypothesized factor structure and the (newly designed) measurement instrument for Collective Learning be improved? What is the quality of the resulting model when tested in the context of higher vocational education (i.e. is the hypothesized construct structure adequate)?

We could only identify four factors of 'collective learning': (1) 'shared vision', or a mental image of the future the members of the collective want to create together (Senge et al., 2000), (2) 'dialogue and inquiry', or "dialogue in which people mutually explore ideas, questions, and potential actions" (Watkins & Marsick, 1993, p. 73, see also Savelsbergh, 2010); (3) 'collective action', or imposing a shared reality on the environment through actions by a group of people (Weick, 1979, Lipshitz et al., 2007), and (4) 'evaluation and reflection', or explicit evaluation of both work processes and their outcomes, and reflection on the learning processes and their outcomes. Due to flaws in the operationalization, the aspect 'information generation' was excluded prior to the analyses. Further, due to high factor correlation and item similarity, we combined the factors 'information distribution' and 'evaluation and reflection' (named 'evaluation and reflection'). Then, we designed and tested different models for exploring the connections between the four remaining factors, thereby addressing the following research question:

Research question 2: Starting from the optimized factor structure for Collective Learning, what process models would represent theoretically-logical process models? Do these process models show an adequate fit to the data we collected on Collective Learning?

We tested three models: a second-order factor model and two process models. The second-order factor model (see Chapter 3, Figure 3.1) showed a good fit to the data. In this model,

'collective learning' served as a central (latent) variable explaining the interrelations observed among the four factors identified in the MCFA. Alternatively, two process models of 'collective learning' were tested (see Chapter 3, Figure 3.3). Since teams' ability to go through processes of dialogue and inquiry is found to be an important aspect of team learning (Savelsbergh, 2010), in both models the factor 'dialogue and inquiry' was assumed to be the central factor, positively influencing the other factors. In addition, because of the importance of collective intent in the collective learning process (Senge, 1990), in the second process model the factor 'shared vision' was assumed to positively influence the factors 'collective action' and 'evaluation and reflection'. Both process models showed a good fit to the data. However, in the second model no significant relationships were found between 'shared vision' on the one hand, and 'collective action' and 'evaluation and reflection' on the other. Taking only significant effects into consideration for both process models, they proved to be identical. Overall, results lend support to the conceptualization of 'collective learning' as a social, experiential learning process in which processes of dialogue and inquiry are likely to play a central role. However, the correlational data of our study cannot be used to prove causal relationships among the factors of 'collective learning', and conclusions are therefore of a tentative nature.

In our literature study (Chapter 2) we discerned a second type of work-related learning based on social interaction, which we labeled 'social individual learning'. Using the framework presented by De Laat and Simons (2002) we argued that 'collective learning' leads to collective outcomes, while 'social individual learning' leads to individual outcomes. We described the latter form of learning as:

> *the work-related learning processes that arise when an individual interacts with others to improve the quality of his or her work, to realize change, and/or to accomplish personal goals. Such learning may result in long-term changes in skills, knowledge, attitudes and learning abilities, or in changes in work processes or work outcomes, signifying development and change respectively.*

We focused on *intentional* processes of 'social individual learning' (specifically 'learning from knowledge sharing', 'learning from giving and receiving feedback', and 'learning from collaboration'), because those represent an active learning orientation of individuals. We hypothesized that there would be a positive relationship between such an orientation and the way individuals perceive collective learning processes; or, between 'social individual learning' and 'collective learning' (Hypothesis 1). Furthermore, we hypothesized that 'transformational leadership' has a positive effect on 'collective learning' (Hypothesis 2), and on 'social individual learning' (Hypothesis 3), and that the positive effects of 'transformational leadership' on 'social individual learning' and 'collective learning', as well as the positive effect of 'social individual learning' on 'collective learning', would still be present when the variables teachers' gender, age, educational level, and employment status (part-time or full-time) would be taken into account (Hypothesis 4).

The hypothesized relationships between 'social individual learning', 'collective learning' and 'transformational leadership' were modeled in two alternative structural equation models (Study 1b, Chapter 4), which were tested by means of multilevel covariance structure analysis using the EQS 6.1 program (Bentler & Wu, 2002; Bentler, 2005). The revision of the

measurement instrument for 'social individual learning' led to a more narrow definition of the concept than was originally intended and we therefore renamed the concept: 'individual learning in interaction'. Consequently, hypotheses were slightly modified by replacing the concept of social individual learning with the concept of individual learning in interaction. In line with the approach sketched above, two models were tested: one model in which 'collective learning' is represented as a second-order factor (Model 1, see Chapter 4, Figure 4.2), and one model in which it is represented as a process with the sub-construct 'dialogue and inquiry' at its core (Model 2, see Chapter 4, Figure 4.3). Results showed a good fit of both models to the data. For Model 1 results showed significant, positive effects of 'transformational leadership' both on 'individual learning in interaction' and on 'collective learning', as well as a significant, positive effect of 'individual learning in interaction' on 'collective learning'. Moreover, results showed that 'transformational leadership' has a direct effect on 'collective learning', as well as an indirect effect via 'individual learning in interaction'. For Model 2 results showed significant positive effects of 'transformational leadership' on 'collective learning' and on 'individual learning in interaction', and a significant positive effect of 'individual learning in on 'collective learning'. Results for Model 1 and 2 lend support to Hypothesis 1, 2 and 3, both when 'collective learning' is modeled as second-order factor and when it is modeled as a process with 'dialogue and inquiry' at its core. These effects remained when teachers' gender, age, educational level, and employment status (part-time or full-time) were taken into account as background variables. Such results lend support to Hypothesis 4.

In order to shed new light on the insights gained in the quantitative study, we used a case study design to re-explore the concepts of collective learning, social individual learning, and transformational leadership, and their interrelationships (Study 2, Chapter 5). We studied three cases of academic departments that, in earlier quantitative research (see Kuijpers & Meijers, 2012), had demonstrated above average success in developing and implementing an innovative career guidance program (CGP). We studied those 'best practice cases', because we assumed that in successful innovation projects we would be able to find evident examples of the core concepts we were studying. First, performing a within-case and a cross-case analysis, we tried to answer the following research question:

Research question 3: What connections can be found between Collective Learning, Social Individual Learning, Transformational Leadership and Team Results in daily practice, specifically in educational innovation processes where teams have successfully developed and implemented a career guidance program?

The three cases showed many commonalities, a result which is not surprising given that teacher teams aiming to innovate are to a large extent confronted with comparable start conditions (see f.i., Kessels & Ehlen, 2006; Bronneman-Helmers, 2011; Meijers, 2012). Moreover, the teams' goals – developing and implementing a career guidance program – required a change of the educational principles and is therefore associated with third-order learning. With this form of learning, knowing and learning are basically social processes aimed at creating, in dialogue, a shared meaning about issues and new possibilities. In such an approach, organizational change and learning are interwoven, implying a form of organizing that might be described as 'organizing while learning'. As we pointed out before, third-order learning is

strongly associated with 'collective learning'. Indeed, in the cases we could identify each of the aspects of 'collective learning'. Overall, innovation processes were designed as processes of collaborative, developmental learning. These processes were inspired and guided by team visions, which were developed within the teams. In two cases, teams strived for continuous adaptation, an approach which is consistent with the image of a learning organization. In the remaining case the continuous approach was less evident, and interestingly the implementation of the CGP was followed by a decreased interest in the CGP. In each of the three cases dialogue and a dialogical culture turned out to be at the core to the innovation process, and teachers were supported in developing the skills required for social learning. Such results confirm the relevance of the process model of the 'collective learning' we developed in the quantitative study; the model with 'dialogue and inquiry' at its core.

In two cases the topic leadership was addressed (in one case only one interview could be held, and due to time limitations the topic leadership remained unaddressed). In both cases there seemed to be a direct relationship between 'transformational leadership' and 'innovation,' as well as an indirect relationship via 'collective learning'. Through actions associated with a transformational leadership style, managers stimulated collective learning processes, which, in turn, were likely to positively influence the teams' innovative performance. We found managers supported their teams in developing and sustaining a vision, in aligning teachers' individual goals and team goals, and in stimulating social learning and processes of dialogue and inquiry, and in the creation of a shared understanding. Interestingly and in line with our expectations, in both cases the replacement of incumbent managers by managers with a less transformational leadership style led to decreased interest in social learning and innovation.

In addition, we found a number of factors related to leadership and/or learning which participants perceived to have negatively affected the innovation process. Specifically, five types of factors were perceived as inhibiting the innovation process: misalignment between teachers' preferences or capabilities and the tasks assigned to them, a limited willingness or ability of managers to invest in the continuity of the CGP in its current (extensive) form, lack of time/time pressure, resistance to change, cultural limitations (e.g., a culture not supportive of social learning), and organizational limitations (e.g., structural inflexibility). We found that these factors were, to a certain extent, within managers' field of influence. In response to these results, the theme 'inhibiting factors' will be added to our revised conceptual model (see Figure 7.1).

Overall, comparing our results with the results of the quantitative study by Kuijpers and Meijers (2012), we concluded that teachers in the best practice cases seemed to be able to have offered students a powerful learning environment, because they themselves operated within a powerful learning environment. These learning environments were shown to be supportive of learning processes based on interaction, specifically 'collective learning'.

Second, we performed a cross-case analysis in order to explore what, in daily practice, is behind the abstract concepts of social individual learning, collective learning and transformational leadership, as described in our theoretical model. Using a case study approach we tried to map the concepts' variety and richness, thereby striving to answer the following research question:

Research question 4: What forms of Social Individual Learning, Collective Learning and Transformational Leadership can be identified in the educational innovation processes described above?

Comparison of the cases with respect to 'collective learning' showed that, overall, learning process were information-oriented. In all three cases, most references were made to (in)formal processes of information generation and distribution, both internally (i.e., within the team) and externally. In one case information was also exchanged with parties outside the university. Information exchange was often associated with the development of a shared understanding, or with (stimulating) social learning. The other aspects of the collective learning process were also identified in each of the three cases, though to varying extents. One case showed a relatively strong focus on the aspect 'dialogue and inquiry'. Here social learning processes were institutionalized in order to stimulate the innovation process and the underlying collective learning process. Another case showed a relative strong focus on the aspect 'evaluation and reflection'. In this team the innovation process was considered a continuous learning process, stimulated through continuous evaluation. In contrast to the other two cases, references were made here to process evaluation, in addition to references about product evaluation (which were made in all three cases). In the third case a relatively strong focus on the aspects 'shared vision' and 'collective action' was found. Teachers were actively involved in designing the new educational model and in creating concrete educational products (e.g., the curriculum, projects, modules). As part of the process, a culture favorable of social learning was developed in this case.

With respect to the collective learning process we developed a number of insights. First, its aspects were shown to be highly interwoven; a result which is in line with the significant correlations that were observed between the scales measuring those in the quantitative study. Second, the collective learning processes might best be characterized through the aspect 'dialogue and inquiry', because processes of dialogue and inquiry seemed to underlie all other aspects of 'collective learning'. Such result is in line with the process model of 'collective learning' we developed in the quantitative study (i.e., the model with 'dialogue and inquiry' at its core, influencing the other factors of 'collective learning'). We found that shared understanding was created in a dialogue that was both respectful and challenging (i.e., addressing conflicting ideas). In all cases, team members were explicitly trained on developing a so-called 'dialogical learning attitude'. Such an attitude entails acceptance of open communication, curiosity about and respect for different viewpoints, tolerance of tensions associated with conflicting viewpoints, and engagement in processes of dialogue aimed at creating a shared understanding. Third, we found that teams' visions were in and of themselves a product of a collective learning process in which team members were actively involved. While a team vision with respect to the CGP seemed to be present in all three cases, not all team members automatically felt committed to this vision (e.g., members new to the team). Fourth, we found that the aspects 'information generation' and 'information distribution' were difficult to distinguish from one another. This comes from the fact that most recorded comments made were about information exchange, implying both generation and distribution at the same time. Fifth, we found that 'collective action' does not necessarily require teachers to perform their tasks in the same way, or to actually work together. When they strive for common outcomes (as indicated by the team's vision), results become aligned and

might be considered to be of a collective nature. In two cases participants indeed indicated having differing approaches to the CGP; in one case it was considered a source of innovation. Sixth, the aspect 'evaluation and reflection' was shown to be an underexposed aspect of the collective learning process; a result we also found in our quantitative study. Evaluation only concerned the output of the CGP in two cases, and no direct references were made to acts of reflection (though intervision, a method actively used in one case, might be considered a form of reflection). Finally, we found that a 'learning orientation', characterized as the acknowledgment of the innovation process as a learning process, and a focus on team oriented staff development as part of the innovation process, likely created a positive learning environment for experiential and social learning. In the discussion section of Chapter 5 we have elaborated upon the relationship between 'collective learning' and a 'learning orientation'. In response to these results, we add the theme 'learning orientation' to the revised conceptual model (see Figure 7.1).

In the case study we could not clearly distinguish 'social individual learning' from 'collective learning'. In our theoretical framework 'social individual learning' was defined as a form of learning characterized by a shared process with individual outcomes, whereas 'collective learning' was defined as a form of learning characterized by a shared process with shared outcomes. In many of the comments made on that topic the shared nature of the learning process was evident, but the result of the process was difficult to assess as either individual or shared. Results consequently seemed to (at least) go beyond the individual level. Consequently, we decided to omit the social individual learning concept from the analysis, and we were therefore unable to address part of research question 4. Reflecting on the differences and similarities between 'social individual learning' and 'collective learning', we concluded that the outcomes of 'social individual learning' are not necessarily restricted to the individual level and that the outcomes of 'collective learning' are not necessarily restricted to the group level either. As a result, the boundaries between 'individual results' and 'collective results' become blurred and it seems to be the learner's intent which is decisive.

With respect to 'transformational leadership' we found that many quotes could be attributed to the dimension 'individualized support' as well as 'intellectual stimulation'. Such results are in line with results of our quantitative study, where we found high correlations between the scales measuring these dimensions. Participants predominantly mentioned facets of 'transformational leadership' related to the dimensions 'individualized support' and 'intellectual stimulation'. They pointed to specific ways in which innovation was fostered and team (members') development was stimulated. While little reference was made to the dimension 'initiating vision', participants in all three cases indicated that the teams were empowered to create a team vision. The facet of empowerment is also associated with 'transformational leadership' (Ten Bruggencate, 2009). Specifically, it is associated with stimulating teachers with respect to innovation and development. Managers contributed to both by fostering innovation, particularly by being involved in, and committed to the innovation, and by acknowledging team(members)' strengths and supporting team(members)' development. Such a conclusion is supported by participants' observation that, in both best practice cases, the replacement of a manager with a transformational leadership style by a manager with a different leadership style led to a significantly reduced focus on learning and innovation. Moreover, participants (mainly managers and Career Guidance Programcoordinators) stressed the necessity of a dialogical learning attitude and open communica-

tion for the innovation process. They indicated to acknowledge teachers' vulnerabilities in this process.

Overall, we noted that results of the cases study with respect to 'collective learning', 'transformational leadership', and the factors inhibiting the innovation process, might be understood in terms of the design principles identified by Verdonschot (2009, 2011). These principles reflect factors that enhance learning in innovation practices. We therefore include the design principles in our revised conceptual model (see Figure 7.1).

In the third empirical study we used a game simulation (based on the Knowledge game developed by Kessels (1998)) to explore the relationship between 'collective learning' and teams' financial and innovative performance (Chapter 6). We tried to answer the following research question:

Research question 5: How are Collective Learning and Team Results (i.e., Team Performance and Innovativeness) related in the context of a game simulation where teacher teams compete in producing and designing products?

Five groups representing teacher teams involved with different bachelor programs participated in a market simulation, each operating as a production company. Since teams needed to figure out how to assemble the product models presented on the market, teams' commercial success was related to their innovativeness. Teams introducing new product models to the market also received royalties when teams copied their innovations. During the simulation, team members, teams and observers assessed teams' behavior with respect to 'collective learning'. Teams' financial position, a result of their efficiency and innovativeness, was used as an outcome measure. Results showed that, while teams' financial and innovative results were not unambiguously related to teams' or observers' perception of the collective learning process, a positive relationship between 'team innovative performance' and teams' *own* perception of the collective learning process seems likely.

Observer scores were mostly in accordance with teams' financial results in that strongest financial performance was predominantly observed in the game round where the observers signaled most types of behavior positively associated with 'collective learning'. However, observers' scores sometimes only differed marginally from one game round to the next, while team results significantly differed. Results should therefore be carefully interpreted, and the conclusion should only be considered tentative. In addition, we found that there might be a delay between 'collective learning' as assessed by the observer and teams' 'financial performance'. While some teams were involved in 'collective learning' from the start, it took them some time to design products conform market specifications. Such a result seems to imply that teams are able to startup the process of collective learning directly, but that it takes time to align their performance with their environments. Observer scores were not consistently positively related to a team's innovative results.

In addition, we found indications that: (1) 'creative turmoil' (Kessels, 2001a) might stimulate teams' innovative performance, (2) the emotional and affective component of the learning process might be relevant for teams' performance (cf. Kessels, 2001a), (3) observers' and teams' frames of reference might be different when assessing the teams' behavior with re-

spect to 'collective learning', and (4) a 'shared vision' might bind teachers' individual activities and align those with respect to the team's goal. These results suggest that the relationship between 'collective learning' and 'team performance and innovativeness' is more complex than we originally assumed it to be.

Second, we studied the relationship between team members' individual assessment and team assessment, striving to find an answer to the following research question:

Research question 6: How are team members' perceptions and teams' perceptions of the collective learning process related when teacher teams compete in producing and designing products?

We found that team members' scores of 'collective learning' varied, but tended to converged in the course of the game. Possibly, teachers' perception of the learning process was a byproduct of a shared understanding created during the game. We also found that team scores fell within a smaller range than individual scores, that team scores often exceeded team members' average score, and that teams perceived the level of 'collective learning' to increase even when part of the team perceived a decrease. At the same time, we found a negative perception of the development of 'collective learning' to be reflected in team scores overall. We concluded that teams' assessments of 'collective learning' tended to be more positive than individual team members' assessments, suggesting that relatively negative individual perceptions were offset when a set of individual scores needed to be translated into a team score.

7.3 REVISED CONCEPTUAL MODEL

In Chapter 2 we presented a conceptual model, depicting the hypothesized interrelationships among 'individual learning in interaction', 'collective learning', 'transformational leadership', 'team results', and a set of background variables (Figure 2.2). Combining results of chapters 2 – 6, we present a revised conceptual model (see Figure 7.1), which is explained below.

Based on our literature study we describe organizational learning in terms of the learning processes taking place within organizations, the outcomes, and the organizational context in which learning is situated. Using the framework presented by De Laat and Simons (2002), we distinguished four types of learning, ranging from purely individual (individual process and individual outcomes) to collective (collective process and collective outcomes). Based on the results of our case study we altered this framework and argue that 'individual learning in interaction' and 'collective learning' both lead to individual and collective outcomes. In our vision, the difference between these forms of learning is found in the learner's intent: 'individual learning in interaction' is characterized by individual goals based on individual intent, whereas 'collective learning' is characterized by the combination of collective goals (with respect to work and/ or learning) and individual goals, the latter derived from a team's collective goals.

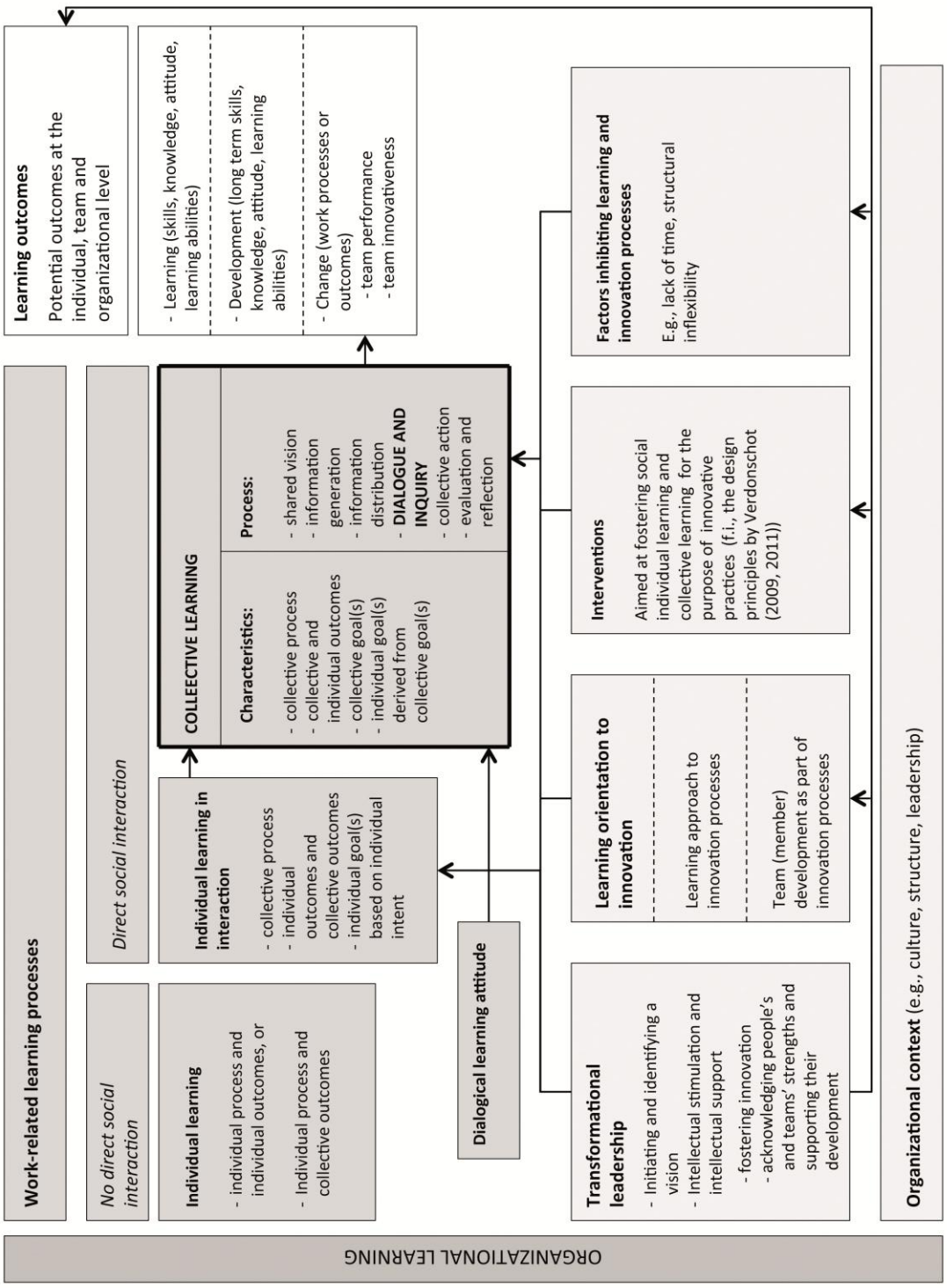

Figure 7.1. Revised conceptual model, on the basis of the study's results.

By including individual and collective forms of learning in our framework and by acknowledging the influence of the organization, conform contemporary insights, we conceptualize 'organizational learning' as a multilevel concept (see Cousins, 1998; Edmondson & Moingeon, 2004; Örtenblad, 2004; Popper & Lipshitz, 2004; Verbiest, 2004; Kozlowski et al., 2010). In our study we found 'individual learning in interaction' and 'collective learning' to be closely related. Therefore, in the revised conceptual model we group them under the heading 'learning through direct social interaction', in order to emphasize the common denominator. The concept of dialogical learning attitude, which allows for participation in open communication, may play an important role in collective learning processes. In future research the relationship between this concept and 'collective learning' might be explored further.

Following Simons and Ruijters (2004), we made a distinction between three types of learning outcomes: learning in the restricted sense (referring to skills, knowledge, attitude and learning abilities), 'development' and 'change'. Learning outcomes may occur at the level of individuals, teams and/or organizations. Organizational change occurs when (the development of) individuals', teams', and organizations' skills, knowledge, attitudes and learning abilities lead to changes in work processes or outcomes at each of these levels. A (positive) development of organizations' performance, and innovativeness might be considered such change.

When organizations use a learning strategy to continuously adapt to changes in their internal and external environments, they commonly aim to improve their performance, and increase their adaptive learning capabilities. The latter requires that people have the ability to work together (De Laat & Simons, 2002) and therefore social learning processes play an essential role. In our framework, we specified social learning processes as 'social individual learning' and 'collective learning'. Since individual learning can be considered the foundation for 'collective learning' (Kozlowski et al., 2010), we posit a positive relationship between 'social individual learning' and 'collective learning'. Likely, the more proficient people in a team are at learning individually through social interaction, the more proficient the team is at learning collectively. In our quantitative study we indeed found a positive relationship between both forms of learning. We therefore argue that collective learning processes in teams might benefit from developing the social individual learning processes taking place within the teams. We will further reflect on the nature of the relationship between both forms of learning in the section 'Directions for future research'.

A positive relationship between 'collective learning' and teams' performance (e.g., in terms of productivity, competitiveness, and effectiveness), as well as teams' innovativeness and adaptability is suggested in the literature (Garavan & McCarthy, 2008, see also Jiménez-Jiménez & Sanz-Valle, 2011; Tohidi & Jabbari, 2012). In our case study and our game simulation we indeed found indications that 'collective learning' might be positively related to teams' general and innovative performance. While we acknowledge that each of the four learning processes might result in different types of outcomes (i.e., learning, development and change), based on our study we emphasize the relationship between 'collective learning' and organizational change. As a result of the literature study and our case study we hypothesize that 'collective learning' might be specifically relevant to achieve and sustain third-order changes.

Using the theoretical perspective of 'the learning organization' as a way of looking at and describing organizations, we assume that organizations can facilitate individuals' and teams' learning by providing a structure, a culture, and a leadership style supportive of learning. Such an environment stimulates the development of individuals' and teams' capabilities. Organizations can thus maximize the effectiveness of learning processes by aligning formal structures and resources to support them (Kozlowski et al., 2010). In the case study we found, for example, that social learning processes were actively supported through organizational factors (e.g., institutionalizing forms of social learning, adjusting team culture). In addition, we found a so-called 'learning orientation'; characterized as the acknowledgment of the innovation process as a learning process, and a focus on team oriented staff development as part of the innovation process. Such learning orientation seemed to create a positive learning environment for experiential and social learning, and thus for 'collective learning'. While the organizational context might facilitate processes of learning and innovation, in the case study we found that it might also inhibit those. For example, we found that factors such as 'lack of time' and 'structural inflexibility' can limit collective learning processes.

In both the quantitative study and the case study we found support for the hypothesized positive relationship between 'transformational leadership' on the one hand and 'collective learning' and 'social individual learning' on the other. Moreover, in the case study we found indications that a transformational leadership style influences teams' results both indirectly (i.e., by stimulating social forms of learning, specifically 'collective learning') and directly. Inspired by our case study, we argue that it is likely that the organizational context is, to a certain extent, within the field of influence of managers. For example, in each of the CGP-cases we saw that managers actively strived to create a learning culture. Based on the patterns in the case study we argue that 'social individual learning', 'collective learning', 'transformational leadership' and the factors we identified as inhibiting learning and innovation processes might be understood in terms of the 'design principles' (reflecting factors that enhance learning in innovation practices) formulated by Verdonschot (2009, 2011). When searching for appropriate interventions that can promote 'social individual learning' and 'collective learning' in favor of innovative practices, the design principles might play a guiding role.

We would like to end this section with a reflection. A question that came to mind in the final phase of the study was how 'social individual learning' and 'collective learning' might be discerned in practice. Provided that both forms of learning are based on comparable social processes, and that the outcomes of the learning processes in both cases might be individual as well as collective, it proved difficult to treat them separately. It might be that 'collective learning' can be identified in the following way. In working and learning together, team members develop a team culture. Such a culture embodies team members' ways of communicating, of developing shared understandings, of complementing each other, of collaborating, and so on. In teams that learn collectively, it might be that the team culture stimulates teachers to develop team-specific competencies. For example when team members notice that they can 'safely' engage in a dialogue in which the diversity of ideas and experiences within the team develop into a shared understanding that enriches all individual perspectives. As a result, they might be stimulated to 'step out of their comfort zone' together in thinking and acting. The courage to explore the unknown is then strongly dependent on

the team's culture; because of this a team's 'collective courage' might disappear when the team dissolves. Results of the team's learning process may then remain in the minds of its members (e.g., positive experience with stepping out of the comfort zone together) and actions (e.g., behavior that changed as a result of participation in the team), but the collective competence and memory will evaporate. In the end, it might be that the competencies and memories associated with the team experience (and that only exist as long as the team exists) is what distinguishes 'collective learning' from 'social individual learning'.

7.4 CONTRIBUTIONS OF THE STUDY

Scientific relevance

The present study contributes to the field of HRD, which has a growing interest in various forms of workplace learning (Kessels & Keursten, 2011). Specifically, we tried to contribute to the body of knowledge of organizational learning and the learning organization, by studying in-depth two types of organizational learning, 'social individual learning' and 'collective learning' in the context of higher vocational education. Moreover, we studied the relationship between 'collective learning' and teams' general and innovative performance, thereby exploring the value of 'collective learning' for schools. From a theoretical perspective, our research has delivered three main results.

First, it has resulted in a multi-dimensional measurement instrument for 'collective learning', which can be applied in future research. Based on this instrument, a second-order factor model as well as a process model of 'collective learning' with 'dialogue and inquiry' at its core are recommended for further studies.

The second contribution complements existing theory on organizational learning and the learning organization. We focused on making plausible a positive effect of 'transformational leadership' on 'social individual learning' and 'collective learning', as well as a positive relationship between 'social individual learning' and ' collective learning'. Results show that teachers who perceive higher levels of 'transformational leadership' generally perceive higher levels of learning. Moreover, teachers who perceive higher levels of 'social individual learning' generally perceive a higher level of 'collective learning'.

The third contribution complements existing theory by providing concrete examples of the way in which 'collective learning' and 'transformational leadership' manifest themselves in a radical, large-scale educational innovation project with respect to career guidance, how they interact, and how they are related to organizational outcomes. We have shown that, in the best practice cases, 'collective learning' (in three cases) and 'transformational leadership' (in two cases) likely had a positive impact on a team's ability to successfully introduce such a radical innovation. Results also point to the relevance of additional factors that interact with 'collective learning' and 'transformational leadership'. A final contribution to existing theory comes from the insight gained on the relationship between 'collective learning' and 'team results.' We studied the relationship between teacher teams' perceived level of 'collective learning' and their financial and innovative performance in a game simulation and found

indications that these might be positively related. In addition, we found some factors that influenced the relationship between learning and results.

Practical relevance

We think the results of our study will be useful for teacher teams and their managers in Universities of Applied Sciences in several ways. Teams developing a career guidance program – or other radical innovations – might decide to design the innovation process as a collective learning process. In that case, they will need time to create a shared understanding with respect to their vision and for translating this understanding into an action plan. This is an ongoing process, because teams are continuously confronted with changes in their internal and external environments. The creation of a shared understanding implies that problems need to be collectively explored in team meetings before solutions are generated. In this process, the richness of ideas present within the team should be taken into account. When a norm of open communication is adhered to, a free exchange of ideas and experiences is facilitated; this helps to let the multitude of ideas surface. Information available outside the team (within the university and with parties outside the university) may also enrich teams' dialogues and help team members to think in new directions. It is therefore important for teams to scan their environments for new information, even if team members are themselves able to come up with many ideas. The ideas generated need to be discussed in a dialogue that addresses challenging topics and is at the same time respectful. In order to arrive at 'collective learning', team members do not need to fully agree with each other; they should agree enough to arrive at action theories underlying collective action. Managers might support their teams in creating a shared understanding by allowing them time for the underlying processes, inquiring about their visions, fostering a culture supportive of open communication, stimulating or steering teams' dialogical processes aimed at creating a shared understanding, and organizing team development such that team members become more proficient in conducting constructive dialogues. When teams lose their focus regarding the innovation process, managers may play an important role in keeping the vision 'alive' and making team members feel committed to it.

Because individual goals and team goals need to be aligned in order to arrive at 'collective learning', team members' individual goals should be explored. In a negotiation between team members' and organizational goals, team goals created should be ones that team members are willing to commit themselves to. When such a commitment is lacking, team members might be more inclined to pursue their own goals (i.e., 'individual learning in interaction').

Furthermore, in designing the innovation process as a collective learning process, teams need to specifically focus on evaluating results and reflecting on the process and its outcomes; we found this aspect to be underrepresented in the study. Managers may actively stimulate teams to be involved in processes of collective evaluation and reflection.

In everyday practice, processes of collective learning in teacher teams are likely to occur as a byproduct of the work teachers do. As a result, the process might not actively be steered or stimulated, and learning outcomes might remain implicit. By explicitly addressing the learning process, things that were learned but not noticed consciously might surface, particularly

by means of reflection. Moreover, by learning consciously the team's learning ability is enhanced, as is its ability to give direction to its own learning process. Such an ability is strongly associated with learning organizations (Wierdsma & Swieringa, 2002). Insights into the process of collective learning helps teams to identify which aspects might be promising to develop – for instance parts of the learning process that are underutilized, or parts that are already strongly developed and that could be developed further within the team's culture. While in our study a conscious approach to the collective learning process is not considered necessary for 'collective learning' to occur, there is an indication that teacher teams might benefit from consciously engaging in the learning process.

'Collective learning' requires special abilities, which are not necessarily required for engagement in the primary educational process. Likely, these abilities will need to be explicitly developed in support of collective learning processes. In this context we already pointed to the role of team development aimed at increasing team members' proficiency in conducting constructive dialogues. One way to develop team members' collective learning abilities is for them to be involved in 'individual learning in interaction'. This seems to be a less complex form of social learning than 'collective learning', because it does not require a collective intent from the actors involved in the learning process. Because the underlying social mechanisms are comparable and because both forms of learning are shown to be positively related in our study, teams that are not sufficiently able to start up processes of 'collective learning' might start by motivating and facilitating teachers to get accustomed to 'individual learning in interaction'. We expect that when teachers become used to small scale, individually aimed social learning processes, they will become more proficient in contributing to collective ones. Managers might stimulate these processes in several ways, for example by fostering a culture supportive of social learning, or by institutionalizing social learning. Another aspect that might be developed to stimulate 'collective learning' is team members' 'dialogical learning attitude'. Teachers with such an attitude are willing to participate in open communication, have respect for and are curious about different points of view, are able to endure tensions associated with conflicting points of view, and are willing to engage in processes of dialogue aimed at creating a shared understanding. Teachers' willingness to actually demonstrate a dialogical learning attitude might be critically dependent on their team's culture, because it involves a willingness to be vulnerable.

Educational change requires changes in teachers' behavior, which, in turn, should be supported and guided by educational leaders. Next to the contributions described above, managers might kindle the innovation and related collective learning processes by intellectually stimulating their team members. This way they can encourage team members to think beyond the team's status-quo and come up with (radically) new ideas. As such, more profound forms of innovation are stimulated.

Societal relevance

Universities of Applied Sciences are currently facing profound changes: they need to redefine themselves within the contemporary knowledge economy, and shape their own identities in relation to Research Universities (Diekstra, 2012). These changes require radical innovation. Innovations that should not be imposed top-down, but developed from 'within' (Miedema & Stam, 2008); teams responsible for universities' primary process should be ac-

tively involved in their design and implementation. Such an approach necessitates cultural changes and specific forms of learning; 'collective learning' is one of those forms. Our study provides suggestions on how to develop this form of learning, by offering more insight into the nature of 'collective learning' and into a number of factors that play an important role in supporting collective learning processes. More specially, our study, which was financed by The Hague University of Applied Sciences, may support this university in becoming a knowledge institute; a goal it hopes to achieve in the coming years.

7.5 CRITICAL REFLECTIONS ON THE RESEARCH ACTIVITIES

In this section we reflect on the quality of the present study using four criteria: internal validity, external validity, ecological validity and reliability.

Internal validity

In general, validity refers to the extent to which correct operational measures for the concepts under study are established (Cooper & Schindler, 2003), or, put simply, whether the measurement instruments measure what they are supposed to measure. In general, validity is classified into three basic types: content validity, criterion-related validity and construct validity (Anastasi & Urbina, 1997). We will discuss those in order to assess the quality of our results. The reflection presented in this section is an extension of reflections presented in the concluding sections of Chapters 3, 4, 5 and 6.

Content validity. This type of validity requires "a thorough exploration of the constructs of interest to assure that no vital aspects are excluded in the content of the measure" (Constantine & Ponterotto, 2006, p. 109). In the present study, an exploratory case study of three successful educational innovation projects in conjunction with a literature search determined the variables that were considered to specify the theoretical constructs 'collective learning', 'social individual learning' and 'transformational leadership' (see Chapter 2). Theoretical considerations led us to formulate theoretical models for these constructs, specifying their sub-constructs. The resulting models for 'collective learning' and 'transformational leadership' are highly similar to models and ideas proposed by other scholars in the relevant field of research (see for example Dixon, 1999; De Laat & Simons, 2002; Castelijns et al., 2009, 2010; Geijsel et al., 2009; Goes-Daniëls, 2011; Thoonen, Sleegers, Oort, Peetsma & Geijsel, 2011).

Criterion validity. This type of validity occurs when the result of a measurement instrument can be connected to one or more outcomes. In particular, it relates to the extent to which an outcome (the criterion) may be predicted based on the scores obtained on a measure. The structural models reported in this thesis did not include an outcome measure of 'collective learning' at the level of the team. As such, the criterion validity of this concept could not be studied. At the start of Study 1 we did intend to collect survey data relating to team performance and innovativeness in order to test the hypothesized positive relationship with 'collective learning' (Hypothesis 5). Therefore, scales were included for both variables. However, most teachers in the sample responded to the statements measuring team performance and innovativeness with the answer option 'I don't know'. The limited amount of data

resulting for both outcome measures proved insufficient to allow for reliable statistical analysis and the hypothesis could therefore not be tested. The relationship between 'collective learning' and team performance was readdressed in the game simulation organized in Study 3. In the game simulation, we expected higher levels of 'collective learning' during the game to result in higher levels of 'team performance' and 'team innovativeness' at the end of the game. This hypothesis was generally confirmed. In addition, in the case study (Study 3) we also found positive relationships between 'collective learning' and 'team results', specifically teams' innovative performance.

Construct validity. This type of validity refers to the extent to which a measurement instrument is appropriately measuring the variable of interest. In order to achieve construct validity, observable phenomena need to be identified that cover the theoretical constructs involved in the study adequately (Cooper & Schindler, 2003). Subsequently, the constructs need to be operationalized, or measurement instruments need to be developed to determine these phenomena (Boer, 2005). In the present study, an exploratory case study of three successful educational innovation projects in conjunction with a literature search determined the variables that were considered to specify the theoretical constructs 'collective learning', 'social individual learning' and 'transformational leadership'. Next, we designed a measurement instrument to be applied to each construct in the survey research (Studies 1a and 1b), by choosing items so that they complied with the construct's theoretical model. Where possible, we included scales and/ or items previously validated by other scholars. While we preferred to work from a theory specifying the nature of the core constructs, we did allow ourselves some freedom in the process of developing adequate measures. Such a decision follows from the fact that in the present study we are in the beginning phase of the development of measurement instruments for 'collective learning' and 'social individual learning'. In the first study we used a two-step approach, consisting of a model-generating and a model-testing stage. This way, we assimilated our empirical findings in our process of theory development, leading to adjustments in the hypothesized factor structure (i.e., the sub-constructs associated with each construct) as well as in the sets of items comprising the relevant scales for measuring the core constructs. Adjustments to the factor structure of constructs were only made after careful consideration of the measurement instrument and relevant literature.

Triangulation, or the application of several research methodologies to study the same phenomenon (Denzin, 1978 in De Jong, 2010) presents a way to strengthen the operationalization of data. The second study might be considered a form of cross-validating the core constructs and their structure in terms of the associated sub-constructs. Analysis of the factors perceived to be important for the success of an educational innovation project led to an overview of examples for the sub-constructs of 'collective learning' and 'transformational leadership'. A main finding in this study was that it was difficult to distinguish between 'collective learning' and 'social individual learning'. While both forms of learning are characterized by a shared process, only 'collective learning' is said to lead to common results. In reflecting on the results, we found that the result of 'social individual learning' often goes beyond the level of the individual, making it difficult to distinguish this form of learning from 'collective learning'. Such a result seems to demand a more precise definition of the concept of social individual learning – specifically with respect to its outcome – in order to distinguish it from 'collective learning'. While we have tried to achieve construct validity, it cannot be

assessed in terms of the standard measures referred to as convergent and discriminant validity. To show convergent validity, a scale needs to correlate significantly and positively with alternative instruments designed to measure the same construct. To show discriminant validity, a scale should not correlate significantly with other measures with which theory suggests it should not correlate (Constantine & Ponterotto, 2006). In the present study, the concurrent validity of the core constructs could not be assessed, for alternative measures were not included. Likewise, no data were available to assess the discriminant validity of the core constructs.

External validity

In scientific studies, external validity is the extent to which results of a study can be generalized beyond the study's sample. We will discuss whether conclusions of our study can reasonably be expected to apply to the target population (i.e., all teacher teams working at Universities of Applied Sciences) and to other populations (i.e., teachers in different educational sectors, or non-educational practitioners).

With respect to the survey-based study (Study 1a and 1b), we discussed in Chapter 4 that our sample is not representative of the target population. Therefore, we cannot be sure that the conclusions drawn actually apply to teachers or teacher teams with features dissimilar from the teachers and teams involved in our study. However, part of the variety inherent in the target population is reflected in our sample, supporting the study's external validity. Likewise, we cannot be sure that our conclusions apply to other populations. We argued however, that our results with respect to 'collective learning' might still be relevant to populations that differ from our target population, for example organizations mainly employing 'professionals' (see Chapter 4).

In the second study we used a case-study design, which does not aim to generalize to a larger population. We studied three best practice cases in order to explore the interrelationships between 'collective learning', 'social individual learning', 'transformational leadership' and 'team results'. As is noted by Kessels (1993), the cases should not be regarded as random samples or as a random population. In line with this characteristic of case study design, we used our findings to develop descriptive theory (as opposed to prescriptive theory) and for methodological triangulation, and not primarily to generalize to a larger population. As such, the concept of external validity is less important in this empirical study. That said, however, the parallels that could be drawn among the cases seem to suggest non-idiosyncratic mechanisms that might apply to a larger population. This idea is supported by the agreement with the design principles identified by Verdonschot (2011) in non-educational contexts. Nonetheless, based on our data, inferences to a larger population remain of a tentative nature.

In the third study we used a game simulation to study teachers' and observers' perceptions of 'collective learning' as well as the effect of 'collective learning' on team results. Five teams within one and the same Universities of Applied Sciences participated in the simulation. Teams were selected because of their varying scores of 'collective learning' in Study 1a and the group was composed such that a relatively low-scoring team, a relatively intermediate scoring team, and a relatively high-scoring team participated in the simulation. Such a design was chosen to allow for studying the effects of diverging levels of 'collective learning' on

team results. Team leaders of the five participating teams were asked to set up a game team with four colleagues in such a way that the group would more or less reflect the real-life teacher team. Our aim with this group composition was to form groups that would roughly comply with the team's average scores we found in the quantitative study. In practice, however, groups were composed based on teachers' interest in participation and their availability in terms of their class schedules and therefore the game teams were not necessarily a representative selection of the teacher teams. Again, this particular research design is likely to lead to a loss of external validity with respect to inferences that could be made to the target population, since only teacher teams from one and the same university participated in the simulation. University-specific characteristics might cause these teams to systematically differ from teams at other universities. Because of this, we cannot be sure that the conclusions do actually apply to teachers or teacher teams at other universities. With respect to the teachers participating on behalf of the teams, we cannot rule out the possibility that they have specific characteristics relevant to learning. Since teachers were selected based on their interest in participating in the game (and in the research project), they might have a relatively strong interest in (team) learning, thus potentially biasing results and influencing the external validity of the study.

Ecological validity

A study possesses ecological validity if the research methods, materials and settings approximate the real-life situation that is under investigation (Brewer, 2000). Studies 1a and 1b explore the collective learning concept and the related concepts of social individual learning and transformational leadership in real-life settings. Teachers participating in the survey assessed their day-to-day work situations. In the case study we also explored these concepts and their interrelationships in real-life settings. This approach increases the studies' ecological validity. The work situation created in the Knowledge game differs substantially from the work situation teachers face in daily work situations. As such the research design may limit the study's ecological validity. At the same time, however, the two work situations show a number of important similarities (see Chapter 6). These similarities strengthen the study's ecological validity.

Reliability

In general, the concept of reliability refers to whether a measurement instrument gives results that are consistent, or, alternatively, whether the scores obtained by means of the measurement instruments are free from measurement error. As Constantine and Ponterotto (2006, p. 107) note: "Although in most situations the results of tests are rarely identical when repeated, the results generally should reflect some level of consistency from one trial to another". Several measures were taken to increase the robustness of our research design. In the survey study, we calculated the internal consistency of the scales measuring each of the sub-constructs. The most commonly used coefficient is the Cronbach's alpha, which considers the average inter-correlation between every item of a specific measure (Carmines & Zeller, 1979). All scales showed a reliability coefficient of at least 0.70, a value which is generally considered to be acceptable (Loewenthal, 2001; Kline, 1999). Moreover, in evaluating the measurement models for each of the core constructs as well as in evaluating the structural equation models, we used a split-half method in that we explored and optimized the

models in one part of the sample and tested the result in the remaining part of the sample. Consistently, results for the subsamples proved highly identical. In the case study, we held interviews with various participants – often with different roles – in the innovation process, in order to include a variety of perspectives. Where possible, the interviews were recorded, transcribed and summarized per case in the form of a case description. The case descriptions were checked by the contact persons, who were themselves involved in the innovation project and in the interviews. In the game simulation, observers were given instructions on an individual basis by one of the researchers a week before the simulation. They were informed about the course of the game and their role during the game rounds and reflection rounds. Moreover, the theoretical model of 'collective learning' was explained to them, the observation list was handed out, and a fixed set of examples was provided and discussed for each of the indicators on the list. Based on observers' feedback, the original observation list was modified slightly in order to take out some ambiguities. In addition, all teams were video-recorded and the videos were used during the analysis stage of the study to look into 'typical' situations, such as when an observer's score significantly differed from a team's score.

7.6 DIRECTIONS FOR FUTURE RESEARCH

We conclude this study by looking to the future and by providing some directions for further research. These recommendations stem partly from the shortcomings we've identified in the present study, and partly from the fact that our findings suggest that further exploration is necessary. Since possible directions for further research were already covered in the conclusion sections of Chapters 3 to 6, we will limit ourselves to elaborating on a selection of arguments.

An important limitation of the present study is that results are inconclusive with regards to the causality of the relationship between 'social individual learning', 'collective learning', 'transformational leadership', and 'team results'. In Study 1, relationships between these concepts were tested by means of cross-sectional, quantitative data, but this did not allow us to draw conclusions about causality. Moreover, based on this study, it is not possible to say something about how these variables, taken in conjunction, might evolve over time. Results of our study provide indications that the hypothesized relationships may hold true, a result which was confirmed in Study 2. However, results are only of a tentative nature, and in order to really understand the relationships between learning, leadership and team results, the process of collective learning should be studied over time. In Study 3 we did study the process over time, repeatedly measuring 'collective learning' and 'team results', and those results lend support to the hypothesized positive relationship between 'collective learning' and a team's general and innovative performance. However, because of the limited number of teams that participated in this study, further research is required and we think longitudinal research is a promising avenue for increasing our understanding of 'collective learning' and its relationship to 'social individual learning', 'transformational leadership' and 'team results'.

In line with the previous notion, we continue to ponder the relationship between 'social individual learning' and 'collective learning'. As Morgeson and Hofmann (1999, p. 253) note: "it

is the individuals (or collective) who determine the collective construct, and, through their actions, influence the behavior of others in the collective". While, in our structural models we assumed that 'social individual learning' would have a positive effect on 'collective learning', the relationship here actually appears to be a two-way street. On the one hand, 'collective learning' is founded in individual learning, for teams cannot be said to learn independently of the people making them up. Moreover, 'collective learning' requires the use of more complex and sophisticated skills, which enable team members "to balance advocacy with inquiry and become aware of the assumptions and beliefs that guide the work of team members" (Mitchell & Sackney, 2000, p. 68). It is likely, then, teams cannot develop collective capabilities if team members do not have sufficient individual capabilities in the first place. On the other hand, learning that takes place in teams and in the organizational context form the context for individual learning, development and awareness (Kessels, 2004). Work teams can be considered the proximal social context that shapes individual learning. People construct personal understandings and build personal knowledge bases at least partly through social interaction and social arrangements. In line with the conceptual relatedness of 'social individual learning' and 'collective learning', we found both forms of learning to be strongly related in the quantitative study and the case study. We advise researchers studying individual and collective forms of learning in organizations to consider the reciprocal relationship between 'individual learning in interaction' and 'collective learning'.

When, in future research, scores of 'individual learning in interaction', 'collective learning' and one or more team-level outcome measure(s) would be available, the effect of both types of learning on team outcome(s) could be studied, as well as how they interact. Such analysis is related to the question of where learning actually takes place: is learning an individual activity taking place in a team context (of which 'collective learning' is part), or is the collective actually learning? In the latter case, the collective should be the unit of observation and analysis. Elaborating on this point, an interesting observation comes from the intraclass correlations (*ICCs*) for all items measuring the constructs 'collective learning', 'social individual learning' and 'transformational leadership', respectively. High, or relatively high, *ICCs* signify a substantial influence of the team context on teachers' individual responses, indicating that teachers within a team are more similar to each other than teachers within other teams. It is captivating that, in general, items representing individuals' perceptions of the group construct 'collective learning' have higher *ICCs* than items representing individuals' perceptions of the individual construct 'individual learning in interaction' (see Appendix F, Table F1). A possible explanation for this pattern might be that differences between teams are more important, or more present when it comes to an individual's perception of a group construct as opposed to an individual's perception of an individual construct. This might be an indication that the collective learning construct plays a role at the team level. While the pattern of *ICCs* with respect to 'individual learning in interaction' and 'collective learning' is interesting, such an interpretation is quite tentative.

In addition, we would like to note that part of the similarity between 'individual learning in interaction' and 'collective learning' as found in Study 1 might stem from a different source. Both forms of learning might be related via an underlying construct, representing a broader concept of learning or development (e.g., 'social learning orientation' or 'developmental orientation'). For example, when a teacher chooses to focus more strongly on development, he or she might demonstrate more activities associated with 'individual learning in

interaction' (in order to stimulate personal development), and become more actively involved in school development activities as well (in order to contribute to school development). In such a situation, the teacher likely perceives the levels of 'individual learning in interaction' and 'collective learning' as increasing. Their concurrent increase does, however, not stem from a direct relationship between both forms of learning, but from their relationship to the teacher's underlying orientation with respect to development. We advise researchers studying individual and collective forms of learning in organizations to consider the possibility that an underlying, more general, construct might be present.

In the case study we became interested in the question, when can 'collective learning' be said to occur? First, does the learning process consciously and explicitly need to be addressed, or can it simply occur as a byproduct of work? In terms of the collective learning cycle, 'evaluation and reflection' is the phase that most strongly relates to a conscious learning process, which might explain the fact that little reference was made to it. In the quantitative study we found that teachers perceived the aspect of 'evaluation and reflection' (as measured) to be least present in their teams. In addition, in the case study we found that no direct references were made to the act of reflection, a result which might indicate that the collective learning process was not explicitly addressed. If that was the case, the teacher teams operated as 'working teams' as opposed to 'communities of practice' – both of which are capable of 'collective learning' (De Laat & Simons, 2002). In such teams learning is work-related and implicit, meaning that "there is no intention to learn, and no awareness of learning at the time it takes place" (Van Woerkom, 2003, p. 36). Second, if the learning process needs to be explicitly addressed, who should do so? Moreover, does the process need to be owned by one or multiple person(s)? Or is it sufficient if all aspects of 'collective learning' are addressed (and then, by whom?) without an explicit focus on 'collective learning'? Do all aspects of the learning cycle need to be present in order for 'collective learning' to occur? Or do incomplete cycles also represent 'collective learning'? This latter question is specifically relevant to the educational context, for incomplete learning cycles are probably more common in schools than complete cycles (Rait, 1995). As Goes-Daniëls (2011) recently found for the context of vocational education training, none of the teacher teams she studied completed all stages of the collective learning cycle. Further research may help in the search for answers. An example of possible research could be the study of various collective learning processes (complete and incomplete, undertaken consciously and unconsciously) in relation to the effect (i.e., the learning outcomes) they have. Such research is considered important, for 'collective learning' is not an end in and of itself, but is believed to contribute positively to organizations' performance and their capacity to develop and innovate.

Finally, because of the social nature of 'collective learning', it cannot occur unless people collaborate. Therefore, building organizational capacity means paying attention to the social-cultural conditions within organizations. Schools are currently constructed in accordance with the assumptions of a mechanistic worldview and a bureaucratic mode of organization (Mitchell & Sackney, 2000; Hargreaves, 2003; Kronman, 2007; Nichols & Berliner, 2007; Wagner, 2010). From a mechanistic perspective, learning is viewed as an individual activity and little attention is paid to social forms of learning. As such, schools are largely arranged to keep teachers separated from one another, reducing opportunities for them to learn from and with one another. Moreover, collaboration might be uncomfortable for teachers, because it requires that they subject their work to scrutiny, which can be extremely threaten-

ing (Mitchell & Sackney, 2000). White and Weathersby (2005) therefore argue that social learning is an espoused ideal rather than actual practice in universities. In advocating the importance of 'collective learning' for the educational context, we should be aware of the specific culture that can be found in many schools. When individualism, isolation and norms of privacy characterize the culture of the teacher team, 'collective learning' is not likely to occur. A cultural transition seems to be required first. Future research might focus on studying to what extent conditions in teacher teams are indeed supportive of 'collective learning'.

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Appendix A (Chapter 3)
Original scales and items of Collective Learning

Table A1
Original scales and items of Collective Learning

Factor	Item	Within my department…	
Shared vision	3	…we are committed to the goals because we believe in them, not because they have been imposed.	Item 18 we developed ourselves. All other items were adapted from the shared vision scale (García-Morales et al., 2006).
	11	… we have coherent and shared ideas about the goals of the department.	
	17	… we have shared and coherent ideas about the problems we need to solve.	
	18	… decisions are taken about educational activities that do not influence the way I organize my classes (contra-indicative item).	
	20	… we have shared and coherent ideas about how we would like to develop as a department.	
	21	… we teach based on coherent ideas about education.	
	24	… we have shared ideas about the execution of the studies.	
	28	… we develop our studies based on coherent ideas about education.	
Information generation	4	… everyone is involved in collecting information aimed at improving (parts of) the studies.	Items 15a-15e were adapted from the information seeking scale of the Organizational Learning Mechanisms instrument (Schechter, 2009). Items 4 and 33 we developed ourselves, based on the descriptions of Castelijns et al. (2009).
	15a	… meetings are being organized where knowledge can be shared with teachers within the department.	
	15b	… meetings are being organized where knowledge can be shared with teachers from other departments/ educational institutes.	
	15c	… meetings are being organized where knowledge can be shared with external experts in the field of (theory of) education.	
	15d	… meetings are being organized where knowledge can be shared with students.	
	15e	… meetings are being organized where knowledge can be shared with the industry.	
	33	… the same person(s) decide(s) time and again what information is needed for the department (contra-indicative item).	
Dialogue and inquiry	8	… we spend time building trust with each other.	All items were adapted from the dialogue and inquiry scale of the Learning Organization Questionnaire (Marsick & Watkins, 2003).
	14	… whenever we state our view, we also ask what others think.	
	23	… we listen to others' views before speaking.	
	25	… we treat each other with respect.	
	26	… we give open and honest feedback to each other.	
	29	… we ask "why?" regardless of rank or status.	

Table A1 *(continued)*

Factor	Item	Within my department…	
Collective action	16	… we are appreciated/ rewarded for our achievements as a team/group.	Item 16 was adapted from the collaboration and team scale of the Learning Organization Questionnaire (Marsick & Watkins, 2003). All other items we developed ourselves.
	38	… I prepare my lessons together with colleagues.	
	42	… communicating with colleagues leads me to adapt the development of my educational activities.	
	54	… I discuss problems in my work with others.	
	55	… communicating with colleagues leads me to adapt the execution of my educational activities.	
	65	… communicating with colleagues leads me to work more in line with others.	
	67	… I work together with colleagues to develop subjects/ modules.	
Evaluation and reflection	2	… together we think about what we have not done well in the past year.	Item 35 was adapted from the systems to capture learning scale of the Learning Organization Questionnaire (Marsick & Watkins, 2003). All other items were adapted from the reflection scale of the critically reflective work behavior instrument (Van Woerkom, 2003).
	6	… together we compare our current performance with how we performed a year ago.	
	9	… we find it difficult to pinpoint what we have learned in the past (contra-indicative item).	
	12	… we reflect together on the we do our work.	
	19	… together we compare our studies with similar ones.	
	30	… we compare our performance with the performance of other departments.	
	32	… we discuss the way we communicate with each other.	
	35	…we measure gaps between current and expected performance.	

Appendix B (Chapter 3)
Final scales and items of Collective Learning

Table B1
Final scales and items of Collective Learning

Factor	Item	Within my department…
Shared vision	3	…we are committed to the goals because we believe in them, not because they have been imposed.
α_A= 0.87	11	… we have coherent and shared ideas about the goals of the department.
α_A= 0.85	17	… we have shared and coherent ideas about the problems we need to solve.
	20	… we have shared and coherent ideas about how we would like to develop as a department.
	21	… we teach based on coherent ideas about education.
	24	… we have shared ideas about the execution of the studies.
	28	… we develop our studies based on coherent ideas about education.
Dialogue and inquiry	8	… we spend time building trust with each other.
	14	… whenever we state our view, we also ask what others think.
α_A= 0.79	23	… we listen to others' views before speaking.
α_A= 0.83	25	… we treat each other with respect.
	26	… we give open and honest feedback to each other.
	29	… we ask "why?" regardless of rank or status.
Collective action	38	… I prepare my lessons together with colleagues.
	42	… communicating with colleagues leads me to adapt the development of my educational activities.
α_A= 0.77	54	… I discuss problems in my work with others.
α_A= 0.81	55	… communicating with colleagues leads me to adapt the execution of my educational activities.
	65	… communicating with colleagues leads me to work more in line with others.
	67	… I work together with colleagues to develop subjects/ modules.

Table B1 *(continued)*

Factor	Item	Within my department…
Evaluation and reflection	2	… together we think about what we have not done well in the past year.
	5	… the lessons learned are made available to all teachers in order for the teachers to make use of these.
α_A= 0.80		
α_A= 0.77	6	… together we compare our current performance with how we performed a year ago.
	12	… we reflect together on the we do our work.
	13	… we document people's expertise so everyone is able to keep track of it.
	30	… we compare our performance with the performance of other departments.
	32	… we discuss the way we communicate with each other.
	35	…we measure gaps between current and expected performance.

Appendix C (Chapter 4)
Original scales and items related to Social Individual Learning

Table C1
Original scales and items related to Social Individual Learning

Factor	Item		
Learning from feedback	40	If I think I have not done my work well, I discuss this with colleagues.	Item 52 we developed ourselves. All other items are derived from the 'asking for feedback scale' of the critically reflective work behavior instrument (Van Woerkom, 2003). Items 45, 47 and 61 were adapted to the context.
	45	I ask my students what they think of my lessons.	
	47	I discuss future developments in my subject(s) and/or in the industry with colleagues.	
	48	I ask my supervisor for feedback.	
	51	I discuss with colleagues how I have developed.	
	52	I let colleagues observe my work.	
	56	If I think I have my work badly, I discuss this with my supervisor.	
	57	I invite colleagues to assess my work critically.	
	61	I discuss with colleagues new developments in education, teaching and learning.	
	64	I ask my colleagues for feedback.	
Learning from knowledge sharing	37	I regularly inform my colleagues of what I am working on.	Item 39 we developed ourselves. All other items are derived from the 'knowledge sharing scale' (Van de Hooff & Huysman, 2008).
	39	I discuss things I feel uncertain about with colleagues.	
	59	When a colleague is good at something, I ask him/her to teach me.	
	66	When I need certain knowledge, I ask my colleagues about it.	
Learning from collaboration	22	… my colleagues give me positive feedback about my teaching.	All items are derived from the 'collaboration among teachers scale' (Geijsel et al., 2009).
	27	… my colleagues give me support when I try out new teaching methods.	
	31	… my colleagues discuss new teaching methods with me (contra-indicative item).	
	34	… my colleagues pass on to me things they have learned from further training.	
	36	… my colleagues are only interested in their own lessons (contra-indicative item).	

Appendix D (Chapter 4)
Final scales and items related to Individual Learning in Interaction

Table D1
Final scales and items related to Individual Learning in Interaction

Factor	Item	
Individual learning in interaction	37	I regularly inform my colleagues of what I am working on.
	40	If I think I have not done my work well, I discuss this with colleagues.
α_A= 0.84		
α_B= 0.81	45	I ask my students what they think of my lessons.
	47	I discuss future developments in my subject(s) and/or in the industry with colleagues.
	48	I ask my supervisor for feedback.
	57	I invite colleagues to assess my work critically.
	59	When a colleague is good at something, I ask him/her to teach me.
	64	I ask my colleagues for feedback.

Appendix E (Chapter 4)
Original/final scales and items of Transformational Leadership

Table E1
Original/final scales and items related to Transformational Leadership

Factor	Item	My team leader…	
Initiating vision	70	… makes use of all possible opportunities to communicate the departments vision to the team, the students, the hospitality industry and others.	All items are derived from the Transformational Leadership Questionnaire (TLQ) (Geijsel et al., 2009).
α_A= 0.86	75	… clearly defines current problems from the perspective of a vision of future of the department.	
α_B= 0.88	79	… explains to the team the relationship between the departments vision and initiatives taken by the school board, alliances and the national government.	
	82	… outlines during meetings how the vision of the future of the department affects departments life at the present time.	
	85	… refers explicitly to the departments objectives during the decision making process.	
Intellectual stimulation	71	… encourages teachers to try new things in line with their own interests.	Items 73 and 86 are advised by Dr Geijsel in personal communication (March 4, 2009).
	72	… creates sufficient opportunities for teachers to work on their personal development.	
α_A= 0.89	73	… helps teachers to verbalize and clarify their personal ideas about education.	
α_B= 0.91	74	… encourages teachers to seek and discuss new information and ideas that are relevant to the direction in which the department is developing.	All other items are derived from the TLQ (Geijsel et al., 2009).
	77	… engages individual teachers in ongoing discussion about their personal professional goals.	
	78	… encourages teachers to experiment with new teaching methods.	
	83	… helps teachers to reflect on new experiences that they have gained on the job.	
	86	… encourages teachers to think of ways on how to improve (within) our department.	
Individualized support	76	… shows appreciation when a teacher takes the initiative to improve teaching.	Item 80 is advised by Dr Geijsel in personal communication (March 4, 2009).
	80	… is sensitive to problems that teachers experience with the implementation of innovations.	
α_A= 0.85	81	… listens carefully to the ideas of members of the team.	
α_B= 0.87	84	… takes the beliefs of individual teachers seriously.	
	87	… helps teachers to put their emotions into words.	All other items are derived from the TLQ (Geijsel et al., 2009).

Appendix F (Chapter 4)
Intra-class correlations

Table F1

Intra-class correlations for all items related to Collective Learning, Social Individual Learning and Transformational Leadership

Item[1]	Intra-class correlation (*ρ*)		Item[1]	Intra-class correlation (*ρ*)		Item[1]	Intra-class correlation (*ρ*)	
	Sub-sample A	Sub-sample B		Sub-sample A	Sub-sample B		Sub-sample A	Sub-sample B
1	0.19	0.21	***30***	0.14	0.07	**59**	0.07	0.00
2	0.20	0.27	**31**	0.13	0.16	**60**	n.a.[3]	n.a.[3]
3	0.10	0.12	***32***	0.04	0.06	**61**	0.04	0.01
4	n.a.[2]	n.a.[2]	**33**	n.a.[2]	n.a.[2]	**62**	n.a.[3]	n.a.[3]
5	0.06	0.10	**34**	0.11	0.09	**63**	n.a.[3]	n.a.[3]
6	0.20	0.13	***35***	0.15	0.09	**64**	0.09	0.01
7	0.11	0.13	**36**	0.02	0.08	***65***	0.11	0.06
8	0.11	0.18	**37**	0.05	0.04	**66**	0.02	0.05
9	0.09	0.13	***38***	0.08	0.13	***67***	0.09	0.03
10	0.03	0.05	**39**	0.09	0.03	**68**	n.a.[3]	n.a.[3]
11	0.20	0.05	**40**	0.09	0.00	**69**	n.a.[2]	n.a.[2]
12	0.07	0.15	**41**	n.a.[3]	n.a.[3]	**70**	0.19	0.26
13	0.00	0.06	***42***	0.18	0.08	**71**	0.09	0.11
14	0.07	0.03	**43**	n.a.[2]	n.a.[2]	**72**	0.10	0.09
15	n.a.[2]	n.a.[2]	**44**	n.a.[3]	n.a.[3]	**73**	0.10	0.11
16	0.00	0.11	**45**	0.13	0.04	**74**	0.06	0.08
17	0.13	0.00	**46**	n.a.[3]	n.a.[3]	**75**	0.26	0.13
18	n.a.[2]	n.a.[2]	**47**	0.06	0.06	**76**	0.07	0.06
19	0.04	0.00	**48**	0.04	0.03	**77**	0.07	0.04
20	0.14	0.06	**49**	n.a.[2]	n.a.[2]	**78**	0.12	0.10
21	0.15	0.02	**50**	n.a.[3]	n.a.[3]	**79**	0.22	0.09
22	0.16	0.10	**51**	0.10	0.06	**80**	0.14	0.18
23	0.10	0.01	**52**	0.02	0.01	**81**	0.21	0.12
24	0.18	0.00	**53**	0.00	0.04	**82**	0.21	0.13
25	0.25	0.10	***54***	0.03	0.01	**83**	0.11	0.15
26	0.11	0.13	***55***	0.09	0.00	**84**	0.23	0.10
27	0.10	0.07	**56**	0.05	0.07	**85**	0.18	0.11
28	0.09	0.00	**57**	0.10	0.00	**86**	0.16	0.14
29	0.02	0.04	**58**	n.a.[2]	n.a.[2]	**87**	0.12	0.18

Notes:

1) Items indicated in italics relate to the construct of 'collective learning', underlined items relate to the construct of 'social individual learning', and all remaining items relate to the construct of 'transformational leadership'.

2) *ICC* is not available, because the item was excluded from the analysis.

3) *ICC* is not available, because the corresponding scale is not applied in the current research.

Appendix G (Chapter 4)
Descriptives for the (sub-)scales of Individual Learning in Interaction, Collective Learning and Transformational Leadership

Table G1

Descriptives for the computed (sub-)scales of Individual Learning in Interaction (ILI), Collective Learning (CL), and Transformational Leadership (TL), including scale average (M), range, and standard deviation (SD), in both subsamples A and B

	M*	Range*	SD
ILI: Individual learning in interaction	A 2.81	A 1.38 – 4.00	A 0.55
	B 2.92	B 1.13 – 4.00	B 0.52
CL: Shared vision	A 2.50	A 1.00 – 4.00	A 0.63
	B 2.65	B 1.14 – 4.00	B 0.67
CL: Dialogue and inquiry	A 2.67	A 1.00 – 4.00	A 0.60
	B 2.75	B 1.17 – 4.00	B 0.60
CL: Collective action	A 2.83	A 1.33 – 4.00	A 0.55
	B 2.95	B 1.00 – 4.00	B 0.56
CL: Evaluation and reflection	A 2.20	A 1.00 – 4.00	A 0.58
	B 2.38	B 1.14 – 4.00	B 0.60
TL: Initiating vision	A 2.51	A 1.00 – 4.00	A 0.76
	B 2.73	B 1.00 – 4.00	B 0.78
TL: Intellectual stimulation	A 2.48	A 1.00 – 4.00	A 0.66
	B 2.72	B 1.00 – 4.00	B 0.71
TL: Individualized support	A 2.67	A 1.00 – 4.00	A 0.74
	B 2.80	B 1.00 – 4.00	B 0.77

* Scale scores may vary from 1.00 to 4.00

Appendix H (Chapter 4)
Correlations among the latent variables in the full structural equation models

Table H1

Correlations of the factors relating to Collective Learning (CL), Individual Learning in Interaction (ILI) and Transformational Leadership (TL) in full structural equation Model 1, modeling Collective Learning as a second-order factor

	CL SV	CL DI	CL CA	CL ER	CL (2^{nd})	ILI
CL: Dialogue and inquiry	A 0.72	–				
	B 0.68	–				
CL: Collective action	A 0.57	A 0.63	–			
	B 0.62	B 0.69	–			
CL: Evaluation and reflection	A 0.70	A 0.77	A 0.61	–		
	B 0.62	B 0.69	B 0.63	–		
CL: Collective learning (2^{nd} order)	A 0.81	A 0.89	A 0.71	A 0.87	–	
	B 0.78	B 0.87	B 0.79	B 0.80	–	
ILI: Individual learning in interaction	A 0.57	A 0.62	A 0.50	A 0.61	A 0.70	–
	B 0.64	B 0.71	B 0.64	B 0.65	B 0.82	–
TL: Initiating vision	A 0.44	A 0.48	A 0.38	A 0.47	A 0.54	A 0.33
	B 0.52	B 0.58	B 0.53	B 0.53	B 0.66	B 0.52
TL: Intellectual stimulation	A 0.52	A 0.57	A 0.46	A 0.56	A 0.64	A 0.39
	B 0.53	B 0.59	B 0.54	B 0.54	B 0.68	B 0.53
TL: Individualized support	A 0.49	A 0.54	A 0.43	A 0.53	A 0.61	A 0.37
	B 0.51	B 0.56	B 0.51	B 0.52	B 0.65	B 0.51
Transformational leadership (2^{nd} order)	A 0.54	A 0.60	A 0.47	A 0.58	A 0.67	A 0.41
	B 0.56	B 0.62	B 0.57	B 0.57	B 0.72	B 0.56

Table H1 *(continued)*

	TL IV	TL IST	TL ISU
CL: Dialogue and inquiry			
CL: Collective action			
CL: Evaluation and reflection			
CL: Collective learning (2^{nd} order)			
ILI: Individual learning in interaction			
TL: Initiating vision	–		
	–		
TL: Intellectual stimulation	A 0.78	–	
	B 0.88	–	
TL: Individualized support	A 0.79	A 0.81	–
	B 0.84	B 0.86	–
Transformational leadership (2^{nd} order)	A 0.87	A 0.89	A 0.91
	B 0.93	B 0.95	B 0.91

Table H2

Correlations of the factors relating to Collective Learning (CL), Individual Learning in Interaction (ILI) and Transformational Leadership (TL) in a full structural equation Model 2, modeling Collective Learning as a process with the factor dialogue and inquiry at its core

	CL SV	CL DI	CL CA	CL ER	ILI
CL: Dialogue and inquiry	A 0.81	–			
	B 0.80	–			
CL: Collective action	A 0.55	A 0.67	–		
	B 0.57	B 0.71	–		
CL: Evaluation and reflection	A 0.68	A 0.84	A 0.57	–	
	B 0.63	B 0.79	B 0.56	–	
ILI: Individual learning in interaction	A 0.54	A 0.67	A 0.45	A 0.56	–
	B 0.59	B 0.74	B 0.52	B 0.58	–
TL: Initiating vision	A 0.42	A 0.52	A 0.35	A 0.43	A 0.33
	B 0.51	B 0.63	B 0.45	B 0.50	B 0.52
TL: Intellectual stimulation	A 0.50	A 0.62	A 0.42	A 0.52	A 0.39
	B 0.52	B 0.65	B 0.46	B 0.51	B 0.53
TL: Individualized support	A 0.47	A 0.59	A 0.39	A 0.49	A 0.37
	B 0.50	B 0.62	B 0.44	B 0.49	B 0.51
Transformational leadership (2nd order)	A 0.52	A 0.64	A 0.43	A 0.54	A 0.41
	B 0.55	B 0.68	B 0.48	B 0.54	B 0.56

Table H2 *(continued)*

	TL IV	TL IST	TL ISU
CL: Dialogue and inquiry			
CL: Collective action			
CL: Evaluation and reflection			
ILI: Individual learning in interaction			
TL: Initiating vision	–		
	–		
TL: Intellectual stimulation	A 0.77	–	
	B 0.88	–	
TL: Individualized support	A 0.79	A 0.81	–
	B 0.84	B 0.86	–
Transformational leadership (2nd order)	A 0.87	A 0.89	A 0.91
	B 0.93	B 0.95	B 0.91

Appendix I (Chapter 4)
Frequencies for background variables and related dummy variables

Table I1
Frequencies for background variables for the total sample (n = 476)

Background variable		Absolute frequency	Relative frequency
Gender	Male	226	48.7
	Female	238	51.3
	Total	464	100.0
Age	≤ 19 years	1	0.2
	20 - 29 years	44	9.5
	30 - 39 years	118	25.4
	40 - 49 years	148	31.8
	50 - 59 years	128	27.5
	≥ 60 years	26	5.6
	Total	465	100.0
Educational level	Lower vocational education	9	1.9
	Higher vocational education	163	35.1
	University	293	63.0
	Total	465	100.0
Employment status	Part-time contract, ≤ 2 days per week	65	14.1
	Part-time contract, > 2 days per week	220	47.6
	Full-time contract	177	38.3
	Total	462	100.0

Table I2
Frequencies of the dummy variables for the total sample after deletion of participants in the sample with educational level 'lower vocational education' (n = 467)

Background variable	Dummy variable	Absolute frequency
Gender	Male (w.r.t. female)	220 (235)
Age	30 - 49 years (w.r.t. ≤ 19 years)	260 (45)
	≥ 50 years (w.r.t. ≤ 19 years)	151 (45)
Educational level	Research university (w.r.t. university of applied sciences)	293 (163)
Employment status	Part-time contract, > 2 days per week (w.r.t. part-time contract, ≤ 2 days per week)	219 (62)
	Full-time contract (w.r.t. part-time contract, ≤ 2 days per week)	172 (62)

Appendix J (Chapter 5)
Interview guidelines for the case study

Table J1

Interview guidelines for the interviews held with staff in the best practice cases with respect to the innovation project career guidance program (CGP)

Theme	Question
Development of the CGP	What is the vision on the CGP? To what extent is the vision on the CGP communicated to the team members? To what extent is the vision on the CGP shared by the team members? What happens if team members disagree on the vision on the CGP? Is the vision on the CGP open to change? What is the content of the CGP? How was the CGP developed (with respect to vision and content)? Ups and downs? Did you have influence on the development of/content of the CGP? If so, how? Were you involved in the development of the CGP? Why (not)? If so, how? Currently, are there plans to (further) develop the CGP?
Professional development	In preparing to be a CGP-teacher, did you learn new things? What things regarding CGP would you like to learn in the future? As a CGP-teacher, do you learn from your students? If so, how? As a CGP-teacher, do you learn from experiences from other departments and/or educational institutes? Examples? To what extent do you share experiences and /or new ideas with respect to the CGP with colleagues? Examples? Do you share successes, failures, difficulties and/or learning experiences? Do you evaluate the CGP individually and/or as a team? If so, what happens with the results? Are results related to the vision/goals? Do you reflect individually and/or as a team on the experiences gained with the CGP? As a CGP-teacher, do you experiment with new approaches? Examples?
Experiences with CGP	What (positive/negative) experiences do you have with CGP? What makes you feel (un)comfortable as a CGP-teacher? To what extent do you feel supported in your task as a CGP-teacher? Examples? What are the main roles of CGP-teachers? Examples? Do all teachers qualify as a CGP-teacher? Examples? For CGP, to what extent do you work together with other (CGP)-teachers? Why (not)? If you have questions about CGP, who do you turn to?
Leadership*	To what extent are teachers expected or encouraged to contribute to actively share knowledge and experiences with respect to CGP? Are teachers provided with time and space to actively share knowledge and experiences with respect to CGP? To what extent does your team leader listen to ideas and problems of CGP-teachers? To what extent does your team leader stimulate you to think about ideas to improve the CGP and to experiment with new approaches? To what extent does your team leader show appreciation if you take an initiative to improve the CGP? To what extent does your team leader stimulate collaboration among teachers? To what extent does your team leader operate based on an explicit vision on CGP?

*Depending on the participant's position in the team, questions were formulated either from the perspective of a team member ("does your team leader..."), or the team leader ("do you...").

Table J2

Interview guidelines for the interviews held with students in the best practice cases with respect to the innovation project career guidance program (CGP)

Theme	Question
The CGP	What is the content of the CGP during the four years of the curriculum? What do you consider the goal of the CGP? What are the most important things you have learning during the CGP? Are you interested in the CGP? Why (not)? What do you (dis)like about the CGP? What motivates you in your studies?
CGP meetings with your CGP-teacher	What topics are discussed in the meetings with your CGP-teacher? What topics would you like to discuss in the meetings with your CGP-teacher? What is the course of the meetings? How can your CGP-teacher help you to achieve your goals?
Your CGP-teacher(s)	What characterizes a good CGP-teacher? To what extent do you consider different CGP-teachers to have comparable ideas about CGP? To what extent does your CGP-teacher customizes his/her CGP-classes?
Your talents	Can you point out your talents? If so, what talents do you have? Where did you learn about your talents? To what extent did you learn about your talents with CGP?
Your future work	What kind of work would you like do once you have finished your studies? Do you have ideas on the type of work that best fits you? Please explain. If so, where did you develop those ideas? What was the contribution of the CGP? What do you do in order to increase your chances of getting the job you want (e.g., what choices do you make, what activities do you undertake)?
Making choices	Are you able to adequately make choices within and outside your studies? Examples? How do you make career related choices (e.g., choosing your studies, a job, or an internship)? Examples? How do you prefer to be guided in making such choices?
Your influence within the curriculum	At what point(s) in your studies are you able to influence what/how you learn? Examples?

Appendix K (Chapter 5)
Content of the Career Guidance Program

In the quantitative research (Kuijpers & Meijers, 2012) it became clear that in the best-practice cases, students found their learning environment to be inquiry and practice based as well as dialogical. How the learning environments were set up is explained per case in the following section.

Case 1. The dialogical aspect of the learning environment can be seen in the interviews that show the academy's culture, which was focused on teaching students and colleagues to direct their own learning processes by means of a dialogue with colleagues and relevant others. Approaches that are used are study circles, intervision, and supervision. The inquiry-based aspect shows up in the fact that students are encouraged to promote themselves based on their ambitions and capabilities. The basis for the personal development which happens in the study circles is the personal development plan (POP). Via ongoing reflection, the student is constantly stimulated to translate work experiences into consequences for his/her professional development. Reflection on experiences and the supportive dialogues, help him to develop a vision of 'his' place in the field, which contributes to him promoting himself and creating a personal learning path. The insights that the student gains in the study circle with regards to his own ambitions, qualities and growth points form the foundation of the development of his POP. The practice-based aspect is expressed in the fact that students work on as many 'real life' work tasks as possible and create products that are in line with the actual field of work they're engaged in. Not only the learning but also the evaluation of students happens based on the products that they develop. They legitimize their products in their portfolio and with that explicitly attach those experiences to their personal development and their POP. As a result this learning process becomes explicitly bound to the career guidance of students.

Case 2. The practice-based nature of the learning environment can be seen in the institution's approach to competencies. This approach is characterized by students working in typical work situations: situations that commonly occur in the profession. These situations are a rich and meaningful learning environment for the learning process, as well as for the evaluation process. Within the professional situations a student works in a (simulated) professional work setting developing 'characteristic pieces of proof', products that can be seen as evidence of proficiency. The student includes these products in his/her portfolio and a 'summarizing assessment' follows regarding the work situation. The inquiry-based aspect can be seen in the 'heart' of the curriculum; it is aimed at supporting students in the development of a personal profile with which they can eventually leave. In dialogue with others and based on the structured assignments, students learn – by developing career competencies – on the one hand to know their ambitions, identity, values and beliefs, strong and weak points, and on the other hand to identify the work that suits them. With this combination of elements they learn to formulate learning- and development wishes and to consequently create a learning environment so that they can work to fulfill those. Within the curriculum, students have a choice of various work situations and are encouraged by their guidance counselor to find a fitting work placement so they can work on their learning goals. The guidance of students is continually aimed at supporting them in determining and adjusting a learning track

that fits with their personality, their wishes, future possibilities, and professional ambitions. The personal development plan (POP), personal activity plan (PAP) and portfolio are utilized as guidance instruments. We see the dialogical nature of this case in the importance the academy ascribes to social learning, learning together and in dialogue with others. In small groups and in conversation with peers and a guidance counselor, students work on the development of career competencies; in the group they simultaneously develop their own learning and development track. This form of group guidance is complemented by individual guidance conversations between students and their career counselors. The coaching approach of career counselors contributes strongly to the activating nature of the conversations.

Case 3. The practice-based nature of the learning environment can be seen here (again) in the focus on competencies. In the set up of the learning environment, a practice-directed and career-oriented approach are at the core of the curriculum and this shows up in the focus on working in actual professional situations. In other words, wherever possible learning takes place in 'real life' situations and students work in response to tasks aimed at developing actual products. By applying a variety of approaches here, the institution aims to give students as strong a learning environment as possible. In the course of the program, learning done in the school decreases in favor of learning done outside the school, which in part, means that more attention is paid to work placements. Not only learning, but also evaluations take place as much as possible in 'real life' situations with the use of the portfolio and assessment. Assessment takes place in a dialogue between one or more students or one or more assessors. The inquiry-based aspect of the learning environment shows up in that the curriculum is set up to allow students to make choices that fit with their own learning- and development track. The choice-based track is created based on a Personal Educational plan (wishes with regard to educational units and work placements) and a Personal Activity Plan (making concrete plans and attention paid to working within the actual professional setting). The curriculum not only offers the student the space to ask questions, but the academy, the field, and society are also welcome to ask questions. Various cooperative relationships exist between the school and the field, therefore the curriculum is continually developing in tandem with what the field demands. The dialogical nature of education is something that shows up in this case in the value the academy ascribes to social learning: learning together and in dialogue with others. The guidance of students (e.g. assessments) takes place in small groups, where students develop – with their mentoring teacher – based on their talents, ambitions, and experiences a career perspective, where they give shape to their personal development and learning track, where they reflect on their experiences and where they learn to develop alternate plans. This type of guidance is complemented by talks with guidance counselors where students are encouraged to ask questions about the choices they've made and the experiences they've had. This conversation is both the completion of the earlier learning track and the start of the one that will follow. It connects the various learning cycles the student has completed into a continuous learning process.

Appendix L (Chapter 5)
Adjusting the framework of analysis for the cross-case analysis

Collective Learning

Based on the content of the relevant quotes and the overlap between categories representing dissimilar aspects, some adjustments were made to the model of 'collective learning' as described in our theoretical framework (see Chapter 2). Notwithstanding our efforts to formulate categories with a limited amount of overlap, a number of quotes was assigned more than one code. Such a result suggests that the various aspects of 'collective learning' are interrelated, a result which is in line with the observed correlations between the scales measuring the aspects of 'collective learning' in Study 1a (*r* is in the range 0.44 to 0.81, see Chapter 3, Table 3.3). In coding the quotes, the following adjustments were made to our framework of analysis.

The main categories 'information generation' and 'information distribution' were merged into a new main category, namely: 'information generation and distribution'. Most of the quotes concerning information generation or distribution are in fact related to information exchange, implying both generation and distribution at the same time. When team members, for example, offer a training to other team members, this indicates that there is both information generation (for the trainees) and information distribution (for the trainers). As a result, in the best practice cases aspects of 'collective learning' are interwoven and differ insufficiently to warrant distinctive categories.

The quotes that were originally assigned to the main category 'dialogue and inquiry' can roughly be divided into two categories: one relating to the process of dialogue itself or the outcome of the process and another relating to a dialogical learning attitude. Based on this observation, we revise the term 'dialogue and inquiry' and change it to 'dialogue and a dialogical learning attitude'.

Within the main category 'evaluation and reflection', no quotes were identified that refer to reflection. Therefore, the category was renamed 'evaluation'. While no direct references were made about reflection, a number of indirect references could be identified; in Case 1 intervision is considered an important method for teachers to learn in the context of CGP. As Verbiest (2004) points out, by means of this method, teachers predominantly focus on reflecting (in interaction) about their own professional activities and behavior. Verbiest contrasts this with collegial consultation, which is aimed at advising colleagues on problems in daily practice. However, despite this theoretical notion, participants in Case 1 associate intervision with problem solving and the creation of a shared understanding, and not so much with reflection. Therefore, these quotes were assigned to the dimensions 'information generation and distribution' and/or 'dialogue and a dialogical learning attitude' (depending on the participant's intent).

A number of quotes were identified which cannot not be directly related to one of the main categories of 'collective learning', but were, however, associated with team level learning. Such quotes either indicate a learning approach to the innovation process, or they emphasize the (collective) development of team members as part of the innovation process. Be-

cause of the close relationship of these themes with 'collective learning', the additional category 'learning orientation', with these themes as sub-categories, was added to the coding scheme.

Transformational Leadership

Some adjustments were also made to the model of 'transformational leadership' described in our theoretical framework (see Chapter 2).

In coding we noted that it was often difficult to assign a quote to either 'individualized support' or 'intellectual stimulation', as one could argue that either or both dimensions were applicable. The following quote is illustrative in that respect:

> *"When team members present ideas that don't correspond with the vision then you do look at the possibilities and sometimes you have to say, "that's not possible". But I don't think that's bad, because that makes you more creative and then you say to yourself, "how are you going to deal with this or what other routes could you take, how are you going to do that in the future or in which phase do you want to do something about it?".*

In this quote the team leader indicates that she carefully listens to the ideas of team members ('individualized support'), and encourages teachers to discuss ideas that are relevant to the direction in which the department is developing ('intellectual stimulation'). In the cases the two dimensions seemed to be interwoven and we therefore placed relevant quotes in both categories. Such results are in line with the observed correlations between the scales measuring the dimensions of 'transformational leadership' in Study 1b (r = 0.88 in subsample A, r = 0.92 in subsample B, see Chapter 4, Table 4.6). Within the subset of quotes for 'individualized support and intellectual stimulation', we identified two themes, which we described as 'fostering innovation' and 'acknowledging team (members') strengths and supporting team (members') development'.

Appendix M (Chapter 5)
Quotes illustrating Collective Learning

Table M1
Quotes illustrating the sub-categories that are identified for each of the aspects of Collective Learning

Sub-categories for the aspects of Collective Learning	Illustrating quote
1. Shared vision	
– Emphasizing the importance of a shared vision	If you don't continue to think based on a vision or from the policy then the CGP becomes a kind of water-down form.
– Indicating the presence of a shared vision	This change is fully supported, which is important.
– Indicating that the vision is embedded in the organization's vision	We really work from a vision and that is fortunately strongly supported by the academy's vision, which we've included in it. That really led to a memo about this and that was also adopted by the policy-making team. As in this has priority. We put it so that, really, in principle, everyone is facing the same direction.
– Indicating a lack of agreement or commitment to the vision	At first there were two different, opposing ideas about career guidance. On the one hand people were really enthusiastic to work with students about personal things, on the other hand there were those who didn't want to 'take psychology' and make things explicit. In particular the older teachers are not used to it and fall under the second category. This led to tensions, because people really stood opposite one another.
– Indicating that team vision is developed in dialogue between team members	Then we figured, we're going to get together (with someone from the outside) and just really take a critical look at the question: "what is reflection" and "how are we going to do that with our students?" That is a way to get a clear vision again.. By doing this one morning in a room together, there was clarity and we don't have anymore static about that morning: "this is how we're going to do it and that's it!"
2. Information generation and distribution	
– Structured collegial knowledge exchange	Career counselors are included in a 'buddy system' where a senior is paired up with a junior. Next to that intervision and schooling exists.
– Personal deliberation/collegial consult	Amongst each other we easily exchange experiences because we share a room.

Table M1 *(continued)*

Sub-categories for the aspects of Collective Learning	Illustrating quote
– (Sub-)team meetings/ information meetings	During the team days we had a conversation about the vision, the goals, and the concrete ways in which we could achieve them.
– Information distribution via documentation (handbook)	And the hand book. Trying to write clearly so that it's at least clear from the hand book what the intention is.
– Information generation via hiring new staff	There are more and more people who come in as teachers who have studied and people who have tried the 'old' ideas in practice. These people have new ideas. This created momentum for change of course: the frozen ideas turned out to no longer work in practice.
– Information generation via participation in schooling/trainings	In order to work out the school themes we worked with theme creators who had a year to express and work on their themes. In the first six months this development was supported by a didactical schooling approach, within which they could work on their ideas independently (but with guidance).
– Information distribution via offering schooling/trainings	We remained very connected to university-wide developments, also the training that was developed from that. We had a part to play in that as well, a number of us, and you contribute your strength, you do. So that the training that was given Saxon-wide also fit with us. That's how you keep that alive.
– Information exchange with students	At what point do you refer if the problem is too big? You're not a caregiver, so we wrestled with each other about that and that's why we had our intervision: what do we encounter, why is it that this group is not working right?
– Information exchange with other studies within the institute	The money that was freed up through the higher vocational school for organizational development was used to start various projects with participants from the three different programs. Various project groups were started up, among others the project group CGP.
– Information exchange with parties outside the institute	Where do the ideas for career guidance come from? There are collaborative projects among several vocational schools, various methods came from that. Scientific research was another source.

Table M1 *(continued)*

Sub-categories for the aspects of Collective Learning	Illustrating quote
3. Dialogue and inquiry	
– Emphasizing the importance of dialogue and a dialogical learning attitude	That remains the foundation…daring to communicate openly with one another, having that conversation, daring to disagree, it also has to do with …and not seeing a conflict as "now we have a problem with each other that will never be okay", or I know…But it's a game you have to play with one another, I think. Dare to play.
– Indicating that diverse and/or conflicting ideas are discussed	But when you say that you yourself, are walking around with the sense, I want to share my vision, or I want to express my thing, in a manner of speaking, that's the foundation, I think, that you only, and I think that's what it's about here, that you talk about that with one another
– Indicating that shared understanding is created in dialogue	Through the study days people in the team worked together to arrive at a new educational model. Teaching was stopped for a week to create time for this. Important questions about this were: "how do we define inquiry-based and competence-based education.
4. Collective action	
– Indicating individual approaches as a result of linking up with the teachers	Also the teaching style, because that also plays a part. Like, how do you actually do certain things. You can never say, this is what a lesson should look like. Since the teacher has his own qualities, students ask for more, otherwise.
– Indicating individual approaches as a result of linking up with the students	The hours of supervision and the guidance hours can be fill by teachers as desired, dependent on their preferred style…the group. The question that is most important is: "what is the meaning of the experiences I'm (the student) having for my personal growth.
– Acknowledging differences in individuals' approaches	There are differences each year and per person with regards to how career guidance is 'filled in' (frequency of contact with the group and which part of the group invites you to do career guidance lessons). Everyone fills those hours, but have their own concept of career guidance.

Table M1 *(continued)*

Sub-categories for the aspects of Collective Learning	Illustrating quote
– Indicating acceptance of differences in individuals' approaches	Look, you can say, "one supervisor from practice evaluates things differently than another." Yes, that's true. But is that bad? If only one person is constantly evaluating that student, then things can go awry. But that is also…there should be more assessors. So, different situations and a mix of assessors. And in that case I have faith in the process; if you do this three years in a row and get feedback that shows that you're still doing okay, then I think, "okay, in that case, it's fine."
– Indicating acceptance of differences provided team goals are met	We're working towards something, an end result you could say, with the whole learning-thread. That doesn't mean that you and I have the same… The intention is that you listen to that student and that you follow that. And also that you're able to achieve your ultimate goal, and with the help of colleagues get ideas about how to fill-in that lesson, how can you, in that conversation, better…It can differ as long as you achieve the goal. And also, you can go left, or right, and then straight ahead. That doesn't matter at all. If it's about those kinds of differences, it's not a problem.
– Indicating negative perception of differences in individuals' approaches	What you notice about career counselors …they all have their own hobbyhorses. So if you look at how it's set up and how difficult it to be good at that role, when you let that go a bit, everyone creates their own approach…But then you lose the connection that should be there. Providing direction in this really is very important.
– Indicating innovation is a product of joint development within the team	In past years a process has been started with the goal to develop new educational models with colleagues instead of having them implemented from the top down.
5. Evaluation	
– Emphasizing the importance of evaluation	Therefore you have to really be aware and keep the vision clearly in view. Otherwise others are just going to say, "why are we doing all this?" Yes, but wait a minute, "this is what we've achieved, that's what we've achieved, that's what we've achieved…"
– Indicating program results are evaluated	The evaluation of the guidance program happens with the two counselors of the fourth study year, based on their own experiences.

Table M1 *(continued)*

Sub-categories for the aspects of Collective Learning	Illustrating quote
– Indicating results are evaluated against vision/goals	…in the team we say, "these are the goals we determined to achieve, also SMART goals, have we achieved these goals, where are we now and what do we want?" So, really we include a continual evaluation in the process.
– Indicating results are evaluated based on students' feedback	A couple of students are interviewed for the study. In any event we ask students if we can make copies of their measurements and reflections. Of course we take the names off. And written interviews.
– Indicating results are evaluated by a committee external to the team	Evaluation of the program in standard fashion by the quality control department. This takes place in a methodologically responsible way and leads to the question, "how do we go on?"

Appendix N (Chapter 5)
Quotes illustrating Transformational Leadership

Table N1
Quotes illustrating the sub-categories that are identified for the dimensions of Transformational Leadership

Sub-categories for the dimensions of Transformational Leadership	Illustrating quote
1.Initiating vision	
– Manager stimulates team members to think about a vision	That team process, really supports the development of the team. At the start of the year, like "hey, we are a team, what do we stand for, which goals do we have?"
– Manager portrays a positive image of a future based on the vision	He (the project leader) aimed at bringing ideas and thoughts to the table and to look for mutual connections. His belief in "we can make something good here" contributed greatly to achieving success.
2/3. Individualized support & intellectual stimulation	
– Manager's involvement in/ commitment to the innovation process	The intervision group sometimes runs better than at other times, not everyone makes use of the possibilities. The role of the team leader is important here too. The previous team leader coached intervision groups, that was super. It gets watered-down, despite the expert group, if the team leader doesn't make it a priority.
– Manager actively influences team culture	A cultural shift is necessary, the manager has to lead the way by example. He/she has to ask for feedback in the performance appraisals for instance.
– Manager is sensitive to problems team members experience with the innovation	As a team leader you have to put the innovation on the agenda. You have to show understanding for those who resist and show them what the new ideas might mean.
– Manager shows appreciation of and offers support to team members in the innovation process where necessary	As manager you can facilitate career counselors … You have to stick to your guns with regards to ideas and people.

Table N1 *(continued)*

Sub-categories for the dimensions of Transformational Leadership	**Illustrating quote**
– Manager stimulates team members to think along about the innovation process	But if people say, “hey, we’ve thought about this and we have an idea, does it fit with what we’re doing?” then that’s possible of course. But do think in terms of, “what are you doing, why do you think that, why do you think that might contribute something…” Or, “how can we do that” you can do that together too, “how should we do that” and “could that contribute to…” and “how and how do we evaluate that if it happens?”
– Manager accepts experimental behavior by team members	The experimentation of teachers is supported as long as they correspond with the principles.
– Manager acknowledges and utilizes the strengths of the team (members)	I think that you reward someone by helping them to discover their strengths lie. And when you notice, “hey, that’s clear, that’s successful and I feel good about it”, that that’s really important. And that you dare to admit that. “Hey, that went really well and we’ve achieved results.”
– Manager supports team (members') development	With new CGP teachers, as team leader, I ask, “what do you think you can and can’t do, what do you have to learning, in what way do you want your support.

Appendix O (Chapter 5)
Relating results of the case study to Verdonschot's theory on design principles for knowledge productivity

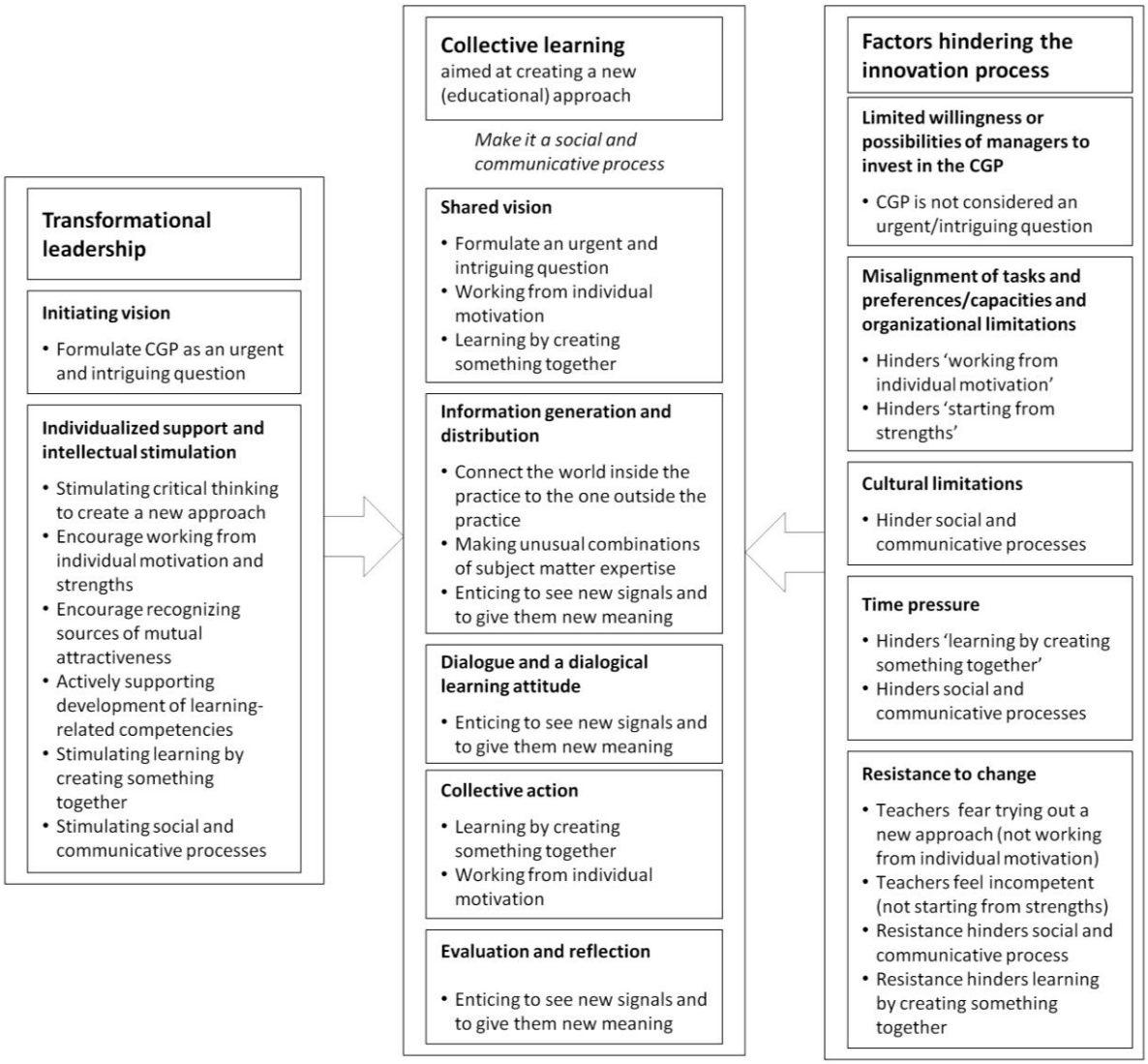


Figure O1. Results of the case study, tentatively interpreted in terms of the design principles important to learning in innovation practice (Verdonschot, 2009, 2011). Design principles: (1) formulate an urgent and intriguing question, (2) create a new approach, (3) work from individual motivation, (4) make unusual combinations of subject matter expertise, (5) work from mutual attractiveness, (6) build on strengths, (7) create something together, (8) entice to see new signals and to give them new meaning, (9) connect the world inside the innovation practice to the world outside, (10) generate creative turmoil, (11) pay attention to the social and communicative process, (12) actively support the development of competences (Verdonschot, 2009, p. 112-113).

Appendix P (Chapter 6)
Team scores of Collective Learning as calculated in the exploration phase of Study 1

Table P1

Team averages (based on provisional scales) for the aspects of Collective Learning, derived at the staring phase of Study 1

Aspect of collective learning	Average Team 1	Average Team 2	Average Team 3	Average Team 4	Average Team 5	Sample average
Shared vision	3.44	2.60	2.68	2.56	2.54	**2.64**
Information generation and distribution	3.42	2.52	2.38	2.34	2.52	**2.41**
Dialogue and inquiry	3.56	2.79	2.67	2.49	2.74	**2.72**
Collective action	3.44	2.82	2.85	2.46	2.56	**2.71**
Evaluation and reflection	3.38	2.70	2.37	2.19	2.53	**2.38**

Appendix Q (Chapter 6)
Example of a product model used in the Knowledge game

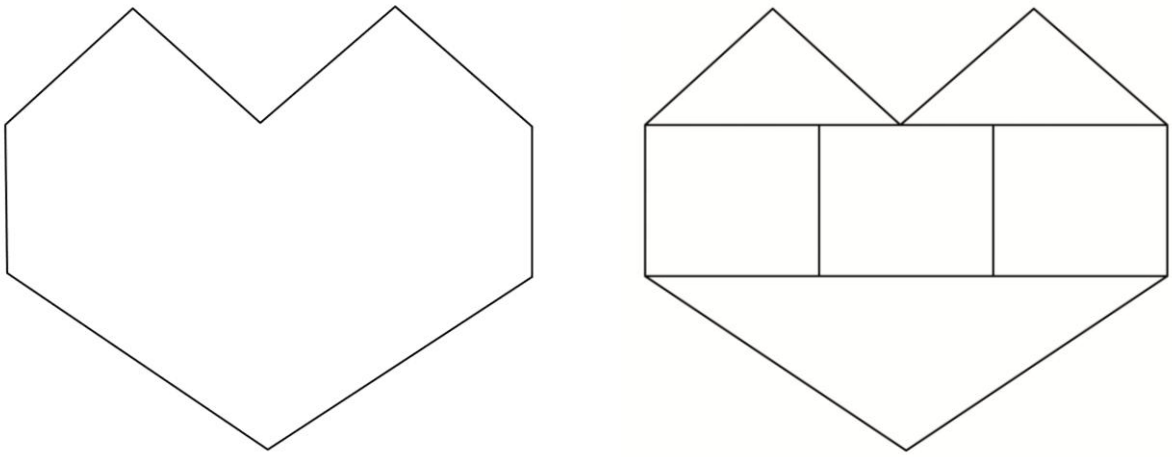


Figure Q1. Example of a product model. The model on the left shows the product model as it is presented on the market. The model on the right shows the inner lines to indicate the Tangram pieces required to assemble the product. Teams are not provided with the latter product model.

Appendix R (Chapter 6)
Observation list for Collective Learning

Table R1
Observation list to be filled in by the team observer during each of the three game rounds

Aspect of the Collective Learning process	Score (0, 1, – 1)[1] assigned to the team by the observer		
	Game round 1	Game round 2	Game round 3
Shared vision			
Team members try to reach agreement on the goals they pursue as a team			
Team members mutual try to get sight on the problems they need to solve as a team			
Team members try to get to an agreement on the preferred development of the team			
Dialogue and inquiry			
Whenever team members state their view, they also ask what others think			
Team members react respectful to each other's ideas, even when those ideas do not match their owns.			
Team members inquiry about each other's ideas ("why?"), regardless of the role distribution in the team.			
Collective action			
Deliberation makes that team members mutually align their activities			
Team members put their problems before others in order to find a solution together			
Team members give each other advice and support with each other's tasks			
Evaluation of the results and reflection on the process			
Together, team members compare the current achievements with the achievements in the previous round			
Together, team members look back (reflect) on the way tasks have been performed within the team			
Together, team members make new agreements and plans based on their reflections			

[1] Score '1' is defined as 'This behavior characterizes the group', score '0' is defined as 'This behavior does not characterize the group, but neither does the opposite behavior', and score –1 is defined as 'This behavior does not characterize the group, the opposite behavior explicitly does'.

Appendix S (Chapter 6)
Examples of behavior characterizing Collective Learning as provided to observers

Table S1
Examples of behavior characterizing Collective Learning

Aspects of Collective Learning			
1. Shared vision: Teacher teams are characterized by teachers who are used to working independently to a high degree and who are used to making their own decisions at work. When teachers don't have a shared vision about the goals they are striving towards, the developments that they consider desirable, and when they can't solve important problems that they are faced with, disintegration can start to occur. A shared ambition (what do we want and how do we get there?) can create cohesiveness among the team members and working towards a goal creates a joint vision that can influence the actions of individuals in the direction of the desired result.			
The behavior		**Absence of the behavior**	**Opposite behavior**
Behavior	The team members try to achieve agreement about the goals that they should strive to achieve within the gain.	The team members start the first round without discussing what the team would like to achieve.	The team members divide the tasks in the game without a dialogue about it (e.g., "If everyone does what they're good in, then things will be fine").
Effect	*The team members play the game from a shared idea about the goals of the game and how they should be achieved.*		*The team members strive towards their own personal goals (for example because they think that it will be fine or because they enjoy a particular task).*
Behavior	Together the team members get a grasp of the problems they must solve as a team.	The team members focus on the problems they encounter as individuals, although they do not explicitly decide on this.	The team members believe that everyone in the team should solve the problems associated with their own task (e.g. "That's not my task, that's your area").
Effect	*The team members share a view about which problems that they need to solve.*		*The team members have different ideas about the problems that the team has to solve and don't agree on what those are (or don't try)*
Behavior	The team members try to agree on the desired direction of the team.	The team members individually focus on possibilities for development without a discussion with the other team members.	The team members believe that everyone should see the possibilities about what is possible and make use of those (e.g. "You know what is best or good, that is your area".).
Effect	*The team members have a common idea about the desired direction of the team.*		*The team members have different ideas about the desired development of the team and can't agree on those (or don't try).*

Table S1 *(continued)*

2. Dialogue and inquiry: The diversity of ideas within a team can strongly enrich and improve the group's joint activities. In order to get ideas on the table, team members must actively seek out the ideas of other team members. This requires that they are open to new ideas, even when those ideas differ (strongly) from their own ideas. It also means that the team members speak openly about their ideas and share more about arguments and thoughts that are behind those ideas. Conversations are aimed at finding added value in the differing perspectives (ideas), they are not aimed at convincing someone about being "right". The "why-question" is often asked to gain more understanding about what other think and do. Team members respect one another's ideas. The status/position/role of the team member is not important; everyone possibly has valuable ideas. Team members dare to ask each other what each thinks/says/does. This requires equality.		
The behavior	**Absence of the behavior**	**Opposite behavior**
When offering opinions, team members also ask other team members what they think.	The team members offer their own opinions without trying to convince anyone else. They don't ask what the other team members think or feel.	The team members try to convince other members of the 'rightness' of their ideas without asking about the views and ideas of other team members.
The team members are respectful about others' ideas even when these don't correspond with their own ideas.	The team members don't affirm each other's ideas but they don't reject them either. They don't respond or they respond superficially to one another's ideas.	The team members respond disrespectfully or with contempt to one another's ideas (e.g. "This won't work here, see.", "That's nonsense.", "There is no use in that at all.", "You're not involved with that at all, are you?").
The team members ask about one another's ideas ('why'), regardless of the division of roles.	The team members don't ask about each other's ideas. The 'why' question remains unexplored.	The team members value one opinion over another because of a particular team member's role in the game or someone's status (e.g., a leader; export role).

Table S1 *(continued)*

3. Collective action

By adjusting one's individual contribution (actions) to match the group, team members come to group action. As tasks are divided among the team members, this means that team members don't always have to work on one specific task. In this case, one does adjust one's ideas and actions to match the actions and ideas of others. The 'shared vision' provides the direction, the 'dialogue and inquiry' the process, and the 'collective action' points to the result. As a result of mutual coordination, the actions and methods of the team members correspond more closely and the behavior within the group is more consistent.

The behavior	**Absence of the behavior**	**Opposite behavior**
Discussion between team members ensures that activities and the way things are carried out can be coordinated.	The division of labor means that the individual team members can each do their own tasks. They don't spend time or pay attention to mutual coordination regarding the tasks.	The team members explicitly communicate to one another that they feel it's unnecessary to coordinate their tasks.
The team members share the problems they encounter with one another so they may be discussed.	The division of labor means that individuals are faced with the problems associated with their tasks. They don't share or discuss these problems with each other.	The team members explicitly communicate that they feel that a problem associated with a task is the problem of the one responsible for that task (even if that task is one's own).
The team members give each other advice and support regarding each other's tasks.	Team members carry out their own tasks and don't get involved with the tasks of other team members.	The team members explicitly hold to the task distribution and see no reason to support one another with the tasks (or don't feel themselves capable of helping)

4. Evaluation result and reflection process:

The team members pause and review the results achieved and reflect on the way in which they met their goals. They compare their achievements with other groups or earlier achievements by their own team. Together the team members evaluate whether and to what degree the formulated goals (joint ambition) was achieved and which aspects played a role. They also look at work- and learning processes that have taken place. They come up with ways in which they could be more efficient in the future. Acquired knowledge and insight is discussed and exchanged within the team. The evaluation becomes the starting point for a new cycle of collective learning.

The behavior	**Absence of the behavior**	**Opposite behavior**
The team members compare the current achievements with the ones achieved in the previous game round	The team members pay no attention to comparing achievements of the different game rounds.	The team members consider the achievements of earlier rounds irrelevant to the current round
The team members look back (reflect) on the way in which tasks were carried out.	The team members don't pay attention to the way in which the tasks with the team were carried out.	The team members consider the way in which the tasks have been carried out irrelevant for the current game round.
The team members share the knowledge/insight they have gained with other team members.	The team members neglect to share the knowledge/insight they have gained with other team members	The team members don't want to share the knowledge/insight they have gained with other team members.

Appendix T (Chapter 6)
Teams' and team members' assessment of each of the aspects of Collective Learning

Table T1

Individual scores and team scores (range: 1 to 10) for Team 1 for each of the aspects of Collective Learning during the three game rounds (R1-R3)

	Aspect of Collective Learning											
	Shared vision			Dialogue and inquiry			Collective action			Evaluation and reflection		
Game round	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
Team member 1	8	7	8	7	7	8	7	8	8	7	8	8
Team member 2	6	8	8	7	8	8	7	9	7	8	9	7
Team member 3	4	6	7	7	7	8	7	7	8	9	7	8
Team member 4	5	7	8	7	8	9	8	7	8	5	7	8
Team score	6	7	8	7	9	9	8	9	9	7	8	8

Table T2

Individual scores and team scores (range: 1 to 10) for Team 2 for each of the aspects of Collective Learning during the three game rounds (R1-R3)

	Aspect of Collective Learning											
	Shared vision			Dialogue and inquiry			Collective action			Evaluation and reflection		
Game round	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
Team member 1	5	7	7	4	5	5	5	6	6	6	4	7
Team member 2	5	7	7	7	6	7	7	7	7	1	5	8
Team member 3	8	6	7	7	6	7	8	7	7	6	5	6
Team member 4	4	5	7	6	6	7	7	5	7	6	5	7
Team member 5	6	7	6	3	6	7	3	6	7	2	6	8
Team score	6	7	7	5	5	7	6	7	7	3	5	7

Table S3

Individual scores and team scores (range: 1 to 10) for Team 3 for each of the aspects of Collective Learning during the three game rounds (R1-R3)

	Aspect of Collective Learning											
	Shared vision			Dialogue and inquiry			Collective action			Evaluation and reflection		
Game round	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
Team member 1	9	8.5	8	7	7	8	8	7	8	6	7	8
Team member 2	5	8	9	4	7	8	6	7	8	0	8	8
Team member 3	8	9	8	8	8	8	6	8	7	6	8	8
Team member 4	8	8	9	9	7	9	6	8	9	2	7	9
Team score	8^{-}	8	8.5	7	7^{+}	8^{+}	6.5	7.5	8^{-}	5	7.5	8

Table T4

Individual scores and team scores (range: 1 to 10) for Team 4 for each of the aspects of Collective Learning during the three game rounds (R1-R3)

	Aspect of Collective Learning											
	Shared vision			Dialogue and inquiry			Collective action			Evaluation and reflection		
Game round	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
Team member 1	7	7	4	7	7	4	7	7	4	7	7	4
Team member 2	8	9	4	8	8	3	8	9	2	7	7	1
Team member 3	8	8	6	8	6	7	8	7	6	8	7	6
Team member 4	8	7	5	6	6	5	8	7	5	8	7	4
Team member 5	5	7	6	6	7	7	7	8	6	5	8	5
Team score	8	9	5	7	8	6	7.5	7.5	5	7	7	5

Table T5

Individual scores and team scores (range: 1 to 10) for Team 5 for each of the aspects of Collective Learning during the three game rounds (R1-R3)

	Aspect of Collective Learning											
	Shared vision			Dialogue and inquiry			Collective action			Evaluation and reflection		
Game round	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
Team member 1	7	8	8	7	8	8	7	8	8	6	8	7
Team member 2	8	5	8	5	6	8	7	7	8	5	6	8
Team member 3	3	7	7	7	8	9	7.5	8	9	3	5	-
Team member 4	3	7	8	7	7	8	6	8	8	5	7	7
Team member 5	5	2	7	7	7	7	8	5	8	8	5	6
Team score	6	6	8	7	7	8	7	7	9	7	7	10

Appendix U (Chapter 6)
Overall assessment of Collective Learning by teams and their members

Table U1

Individual scores and team scores reflecting the perceived level of Collective Learning (CL) during the three game rounds (R1-R3); per game round individual and team scores are calculated as the average (individual, respectively team) score on the aspects of 'collective learning' as presented in Tables T1-T5 in Appendix T; for each team an 'average team score' is also calculated, reflecting the numerical average of team members' individual scores of Collective Learning

		Overall score of Collective Learning		
	Game round	**R1**	**R2**	**R3**
Team 1	Team member 1	7,25	7,50	8,00
	Team member 2	7,00	8,50	7,50
	Team member 3	6,75	6,75	7,75
	Team member 4	6,25	7,25	8,25
	Team average score CL	6,81	7,50	7,88
	Team score CL	7,00	8,25	8,50
Team 2	Team member 1	5,00	5,50	6,25
	Team member 2	5,00	6,25	7,25
	Team member 3	7,25	6,00	6,75
	Team member 4	5,75	5,25	7,00
	Team member 5	3,50	6,25	7,00
	Team average score CL	5,30	5,85	6,85
	Team score CL	5,00	6,00	7,00
Team 3	Team member 1	7,50	7,38	8,00
	Team member 2	3,75	7,50	8,25
	Team member 3	7,00	8,25	7,75
	Team member 4	6,25	7,50	9,00
	Team average score CL	6,13	7,66	8,25
	Team score CL	6,56	7,56	8,13
Team 4	Team member 1	7,00	7,00	4,00
	Team member 2	7,75	8,25	2,50
	Team member 3	8,00	7,00	6,25
	Team member 4	7,50	6,75	4,75
	Team member 5	5,75	7,50	6,00
	Team average score CL	7,20	7,30	4,70
	Team score CL	7,38	7,88	5,25
Team 5	Team member 1	6,75	8,00	7,75
	Team member 2	6,25	6,00	8,00
	Team member 3	5,13	7,00	8,33
	Team member 4	5,25	7,25	7,75
	Team member 5	7,00	4,75	7,00
	Team average score CL	6,08	6,60	7,77
	Team score CL	6,75	6,75	8,75

Appendix V (Chapter 6)
Observers' results with respect to Collective Learning

Table V1
Observation list of the three game rounds for Team 1

Aspect of the collective learning process	Score (0, 1, – 1)[1] assigned to the team by the observer		
	Game round 1	**Game round 2**	**Game round 3**
Shared vision			
Team members try to reach agreement on the goals they pursue as a team	–1/0	0/1	–1
Team members mutual try to get sight on the problems they need to solve as a team	0	0	–1
Team members try to get to an agreement on the preferred development of the team	0	0/1	–1
Dialogue and inquiry			
Whenever team members state their view, they also ask what others think	–1	0/1	–1
Team members react respectful to each other's ideas, even when those ideas do not match their owns.	0	–1/0	–1
Team members inquiry about each other's ideas ("why?"), regardless of the role distribution in the team.	0	–1	–1
Collective action			
Deliberation makes that team members mutually align their activities	0	0	–1
Team members put their problems before others in order to find a solution together	0	0	–1
Team members give each other advice and support with each other's tasks	–1/0	0	–1
Evaluation of the results and reflection on the process			
Together, team members compare the current achievements with the achievements in the previous round	–	1	–1
Together, team members look back (reflect) on the way tasks have been performed within the team	0/1	1	–1
Together, team members make new agreements and plans based on their reflections	0/1	1	–1

[1] Score '1' is defined as 'This behavior characterizes the group', score '0' is defined as 'This behavior does not characterize the group, but neither does the opposite behavior', and score –1 is defined as 'This behavior does not characterize the group, the opposite behavior explicitly does'.

Table V2
Observation list of the three game rounds for Team 2

Aspect of the collective learning process	Score (0, 1, – 1)[1] assigned to the team by the observer		
	Game round 1	**Game round 2**	**Game round 3**
Shared vision			
Team members try to reach agreement on the goals they pursue as a team	0	0	1
Team members mutual try to get sight on the problems they need to solve as a team	0	1	1
Team members try to get to an agreement on the preferred development of the team	–1	0	0
Dialogue and inquiry			
Whenever team members state their view, they also ask what others think	1	1	1
Team members react respectful to each other's ideas, even when those ideas do not match their owns.	1	1	1
Team members inquiry about each other's ideas ("why?"), regardless of the role distribution in the team.	0	0	0
Collective action			
Deliberation makes that team members mutually align their activities	0	1	1
Team members put their problems before others in order to find a solution together	1	1	1
Team members give each other advice and support with each other's tasks	0	1	1
Evaluation of the results and reflection on the process			
Together, team members compare the current achievements with the achievements in the previous round	–	–1	–1
Together, team members look back (reflect) on the way tasks were performed within the team	1	1	1
Together, team members make new agreements and plans based on their reflections	1	1	1

[1] Score '1' is defined as 'This behavior characterizes the group', score '0' is defined as 'This behavior does not characterize the group, but neither does the opposite behavior', and score –1 is defined as 'This behavior does not characterize the group, the opposite behavior explicitly does'.

Table V3
Observation list of the three game rounds for Team 3

Aspect of the collective learning process	Score (0, 1, – 1)[1] assigned to the team by the observer		
	Game round 1	**Game round 2**	**Game round 3**
Shared vision			
Team members try to reach agreement on the goals they pursue as a team	1	1	1
Team members mutual try to get sight on the problems they need to solve as a team	0	0	1
Team members try to get to an agreement on the preferred development of the team	0	0	1
Dialogue and inquiry			
Whenever team members state their view, they also ask what others think	1	0	1
Team members react respectful to each other's ideas, even when those ideas do not match their owns.	1	1	1
Team members inquiry about each other's ideas ("why?"), regardless of the role distribution in the team.	0	0	0
Collective action			
Deliberation makes that team members mutually align their activities	1	1	1
Team members put their problems before others in order to find a solution together	0	1	1
Team members give each other advice and support with each other's tasks	0	0	0
Evaluation of the results and reflection on the process			
Together, team members compare the current achievements with the achievements in the previous round	–	1	1
Together, team members look back (reflect) on the way tasks have been performed within the team	1	0	0
Together, team members make new agreements and plans based on their reflections	0	1	1

[1] Score '1' is defined as 'This behavior characterizes the group', score '0' is defined as 'This behavior does not characterize the group, but neither does the opposite behavior', and score –1 is defined as 'This behavior does not characterize the group, the opposite behavior explicitly does'.

Table V4
Observation list of the three game rounds for Team 4

Aspect of the collective learning process	Score (0, 1, – 1)[1] assigned to the team by the observer		
	Game round 1	**Game round 2**	**Game round 3**
Shared vision			
Team members try to reach agreement on the goals they pursue as a team	0	1	–1
Team members mutual try to get sight on the problems they need to solve as a team	0	1	–1
Team members try to get to an agreement on the preferred development of the team	0	1	–1
Dialogue and inquiry			
Whenever team members state their view, they also ask what others think	0	0	–1
Team members react respectful to each other's ideas, even when those ideas do not match their owns.	0	0	0
Team members inquiry about each other's ideas ("why?"), regardless of the role distribution in the team.	–1	–1	–1
Collective action			
Deliberation makes that team members mutually align their activities	0	1	–1
Team members put their problems before others in order to find a solution together	0	0	0
Team members give each other advice and support with each other's tasks	0	0	0
Evaluation of the results and reflection on the process			
Together, team members compare the current achievements with the achievements in the previous round	–	1	0
Together, team members look back (reflect) on the way tasks have been performed within the team	1	0	1
Together, team members make new agreements and plans based on their reflections	1	1	0

[1] Score '1' is defined as 'This behavior characterizes the group', score '0' is defined as 'This behavior does not characterize the group, but neither does the opposite behavior', and score –1 is defined as 'This behavior does not characterize the group, the opposite behavior explicitly does'.

Table V5
Observation list of the three game rounds for Team 5

Aspect of the collective learning process	Score (0, 1, – 1)[1] assigned to the team by the observer		
	Game round 1	**Game round 2**	**Game round 3**
Shared vision			
Team members try to reach agreement on the goals they pursue as a team	0	1	1
Team members mutual try to get sight on the problems they need to solve as a team	1	1	1
Team members try to get to an agreement on the preferred development of the team	0	1	1
Dialogue and inquiry			
Whenever team members state their view, they also ask what others think	1	1	1
Team members react respectful to each other's ideas, even when those ideas do not match their owns.	1	1	1
Team members inquiry about each other's ideas ("why?"), regardless of the role distribution in the team.	1	1	1
Collective action			
Deliberation makes that team members mutually align their activities	1	1	1
Team members put their problems before others in order to find a solution together	0	0	1
Team members give each other advice and support with each other's tasks	0	0	1
Evaluation of the results and reflection on the process			
Together, team members compare the current achievements with the achievements in the previous round	–	1	1
Together, team members look back (reflect) on the way tasks have been performed within the team	1	1	1
Together, team members make new agreements and plans based on their reflections	1	1	1

[1] Score '1' is defined as 'This behavior characterizes the group', score '0' is defined as 'This behavior does not characterize the group, but neither does the opposite behavior', and score –1 is defined as 'This behavior does not characterize the group, the opposite behavior explicitly does'.

Appendix W (Chapter 6)
Overall financial results of the game simulation

Table W1 presents an overview of teams' financial results, from which their financial and innovative performance per round and for the whole game can be deduced.

Table W1
Financial results for each of the teams during the three game rounds and at the end of the game

		Team 1	Team 2	Team 3	Team 4	Team 5
Round 1	Loan granted	2550	1200	850	3650	0
	Loan repaid	0	0	0	1600	0
	Tax	400	500	400	500	500
	Total	2950	1700	1250	2550	500
	Interest (10%)	295	170	125	255	50
	Balance[1]	***3245***	***1870***	***1375***	***2805***	***550***
Round 2	Loan granted	0	400	1050	2100	2200
	Loan repaid	4850	1300	4000	7450	0
	Tax	400	500	400	500	500
	Total	1205	1470	1175	2045	3250
	Interest (10%)	121	147	118	205	325
	Balance[1]	**1326**	***1617***	**1293**	**2250**	***3575***
Round 3	Loan granted	0	300	0	450	800
	Loan repaid	0	2700	0	1800	8700
	Tax	400	500	400	500	500
	Total	926	283	893	3100	3825
	Interest (10%)	93	28	89	310	383
	Balance[1]	**1018**	**311**	**982**	**3409**	**4208**
End of game	Residual cash	0	1000	0	0	0
	Royalty	720	0	270	270	510
	Result	**1738**	**1311**	**1252**	**3679**	**4718**

[1] Numbers indicated in italic imply a debt for the team, the non-italicized numbers imply a liability.

Appendix X (Chapter 6)
Description of the developments per team

Team descriptions are based on teams' financial results (see Appendix W), their self-assessment of 'collective learning' (see Appendix T), observers' assessments (see Appendix V), and the video recordings made for each team.

Team 1

In Table W1 (Appendix W) we see that the team participated with four teachers (tax = 400). In the first round, the team was rather active in buying raw materials and in trying to assemble products to offer to the market (loan granted = 2550), but the team did not repay (part of) its loan. At the end of the first round, in terms of the team's financial position, the team was last (balance = −3245). Results for the second round show that the team did not invest in raw materials anymore (loan granted = 0), but that it was able to deliver various products to the market (loan repaid = 4850). At the end of the second round, the team's financial position was second-best. Notably, in the final round, this team did not invest in raw materials anymore, and did not sell any products to the market (loan granted = 0, loan repaid = 0, and residual cash = 0). Compared to the other teams, this team received the most income from royalties (royalty = 720) and thus showed best innovative performance during the game. In terms of the team's financial position, this team finished third (result = 1738).

In the video, we see that in the first round team members worked with paper copies of the Tangram pieces (representing raw materials) and used these to try and reconstruct the product models provided by the market. At the same time, they invested in 'real' raw materials. The team sold a number of products to the market, but decided not yet to repay its loan with the bank. In the second round, the team successfully produced existing product models and introduced new products to the market. In the course of this round, the team was confronted with a shortage in raw materials, because (temporarily) no more raw materials were available on the marketplace. Team members got involved in a dialogue and discussed the values underlying the principle of maximizing revenues and concluded that the team had generated enough income. In the reflection round, team members stated that they considered the goal of the game (which they described as "earning money by bringing physical products to the market") to be undesirable from a sustainability perspective and developed a new goal, which is described as "dematerialization". However, they noted that this goal could not be pursued within the context of the game. In the third round the game supervisor offered the team the possibility of using sustainable raw materials for their products, which would be subsidized by the bank. Initially, the team rejected this option. Team members argued that the use of subsidies would only increase the consumption of raw materials and as such would not align with their team goal. Three team members were involved in a dialogue on how the team's goal could not be realized within the setting of the game; after an extensive discussion they concluded that the goal could not be pursued. In response to the game facilitator's suggestion to collaborate with other teams, at the end of the round team members tried to sell sustainable raw materials to other teams as a contribution to their vision. However, other teams refused to collaborate and thus the team focused on sustainability could no longer remain actively involved in the game. In their final reflection,

team members indicated that they were unable to get any form of 'self-reward' from the game, because their team goal and the game's actual goal were at odds.

Looking at team scores of 'collective learning' (see Appendix T, Table T1) we observed that the team predominantly experienced each aspect as being 'high' (score 7 and 8) to 'very high' (score 9). In addition, the team perceived each of the aspects of 'collective learning' to be developing positively in the course of the game. The strongest development was noted for the aspect 'shared vision' (from an intermediate to a high level), and 'dialogue and inquiry' (from a high to a very high level). At the end of the game, the team experienced high levels of 'shared vision' and 'evaluation and reflection'. At the end of the game, the team also experienced high levels of 'dialogue and inquiry' and 'collective action'.

Looking at the observer's scores of 'collective learning' (see Appendix V, Table V1), we saw that in the first round the observer hardly noticed behavior positively associated with it. She only identified some behavior positively associated with 'evaluation and reflection'. However, she did note some counteractive behavior with respect to 'shared vision', 'dialogue and inquiry', and 'collective action'. The relative strong presence of behavior positively associated with 'evaluation and reflection' might be explained by the fact that such behavior was triggered during the reflection rounds (included in observers' scores), where teams were explicitly invited to reflect on their results and the way those are achieved. In the second round, the observer noted behavior positively associated with 'evaluation and reflection', and, to a lesser extent, with 'shared vision' and 'dialogue and inquiry'. At the same time, she also noted some counteractive behavior with respect to 'dialogue and inquiry'. Specifically, she perceived two team members to disrespectfully respond to the other team members, and she perceived team member's input not being equally appreciated. In the observer's perception, one team member was not actively involved in the team and was not taken serious by the two leading team members. Notably, in the final round the observer noticed team members showing counteractive behavior in each of the behavioral criteria associated with 'collective learning'. She perceived the team as having lost interest in playing the game after two rounds, and noticed that team members were stuck in their dialogue about what alternative goals they might pursue and how.

Team 2

In Table W1 (Appendix W) we see that the team participated with five teachers (tax = 500). In the first round, this team was moderately active in buying raw materials and trying to assemble products to be offered to the market (loan granted = 1200), but it did not repay (part of) its loan. Results for the second round show that the team invested in raw materials to a limited extent (loan granted = 400), and that it was able to deliver a moderate number of products to the market (loan repaid = 1300). During the final round, the team invested an additional, though limited sum in raw materials (loan granted = 300), and, again, delivered a moderate number of products to the market (loan repaid = 2700, residual cash = 1000). Notably, this team did not receive any income from royalties (royalty = 0). In terms of the team's financial position, this team finished fourth (result = 1311).

In the video we saw that in the first round the team found a way to copy the product models from the market, using them as a blueprint for its own designs. One team member, the one

deemed most proficient, tried to build products conform market specifications. He was supported by his team members who, in dialogue, shared their ideas and gave suggestions. Once the first model was successfully copied, team members ascertained that its costs exceeded revenues and decided not to offer the product to the market. The second product was assembled cost-efficiently at the end of the round, but then the market no longer accepted it. Team members realized that they had not communicated with the market in the first round and decided to appoint a 'liaison' who continuously informed the team on the status of each of the product models. In the second round, the team again assembled products which, because of their inefficient design, did not generate any profits. The products were sold to the market anyhow, in order to make up for the team's fixed costs. The team was then confronted with a shortage of raw materials. Once new materials were available, the team successfully copied and sold existing products to the market. Team members focused solely on imitating existing product models (without explicitly agreeing on such strategy). At the end of the round, the team was once again confronted with changing market demands and one team member suggests they start innovating. During the break, team members tried to design new products, but did not succeed at it. At the start of the third round team members again focused solely on copying existing models. When one team member pointed out that the team wasn’t striving for innovation, others indicated they could agree on a 'production-strategy'. Team members indicated that they did not master the skills required to innovate and that a production-strategy would be the team's best option. The team successfully produced a number of products, but was confronted with a shortage of raw materials at the end of the final round. During the second and the third round, team members frequently reflected on the team's strategy and the ongoing group process.

Looking at team scores of 'collective learning' (see Appendix T, Table T2), we observed that the team predominantly experienced each of its aspects to be at an intermediate level (score 5 and 6). The aspect of 'evaluation and reflection' is the exception; it was perceived to be at a low level. From the first to the second round, the team experienced a positive development of the aspects 'shared vision', 'collective action', and 'evaluation and reflection'. As a result, in the second round, the team perceived high levels of 'shared vision' and 'collective action', and intermediate levels of 'dialogue and inquiry', and 'evaluation and reflection'. From the second to the third round, the team once again experienced a positive development with respect to 'dialogue and inquiry' and 'evaluation and reflection'.

Looking at the observer's scores on the behavioral indicators of each of the aspects of 'collective learning' (see Appendix V, Table V2), we saw that the observer also noted a positive development over the course of the game. However, he signaled a different kind of development. In the first round he recognized various types of behavior positively associated with 'dialogue and inquiry', 'evaluation and reflection', and, to a lesser extent, 'collective action'. With respect to 'shared vision', he did not note any type of behavior positively associated with it, only some counteractive behavior. During the game he observed a positive development of 'shared vision' and 'collective action'. In the third round he noticed at least two types of behavior positively associated with each of the aspects of 'collective learning', and hardly any counteractive behavior.

Team 3

In Table W1 (Appendix W) we see that the team participated with four teachers (tax = 400). In the first round, this team was moderately active in buying raw materials and trying to assemble products to be offered to the market (loan granted = 850), but it did not repay (part of) its loan. Results for the second round show that the team again invested in raw materials (loan granted = 1050), and that it was able to deliver various products to the market (loan repaid = 4000). Notably, in the final round, this team did not invest in raw materials anymore, and did not sell any products to the market (loan granted = 0, loan repaid = 0, residual cash = 0). Compared to the other teams, this team received a moderate amount of income from royalties (royalty = 270) related to products developed during the second round. In this round, the team thus delivered innovative products to the market, and its designs were copied by other teams to a moderate extent. In terms of the team's financial position, this team finished last (result = 1252).

In the video, we saw that in the first round the team, unlike other teams, did not work with either 'real' raw materials, or paper copies of it. Such an approach is based on the idea that the team should only invest in 'real' raw materials once team members have figured out how to assemble those into a product desired by the market. In the beginning of the game round, one team member checked which products were requested by the market, and shared this information with the rest of the team. Based on a sketch of a specific product, team members then tried to understand its design by comparing it to an A-4 sheet of paper with images of the raw materials available. Using this strategy, the team was not able to produce any products in the first round. Inspired by other teams' approaches, in the second round the team started to work with blueprints of the market's product models, as well as with raw materials. The team was then able to successfully produce products and sell those to the market. Team members continually checked with the market to see what products were in demand. During this round, the team came up with a radically new innovation: 3-dimensional products. Though the idea was readily accepted by the market, team members needed to find a way to make a clear blueprint of the product model. Once they succeeded, team members continued designing new products and copying existing products. Soon, however, the team was confronted with a shortage in raw materials. In response, team members sat down and started to discuss the game and the team's strategy. Next, just before the end of the game round, they studied the product models available on the marketplace. In the third round, the team focused on designing a radically new product and a new marketing strategy, by "thinking out of the box". Team members deliberated extensively, both with each other and with the market, though this did not result in a new product design or another type of innovation. Though team members came up with many ideas, they did not seem to have enough time to select and develop one specific idea.

Looking at team scores of 'collective learning' (see Appendix T, Table T3) we observed that the team predominantly experienced high levels[25] of each of its aspects during the game. Moreover, we saw that the team perceived all aspects as developing positively in the course

[25] Because, in contrast to the other teams, this team has not used integers to score the various aspects of 'collective learning', scores between 4.5 and 6.5 are considered 'intermediate', scores between 6.5 and 8.5 are considered high, and scores of 8.5 and higher are considered 'very high'.

of the game. Notably, with a three-point difference in scores, the team considered the level of 'evaluation and reflection' to have decreased most.

Looking at the observer's scores on the behavioral indicators of the aspects of 'collective learning' (see Appendix V, Table V3), we saw that the observer recognized many of the behaviors positively associated with it throughout the game, though no aspect consistently scores 'fully positive' during the three game rounds although she indicates that most aspects developed positively in the course of the game. Overall, the observer did not recognize any counteractive behavior.

Team 4

In Table W1 (Appendix W) we see that the team participated with five teachers (tax = 500). In the first round, this team was most active in buying raw materials and trying to assemble products to be offered to the market. It was also the only team that, in the first round, repaid part of the loan granted (loan repaid = 1600). Results for the second round show that the team was, once again, able to deliver many products to the market (loan repaid = 7450). The amount of the loan repaid exceeds the amounts repaid by the other teams by far. At the end of the second round, this team's balance position was best. During the final round, the team invested an additional sum in raw materials (loan granted = 450) and delivered a moderate number of products to the market (loan repaid = 1800, no residual cash). Compared to the most innovative teams (Teams 1 and 5), this team received a moderate amount of income from royalties (royalty = 270). The team has thus delivered innovative products to the market, and its designs were copied by other teams to a moderate extent. At the end of the game, this team's financial position was second-best (result = 3409). In summary, compared with competitors, this team was able to work effectively and was moderately innovative, resulting in second-best financial performance.

In the video we saw that the team was quickly able to work conform market's specifications, among other things because it found a way to copy the market's product models and make it into a blueprint for its own designs. In the second round, the team successfully introduced a number of innovative products to the market. At the end of the second round, the team was aware of its financial advantage over the other teams and decided on an 'easy' strategy. Team members were convinced that they could win the game by slowing down production, and by only producing products to finish their inventory of raw materials. Eventually the team members considered their result to be disappointing and tried to pursue a more proactive strategy. However, then the team was confronted with scarcity of resources (demand for specific pieces of raw material exceeds market supply). At that point, disagreement arose in the team and two different and conflicting ideas arose regarding the strategy the team should follow. The video showed that team members' comments became increasingly value-laden. Team members noted that the team became less cohesive, and started to blame each other for the disappointing result. One team members even started to criticize the game simulation ("making stupid designs"). As a result, the team split up into two sub-teams, each pursuing its own goal. One sub-team focused on copying existing product models, the other sub-team worked on designing innovative products. When it came to deciding how to invest the team's money, one team member overruled the competing sub-team. He stated that his

sub-team had the majority of votes (3 instead of 2 teachers) and therefore used the team's money in favor of his sub-team's strategy.

Looking at team scores of each of the aspects of 'collective learning' (see Appendix T, Table T4) we observed that the team predominantly experienced high levels (score between 7 and 8) of each of the aspects of 'collective learning' in the first and second round. From the second to the third round, the team experienced a negative change, in that the perceived level of all aspects significantly decreased to an intermediate rating. Notably, with a four-point difference in scores, the team considered the level of 'shared vision' to have decreased most strongly.

Looking at the observer's scores on the behavioral indicators of each of the aspects of 'collective learning' (see Appendix V, Table V4), we saw that, at the start of the game, the observer noted the team to be involved in 'evaluation and reflection', but not in any other aspect of 'collective learning'. As was noticed before, the exceptional position of 'evaluation and reflection' might be related to the design of the game. She barely identified any counteractive behavior. From the first to the second round, the observer noticed team members starting to work on actively creating a 'shared vision'. The observer also remarked a negative change from the second to the third round. In the second round, she identified different types of behavior positively associated with 'shared vision', 'evaluation and reflection', and, to a lesser extent, 'collective action'. In the third round, she hardly noticed any behavior positively associated with 'collective learning'. Moreover, in this round she identified counteractive behavior, particularly with respect to 'shared vision' and 'dialogue and inquiry', and, to a lesser extent, with respect to 'collective action'.

Team 5

In Table W1 (Appendix W) we see that the team participated with five teachers (tax = 500). Unlike other teams, this team did not buy any raw materials in the first game round (loan granted = 0). In the course of the second round, the team did buy raw materials (loan granted = 2200), but did not repay (part of) its loan. As a result, the team was once again unable to successfully sell products to the market. At the end of the second round, the teams' financial position was far behind the competing teams' positions (balance = −3575). In the final round, the team invested an additional amount in raw materials (loan granted = 800). It delivered a large number of products to the market (loan repaid = 8700, no residual cash), more than any of its competitors). Compared to the other teams, the team received a lot of income from royalties during the game (royalty = 720), indicating that it delivered a large number of (innovative) products to the market, and its designs were often copied by other teams. At the end of the game, this team's financial position was best (result = 4718), and with respect to the royalties its position was second-best. In summary, while the team suffered from a slow start, ultimately it won the game.

In the video we saw that in the first round the team worked with paper copies of the Tangram pieces (representing raw materials), instead of the real Tangram pieces. Such an approach is based on the idea that the team should only invest in 'real' raw materials once team members have figured out how to assemble those into a product desired by the market. In the beginning of the game round, one team member checked which products were

requested by the market, and shared this information with the rest of the team. Team members then tried to design a specific product together, and shifted their focus to an alternative design when they did not succeed, or when a product was already assembled by a competing team. As a result, while the team worked from a clear and shared vision, its focus with respect to the activities team members undertook was constantly shifting. Likely, this led to a lack of efficiency, and an inability of the team to produce products conform market specifications. In the second round, the team continued pursuing this strategy and was then able to successfully design products with paper Tangram piece. However, once the designs were finished it was confronted with the fact that the raw materials required to produce the designs were sold out, or that the market was no longer interested in the products. It seems that the team's work focus (i.e., the specific product(s) to be assembled) was not only shifting constantly, but was also insufficiently connected to the environment. Indeed, the team designed products and only found out afterwards that the raw materials required for their assembly were no longer available in the market place, or that there was no more demand for those products. Consequently, the team was once again unable to successfully introduce products to the market. Team members' comments become increasingly value-laden, and two teachers start to question the team's strategy. One team members even exclaimed: "we're losers, we're too stupid to play the game". This remark triggered a dialogue about the team's capabilities and strategy. Team members discussed whether the team should first come up with a design before buying raw materials, or the other way around. At the end of the second round, the team bought raw materials. From that point on, three teachers actively tried to design products, and two teachers took on a more passive, advisory role. Shortly after, in announcing teams' results, the bank announced publicly that the team had not yet produced anything. One teacher responded by saying that the team was destroyed. In the final round, the team took on a different strategy, in which it actively pursued product innovations. Based on the raw materials available, team members started to design their own products, both individually and in sub-groups. From the video we saw that once the first financial success was achieved, all team members became actively involved in designing products and selling those to the market.

Looking at team scores with respect to 'collective learning' (see Appendix T, Table T5), we saw that the team considers the level of 'shared vision' to be 'intermediate' (score = 6), and the levels of all other aspects to be 'high' (score = 7). From the second to the third round, the team reported that all aspects were developing positively. In this final round, the team considered the levels of 'shared vision' and 'dialogue and inquiry' to be 'high' (score = 8), and the levels of 'collective action' and 'evaluation and reflection' to be 'very high' (score = 9, and score = 10, respectively). While the relatively large increase in the score of 'evaluation and reflection' might stem from the fact that the team won the game, it is interesting to see that generally, improved team financial and innovative results coincided with higher scores of each of the aspects 'collective learning'. Teachers thus associated improved team performance with a higher level of 'collective learning'. On the other hand, the positive perception of each of the aspects of 'collective learning' in the first and second round is not reflected in team financial and innovative performance.

Looking at the observer's scores on the behavioral indicators of each of the aspects of 'collective learning' (see Appendix T, Table T5), we saw that the observer recognized many of the behaviors positively associated with each of the aspects of 'collective learning' through-

out the game. He consistently scored each of the indicators of 'dialogue and inquiry' and 'evaluation and reflection' positively during the three game rounds. He indicated that the aspects of 'shared vision' and 'collective action' developed positively in the course of the game. In the final round he identified all types of behavior that are considered indicators of 'collective learning'. Overall, the observer did not recognize any counteractive behavior.

Appendix Y (Chapter 6)
Comparison of teams' and team members' scores of Collective Learning

Table Y1

Comparison per team of team score (range: 1–10), average, minimum, maximum and range for each of the aspects of Collective Learning during the three game rounds

		Aspect of Collective Learning											
		Shared vision			Dialogue and inquiry			Collective action			Evaluation and reflection		
	Game round	R1	R2	R3	R1	R2	R3	R1	R2	R3	R1	R2	R3
Team 1	Team score	6	7	8	7	9	9	8	9	9	7	8	8
	Average score	5.8	7.0	7.8	7.0	7.5	8.3	7.3	7.8	7.8	7.3	7.8	7.8
	Minimum score	4	6	7	7	7	8	7	7	7	5	7	7
	Maximum score	8	8	8	7	8	9	8	9	8	9	9	8
	Range	4	2	1	0	1	1	1	2	1	4	2	1
Team 2	Team score	6	7	7	5	5	7	6	7	7	3	5	7
	Average score	5.6	6.4	6.8	5.4	5.8	6.6	6.0	6.2	6.8	4.2	5.0	7.2
	Minimum score	4	5	6	3	5	5	3	5	6	1	4	6
	Maximum score	8	7	7	7	6	7	8	7	7	6	6	8
	Range	4	2	1	4	1	2	5	2	1	5	2	2
Team 3	Team score	8^{-}	8	8.5	7	7^{+}	8^{+}	6.5	7.5	8^{-}	5	7.5	8
	Average score	7.5	8.4	8.5	7.0	7.3	8.3	6.5	7.5	8.0	3.5	7.5	8.3
	Minimum score	5	8	8	4	7	8	6	7	7	0	7	8
	Maximum score	9	9	9	9	8	9	8	8	9	6	8	9
	Range	4	1	1	5	1	1	2	1	2	6	1	1
Team 4	Team score	8	9	5	7	8	6	7.5	7.5	5	7	7	5
	Average score	7.2	7.6	5.0	7.0	6.8	5.2	7.6	7.6	4.6	7.0	7.2	4.0
	Minimum score	5	7	4	6	6	3	7	7	2	5	7	1
	Maximum score	8	9	6	8	8	7	8	9	6	8	8	6
	Range	3	2	2	2	2	4	1	2	4	3	1	5
Team 5	Team score	6	6	8	7	7	8	7	7	9	7	7	10
	Average score	5.2	5.8	7.6	6.6	7.2	8.0	7.1	7.2	8.2	5.4	6.2	7.0
	Minimum score	3	2	7	5	6	7	6	5	8	3	5	6
	Maximum score	8	8	8	7	8	9	8	8	9	8	8	8
	Range	5	6	1	2	2	2	2	3	1	5	3	2

Underlined values illustrate the situation in which the difference between the team's score and the (mathematical) average of teachers' individual scores is equal to, or over 1.0.

Summary

TEACHERS LEARNING AND INNOVATING TOGETHER
Exploring collective learning and its relationship to individual learning, transformational leadership and team performance in higher vocational education

In the contemporary knowledge economy, Universities of Applied Sciences are faced with the challenge of redefining themselves. They need to focus more on knowledge acquisition through research and application (Leijnse, 2010, Diekstra, 2012), and are increasingly considered (Franssen, 2004) and judged as (Mulders, 2010) full knowledge institutions on this basis. Consequently teachers are required to engage in continuous learning. Furthermore, universities need to focus on delivering tailor-made programs (SER, 1996), an approach which is in direct opposition to the traditional, supply-oriented educational model (Meijers, 2006). However, recent research by Kuijpers and Meijers (2012) shows that such transformation is difficult to realize. It requires profound learning (third-order learning), which entails much uncertainty – learning that calls universities' essential principles into question and asks them to consider which role they would play within their communities (cf., Wierdsma & Swieringa, 2002). Third-order learning is of a social nature; it is based on a dialogue in which space is made for multiple social realities, and in which a shared meaning around issues and new possibilities is constructed (Wierdsma & Swieringa, 2002; Boonstra, 2004; Wierdsma, 2004). Such processes may be considered collective learning processes.

Another reason for Universities of Applied Sciences to be involved in this type of learning is the increasing speed of knowledge obsolescence in the knowledge economy (Weggeman, 2000). Institutions are operating in a fast-changing environment where proficiency is timeand situation related and the development of adaptive learning capabilities is required. This development requires that teachers be involved in ongoing continuing education, specifically in the form of work-related learning (Kessels, 2001a). Moreover, it requires them to work and learn together (De Laat & Simons, 2002); highlighting the importance of 'collective learning' for school development (Verbiest, 2002). It is thus essential that universities develop their collective learning abilities and achieve the transformation needed in the knowledge economy which means continuous adaptation within a dynamic environment. This process can be supported in an institution by a leader who has a transformational leadership style. Such a leader is particularly focused on the involvement, motivation and capabilities of teachers (and others in the university's organization), and strives to enlarge the potential of the university (as organization) to change and innovate (Geijsel et al., 1999; Sleegers, 1999; Leithwood & Jantzi, 1999, 2000). This leadership style is associated with large-scale innovations that lead to complex transformations in the culture of organizations (Van den Berg, Vandenberghe & Sleegers, 1999). Furthermore, it is considered supportive of 'collective learning' (see Verbiest, 2002), and corresponds with the concept of the school as a learning organization (Ten Bruggencate, 2009).

Starting from the premise that changes in higher vocational education may be achieved using a learning strategy, the current study has focused on the value of 'collective learning' for Universities of Applied Sciences. It addressed the following questions: what does this type of learning look like, what outcomes may it generate, and how can it be fostered?

We conducted three studies: a survey study, a case study and a game simulation. We studied 'collective learning', the closely related concept of 'social individual learning', their relationship, and their relationship to 'transformational leadership' in the three academic departments identified by Kuijpers and Meijers (2012) as 'best practice cases'. In their study, these departments demonstrated above average success in developing and implementing a CGP. As such, we studied 'collective learning' in a 'real life' innovation context. We also studied the indicated interrelationships in a larger set of teacher teams, using a quantitative research design. We used a sample to test a set of hypothesized relationships between 'collective learning', 'social individual learning' and 'transformational leadership' in teachers' day to day work setting. Finally, using a game simulation, we studied the relationship between teams' collective learning processes and their general and innovative performance.

Survey study

In the first study (Study 1a, Chapter 3) we designed, optimized and tested a measurement instrument for 'collective learning'. Based on our literature study (Chapter 2) we defined 'collective learning' as:

> *the work-related learning processes that arise when the members of a collective collaborate and consciously strive for common learning and/or working outcomes. Such learning may result in long-term changes in skills, knowledge, attitudes and learning abilities, or in changes in work processes or work outcomes, signifying development and change respectively.*

We conceptualized it as an experiential learning process consisting of the aspects 'shared vision', 'information generation', 'information distribution', 'dialogue and inquiry', 'collective action', and 'evaluation and reflection'. We designed a measurement instrument (a questionnaire), which we optimized and tested using multilevel confirmatory factor analysis (MCFA). In this study the aspects of 'collective learning' were considered factors of the eponymous, overarching construct. We used a sample of 495 teachers involved in 30 different bachelor programs in Dutch Universities of Applied Sciences. We addressed the following research question:

Research question 1: How can the hypothesized factor structure and the (newly designed) measurement instrument for Collective Learning be improved? What is the quality of the resulting model when tested in the context of higher vocational education (i.e. is the hypothesized construct structure adequate)?

We could only identify four factors of 'collective learning': (1) 'shared vision', or a mental image of the future the members of the collective want to create together (Senge, Cabron-McCabe, Lucas, Smith, Dutton & Kleiner, 2000), (2) 'dialogue and inquiry', or dialogue in which people mutually explore ideas, questions, and potential actions" (Watkins & Marsick, 1993, p. 73, see also Savelsbergh, 2010); (3) 'collective action', or imposing a shared reality on the environment through actions by a group of people (Weick, 1979, Lipshitz et al., 2007), and (4) 'evaluation and reflection', or explicit evaluation of both work processes and their results, and reflection on the learning processes and their outcomes. Due to flaws in the op-

erationalization, the aspect 'information generation' was excluded prior to the analyses. Further, due to high factor correlation and item similarity, we combined the factors 'information distribution' and 'evaluation and reflection' (named 'evaluation and reflection'). In the next step, we designed and tested different models for exploring the connections between the four remaining factors, thereby addressing the following research question:

Research question 2: Starting from the optimized factor structure for Collective Learning, what process models would represent theoretically-logical process models? Do these process models show an adequate fit to the data we collected on Collective Learning'?

We tested three models: a second-order factor model and two process models. The second-order factor model showed a good fit to the data. In this model, 'collective learning' served as a central (latent) variable explaining the relationships observed among the four factors identified in the MCFA. Alternatively, two process models of 'collective learning' were tested. Since teams' ability to go through processes of dialogue and inquiry is found to be an important aspect of team learning (Savelsbergh, 2010), in both models the factor 'dialogue and inquiry' was assumed to be the central factor, positively influencing the other factors. In addition, because of the importance of collective intent in the collective learning process (Senge, 1990), in the second process model the factor 'shared vision' was assumed to positively influence the factors 'collective action' and 'evaluation and reflection'. Both process models showed a good fit to the data. However, in the second model no significant relationships were found between 'shared vision' on the one hand, and 'collective action' and 'evaluation and reflection' on the other. Taking only significant effects into consideration for both process models, they proved to be identical. Overall, results lent support to the conceptualization of 'collective learning' as a social, experiential learning process in which processes of dialogue and inquiry are likely to play a central role.

In our literature study we discerned a second type of work-related learning based on social interaction, which we labeled 'social individual learning'. Using the framework presented by De Laat and Simons (2002) we argued that 'collective learning' leads to collective results, while 'social individual learning' leads to individual results. We described the latter form of learning as:

> *the work-related learning processes that arise when an individual interacts with others to improve the quality of his or her work, to realize change, and/or to accomplish personal goals. Such learning may result in long-term changes in skills, knowledge, attitudes and learning abilities, or in changes in work processes or work outcomes, signifying development and change respectively.*

We focused on *intentional* processes of 'social individual learning' (specifically 'learning from knowledge sharing', 'learning from giving and receiving feedback', and 'learning from collaboration'), because those represent an active learning orientation of individuals. In Study 1b (Chapter 4) we hypothesized that there would be a positive relationship between such an orientation and the way individuals perceive collective learning processes; or, between 'social individual learning' and 'collective learning' **(Hypothesis 1)**. Furthermore, we hypothesized that 'transformational leadership' (dimensions: 'initiating vision',

'individualized support', and 'intellectual stimulation') would have a positive effect on 'collective learning **(Hypothesis 2)**', and on 'social individual learning' **(Hypothesis 3)**, and that the positive effects of 'transformational leadership' on 'social individual learning' and 'collective learning', as well as the positive effect of 'social individual learning' on 'collective learning', would still be present when the variables teachers' gender, age, educational level, and employment status (part-time or full-time) would be taken into account **(Hypothesis 4)**. These hypothesized relationships were tested by means of multilevel covariance structure analysis (Hypotheses 1-3) using the EQS 6.1 program (Bentler & Wu, 2002; Bentler, 2005), and multilevel regression modeling (Hypothesis 4) using the MLwiN 2.20 program (Rasbash, Charlton, Browne, Healy & Cameron, 2009).

The revision of the measurement instrument for 'social individual learning' led to a more narrow definition of the concept than was originally intended and we therefore renamed the concept: 'individual learning in interaction'. Consequently, hypotheses were slightly modified by replacing the concept of 'social individual learning' with the concept of 'individual learning in interaction'. In line with the approach sketched above, two models were tested: one model in which 'collective learning' is represented as a second-order factor (Model 1, Figure 1), and one model in which it is represented as a process with the aspect (i.e., sub-construct) 'dialogue and inquiry' at its core (Model 2, Figure 2).

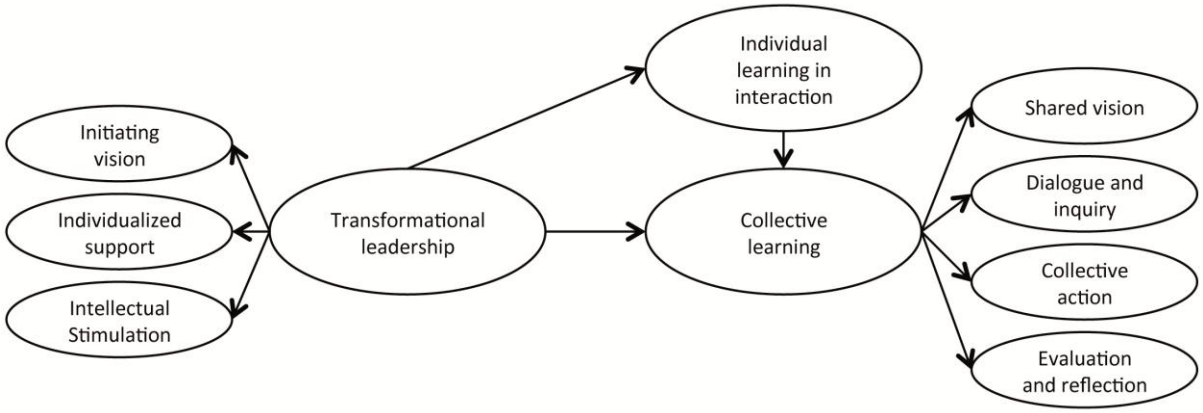


Figure 1. Model 1, specifying the structural relationships among Transformational Leadership, the different aspects of Collective Learning taken together in a second-order factor model, and Individual Learning in Interaction.

Results showed a good fit of both models to the data, with significant, positive effects between the core variables as indicated in figures 1 and 2. Results lend support to Hypothesis 1, 2 and 3, both when 'collective learning' is modeled as second-order factor and when it is modeled as a process with 'dialogue and inquiry' at its core. These effects remained when teachers' gender, age, educational level, and employment status (part-time or full-time) were taken into account as background variables. Such results lend support to Hypothesis 4.

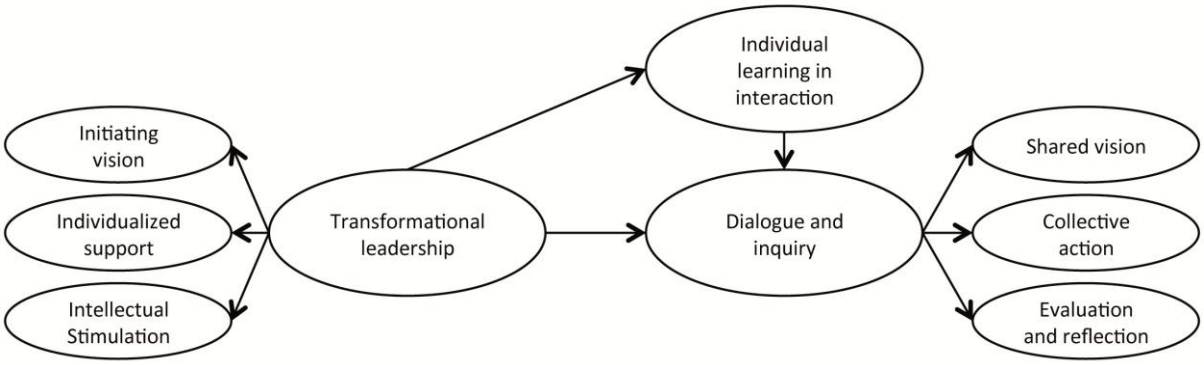


Figure 2. Model 2, specifying the structural relationships among Transformational Leadership, the different aspects of Collective Learning and Individual Learning in Interaction.

Case study

Using a qualitative research approach, specifically a case study, we tried to better understand the relationships we found in the quantitative study (Study 2, Chapter 5). As we argued in Chapter 1, the change from a dominant industrial educational model to an educational model that is suited for a knowledge economy might be said to require 'collective learning'. We therefore expected to find clear examples of 'collective learning' in innovation projects where teacher teams successfully developed and introduced an innovation related to this radical change. We studied three such projects, which were selected based on a study by Kuijpers and Meijers (2012). As was noted before, these particular teams demonstrated above average success in developing and implementing an innovative career guidance program. Performing a within-case and a cross-case analysis, we tried to answer the following research question:

Research question 3: What connections can be found between Collective Learning, Social Individual Learning, Transformational Leadership and Team Results in daily practice, specifically in educational innovation processes where teams have successfully developed and implemented a career guidance program?

The three cases showed many commonalities. Overall, innovation processes were designed as processes of social, collaborative, developmental learning in which we could identify all aspects of 'collective learning'. These processes were inspired and guided by explicit visions, which were developed within the teams. Dialogue and a culture supportive of dialogue turned out to be at the heart of the innovation processes and in these cases, teachers were supported in developing the skills required for social learning. Such results confirm the relevance of the process model of the 'collective learning' we developed in the quantitative study; the model with 'dialogue and inquiry' at its centre. Comparison of the cases with respect to 'collective learning' showed that, overall, learning process were information-oriented. Information exchange was often associated with the development of a shared understanding, or with (stimulating) social learning. Furthermore, one case showed a relatively strong focus on the aspect 'dialogue and inquiry'. Here social learning processes were insti-

tutionalized in order to stimulate the innovation process as well as the underlying collective learning process. Another case showed a relative strong focus on the aspect 'evaluation and reflection'. In this team the innovation process was considered a continuous learning process, stimulated through continuous evaluation. In contrast to the other two cases, references were made here to process evaluation, in addition to references about product evaluation (which were made in all three cases). In the third case, a relatively strong focus on the aspects 'shared vision' and 'collective action' was found. Teachers were actively involved in designing the new educational model and in creating concrete educational products (e.g., the curriculum, projects, modules). As part of the process, a culture favorable of social learning was developed.

We found a direct relationship between 'transformational leadership' and innovation, as well as an indirect relationship via 'collective learning'. Through actions associated with a transformational leadership style, managers stimulated collective learning processes, which, in turn, were likely to positively influence the teams' innovative performance. We found managers supported their teams in developing and sustaining a vision, in aligning teachers' individual goals and team goals, and in stimulating social learning, engaging in processes of dialogue, and in the creation of a shared understanding. In addition, we found a number of factors related to leadership and/or learning which participants perceived to have negatively affected the innovation process: misalignment between teachers' preferences or capabilities and the tasks they were asked to do, a limited willingness or ability of managers to invest in the continuity of the Career Guidance Program/CGP in its current (extensive) form, lack of time/time pressure, resistance to change, and cultural limitations (e.g., lack of support for social learning), and organizational limitations (e.g., structural inflexibility). We found that these factors were, to a certain extent, within managers' field of influence.

In the cross-case analysis we tried to better understand the concepts of 'collective learning' and 'social individual learning' and 'transformational leadership' in the context of educational innovation, by mapping the concepts' variety and richness. As such, we explored what was behind these abstract concepts in daily practice, thereby addressing the following research question:

Research question 4: What forms of Social Individual Learning, Collective Learning and Transformational Leadership can be identified in the educational innovation processes described above?

An important result was that we could not clearly distinguish 'social individual learning' from 'collective learning'. Reflecting on the differences and similarities between both forms of learning, we concluded that the results of 'social individual learning' are not necessarily restricted to the individual and that the results of 'collective learning' are not necessarily restricted to the group either (as we assumed in our theoretical framework). As a result, the boundaries between 'individual results' and 'collective results' become blurred and we concluded that the learner's intent is decisive. In the cases we were unable to find examples that proved the presence of 'social individual learning'.

With respect to the collective learning process we found that: (1) its aspects were shown to be highly interwoven, (2) the aspects 'information generation' and 'information distribution'

were difficult to distinguish from one another, because most recorded comments made were about information exchange, implying both generation and distribution at the same time, (3) the process could best be characterized through the aspect 'dialogue and inquiry', because it seemed to underlie all its other aspects, (4) shared understanding was created in a dialogue that was both respectful and challenging (i.e., addressing conflicting ideas); such dialogue required a so-called 'dialogical learning attitude', or a willingness to participate in open communication, (5) collective action did not necessarily require teachers to perform their tasks in the same way, or to actually work together; when they strived for common outcomes (as indicated by the team's vision), results became aligned and could be considered to be of a collective nature, (6) evaluation and reflection were shown to be underexposed features of the collective learning process; a result we also found in our quantitative study, and (7) a 'learning orientation', characterized as the acknowledgment of the innovation process as a learning process, and a focus on team oriented staff development as part of the innovation process, likely created a positive learning environment for experiential and social learning.

With respect to 'transformational leadership' we found that many quotes could be attributed to the dimension 'individualized support' as well as 'intellectual stimulation'. Such results are in line with results of our quantitative study, where we found high correlations between the scales measuring these dimensions. Participants predominantly mentioned facets of 'transformational leadership' related to the dimensions 'individualized support' and 'intellectual stimulation'. They point to specific ways in which innovation was fostered and team (members') development was stimulated. While little reference was made to the dimension 'initiating vision', participants in all three cases indicated that the teams were empowered to create a team vision. The facet of empowerment is also associated with 'transformational leadership' (Ten Bruggencate, 2009). Specifically, it is associated with stimulating teachers with respect to innovation and development. Managers contributed to both by fostering innovation, particularly by being involved in, and committed to the innovation, and by acknowledging team(members)' strengths and supporting team(members)' development. Moreover, participants (mainly managers and Career Guidance Program-coordinators) stressed the necessity of a dialogical learning attitude and open communication for the innovation process. They indicated that they were aware of and acknowledged teachers' vulnerabilities in this process.

Game simulation

In the third empirical study (Study 3, Chapter 6) we used a game simulation (based on the Knowledge game developed by Kessels (1998)) to explore the relationship between 'collective learning' and teams' financial and innovative performance (i.e., 'team results'). Five groups of teacher teams involved with different bachelor programs, participated in a market simulation, each operating as a production company. Since teams needed to figure out how to assemble products presented on the market or how to design and assemble new products, teams' commercial success was related to their innovativeness. During the simulation, team members, teams and observers assessed teams' behavior with respect to 'collective learning'. Teams' financial position, a result of their efficiency and innovativeness, was used as an outcome measure. Using the game simulation, we tried to answer the following research question:

Research question 5: How are Collective Learning and Team Results (i.e., Team Financial Performance and Innovativeness) related in the context of a game simulation where teacher teams compete in producing and designing products?

Results showed that, while teams' financial and innovative results were not unambiguously related to teams' or observers' perception of the collective learning process, a positive relationship between 'team innovative performance' and teams' *own* perception of the collective learning process was likely. Furthermore, observer scores corresponded for the most part with teams' financial results, in that strongest financial performance was predominantly observed in the game round where the observers signaled most types of behavior positively associated with 'collective learning'. However, observers' scores sometimes only differed marginally from one game round to the next, while team results changed significantly; results should therefore be carefully interpreted. In addition, it was noted that there might be a delay between 'collective learning' as assessed by the observer and teams' financial performance. While some teams were involved in 'collective learning' from the start, it took them some time to design products conform market specifications. Such a result seems to imply that teams are able to startup the process of collective learning directly, but that it might take time to align their performance with their environments. Observer scores were not consistently positively related to a team's innovative results.

We also found that the relationship between 'collective learning' and 'team performance and innovativeness' is more complex than we originally assumed it to be. We found indications that: (1) 'creative turmoil' (Kessels, 2001a) might stimulate teams' innovative performance, (2) the emotional and affective component of the learning process might be relevant for teams' performance (cf. Kessels, 2001a), (3) observers' and teams' frames of reference might be different when assessing the teams' behavior with respect to 'collective learning', and (4) a 'shared vision' might bind teachers' individual activities and align those with respect to the team's goal.

In order to increase our understanding of 'collective learning' we then used the data of the game simulation to study the relationship between team members' individual assessment and team assessment, thereby trying to answer the following research question:

Research question 6: How are team members' perceptions and teams' perceptions of the collective learning process related in the context of the game simulation described above?

We found that team members' scores of 'collective learning' varied, but tended to converged in the course of the game. Possibly, teachers' perception of the learning process is a byproduct of a shared understanding created during the game. We also found that team scores fell within a smaller range than individual scores, that team scores often exceeded team members' average score, and that teams perceived the level of 'collective learning' to increase even when part of the team perceived a decrease. At the same time, we found a negative perception of the development of 'collective learning' to be reflected in team scores overall. We concluded that teams' assessments of 'collective learning' tended to be more positive than individual team members' assessments, suggesting that relative negative

individual perceptions are offset when a set of individual scores needed to be translated into a team score.

Overall conclusions

Combining results of the three studies, we created a conceptual framework that offers a roadmap for future research on 'collective learning' (Figure 3). We described organizational learning in terms of the learning processes taking place within organizations, the outcomes, and the organizational context in which learning is situated. Following De Laat and Simons (2002) we distinguished four types of learning, ranging from purely individual (individual process and individual outcomes) to collective (collective process and collective outcomes). The difference between 'individual learning in interaction' and 'collective learning' (which are both characterized by a collective process and may, in our framework, lead to individual and collective outcomes) is found in the learner's intent: 'individual learning in interaction' is characterized by individual goals (with respect to work and/or learning) based on individual intent, whereas 'collective learning' is characterized by the combination of collective goals and individual goals, the latter derived from a team's collective goals. Since individual learning can be considered the foundation of 'collective learning' (Kozlowski et al., 2010), we anticipated a positive effect of 'individual learning in interaction' on 'collective learning' (while acknowledging a two-way relationship). Likely, the more proficient people in a team are at learning individually through social interaction, the more proficient the team is at learning collectively.

Following ideas by Simons and Ruijters (2004), we made a distinction between three types of learning outcomes: learning in the restricted sense (referring to skills, knowledge, attitude and learning abilities), 'development' and 'change'. Learning outcomes may occur at the level of individuals, teams and/or organizations. Organizational change occurs when (the development of) individuals', teams', and organizations' skills, knowledge, attitudes and learning abilities lead to changes in work processes or outcomes at each of these levels. When organizations use a learning strategy to continuously adapt to changes in their internal and external environments, they commonly aim to improve their performance, and increase their adaptive learning capabilities. The latter requires that people have the ability to work together (De Laat & Simons, 2002). We indeed found a positive relationship between 'collective learning' and team's performance and innovativeness.

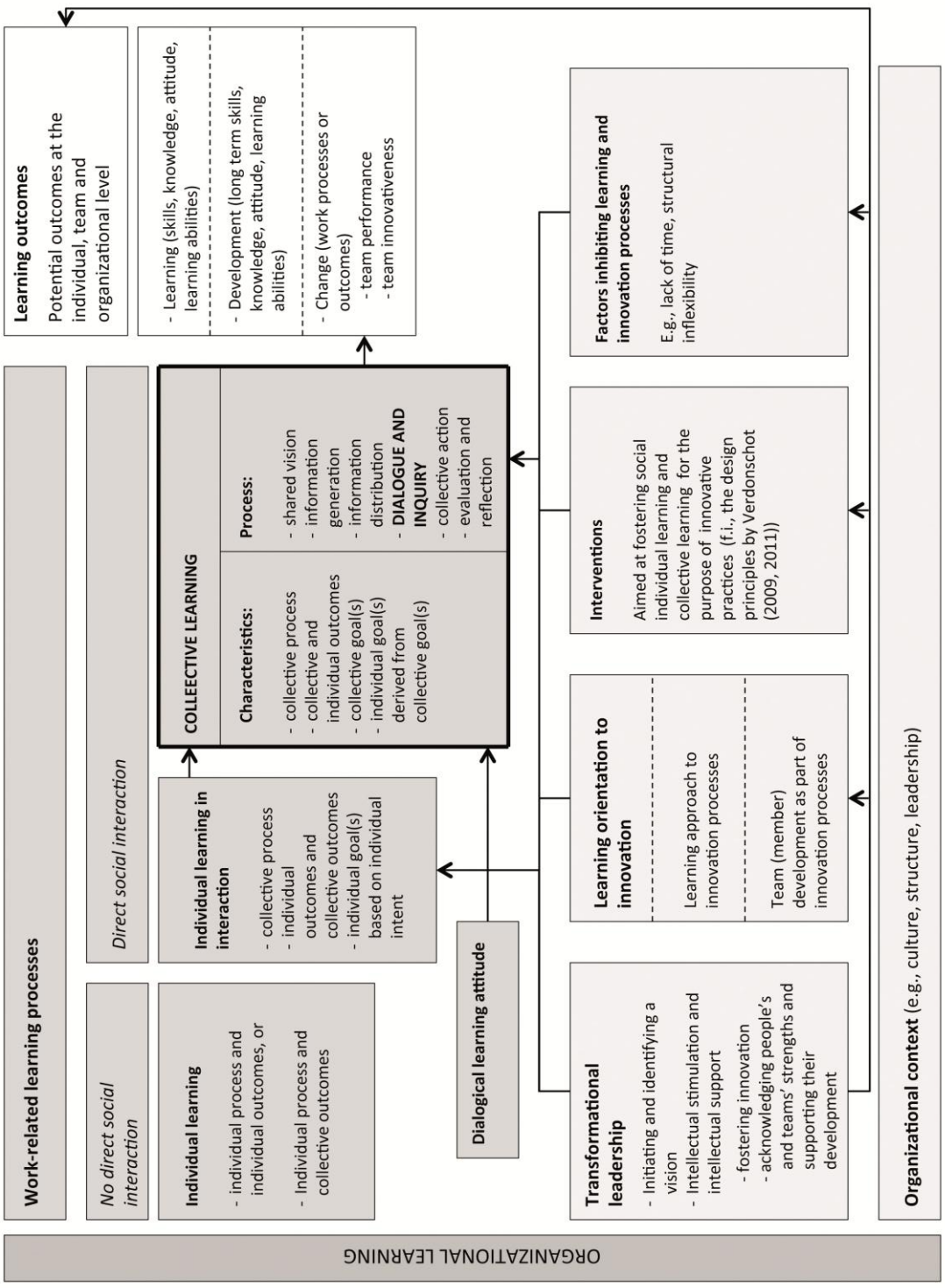


Figure 3. Revised conceptual model, on the basis of the study's results.

We stated that organizations can facilitate individuals' and teams' learning by providing a structure, a culture, and a leadership style supportive of learning. Such an environment stimulates the development of individuals' and teams' capabilities. Organizations can thus maximize the effectiveness of learning processes by aligning formal structures and resources to support them (Kozlowski et al., 2010). We found a so-called 'learning orientation' – characterized by the acknowledgment of the innovation process as a learning process, and a focus on team oriented staff development – fostered the innovation process. It the best practice cases it created a positive learning environment for experiential and social learning, and thus for 'collective learning'. While the organizational context might facilitate processes of learning and innovation, we found it might also inhibit those (e.g., the factors 'lack of time' and 'structural inflexibility' can limit collective learning processes).

We found support for the hypothesized positive relationship between 'transformational leadership' on the one hand and 'collective learning' and 'individual learning in interaction' on the other. Moreover, we found indications that a transformational leadership style influences teams' results both indirectly (i.e., by stimulating social forms of learning, specifically 'collective learning') and directly. Both effects are taken into account in Figure 3. Inspired by our case study, we argued that it is likely that the organizational context is, to a certain extent, within a manager's range of influence.

Finally, based on the patterns in the case study we argued that 'individual learning in interaction', 'collective learning', 'transformational leadership' and the factors we identified as inhibiting learning and innovation processes might be understood in terms of the 'design principles' (reflecting factors that enhance learning in innovation practices) formulated by Verdonschot (2009, 2011). When looking for appropriate interventions that can promote 'social individual learning' and 'collective learning' which support innovative practices, the design principles might play a guiding role in what to offer.

Summary in Dutch (samenvatting)

HET GEZAMENLIJK LEREN EN INNOVEREN DOOR DOCENTEN
Een onderzoek naar collectief leren in relatie tot individueel leren, transformationeel leiderschap en teamprestaties in het hoger beroepsonderwijs

In de hedendaagse kennismaatschappij staan hogescholen voor de uitdaging om zich te herdefiniëren. Zij moeten zich meer gaan richten op kennisverwerving door het uitvoeren van onderzoek en het toepassen van de resultaten daarvan (Leijnse, 2010). In lijn hiermee worden zij in toenemende mate gezien (Franssen, 2004) en afgerekend (Mulders, 2009) als volwaardige kennisinstellingen en worden docenten verondersteld continu te blijven leren. Daarnaast moeten hogescholen meer maatwerk gaan leveren (SER, 1996). Een maatwerkgerichte benadering staat echter haaks op het traditionele, aanbodgestuurde onderwijsmodel waarbinnen studenten collectief worden getoetst op de mate waarin zij het standaardprogramma aan het einde van een voorgeschreven periode beheersen (Meijers, 2006). Recent onderzoek door Kuijpers en Meijers (2012) laat zien dat de benodigde transformatie moeilijk te realiseren is. Het vraagt om diepgaande leerprocessen (drieslagleren), die veel onzekerheid oproepen. Immers, de essentiële principes waarop onderwijsorganisaties zijn gebaseerd komen ter discussie te staan en er worden vragen gesteld over de positie die zij in de omgeving willen innemen en over de rol die zij daarbinnen willen vervullen (cf., Wierdsma & Swieringa, 2002). Drieslagleren is in de kern een sociale vorm van leren. Het is gebaseerd op processen van dialoog waarin ruimte wordt gemaakt voor meervoudige werkelijkheden en waarin een gedeeld begrip van de werkelijkheid en van nieuwe mogelijkheden wordt opgebouwd (Wierdsma & Swieringa, 2002; Boonstra, 2004; Wierdsma, 2004). Deze processen kunnen worden opgevat als *collectieve* leerprocessen.

Een tweede reden voor hogescholen om zich bezig te houden met collectieve leerprocessen is de grote snelheid waarmee kennis veroudert in een kennismaatschappij (Weggeman, 2000). Bedrijven en andere instituten opereren in een snel veranderende omgeving, waarin bekwaamheid tijd- en situatiegebonden is en waarin – teneinde kennis en bekwaamheden te actualiseren – het ontwikkelen van adaptief lerend vermogen noodzakelijk is. Het ontwikkelen van dit vermogen vraagt om processen van werkgerelateerd leren (Kessels, 2001a), waarbij docenten voortdurend samenwerken en samen leren (De Laat & Simons, 2002). Hiermee wordt het belang van collectief leren voor schoolontwikkeling (Verbiest, 2002) duidelijk.

Hogescholen staan daarmee voor de opgave hun vermogen om collectief te leren te ontwikkelen en de transformatie te realiseren die samengaat met de geschetste maatschappelijke ontwikkelingen. Het transformatieproces kan worden ondersteund door leiders met een transformationele leiderschapsstijl. Een dergelijke leider "is vooral gericht op de betrokkenheid, motivatie en capaciteiten van docenten en andere medewerkers in de schoolorganisatie, met als doel het vergroten van het vermogen van de schoolorganisatie om te veranderen en te innoveren (Geijsel, Sleegers & Van den Berg, 1999; Sleegers, 1999; Leithwood & Jantzi, 1999, 2000)" (Ten Bruggencate, 2009, p. 17). Deze leiderschapsstijl wordt geassocieerd met grootschalige innovaties die leiden tot complexe transformaties in de cultuur van organisaties (Van den Berg, Vandenberghe & Sleegers, 1999) en wordt verondersteld collectieve leerprocessen te ondersteunen (zie Verbiest, 2002). Het sluit het aan bij het concept van de school als lerende organisatie (Ten Bruggencate, 2009).

Uitgaande van het idee dat de veranderingen waar het hoger beroepsonderwijs (HBO) voor staat gerealiseerd kunnen worden door middel van een leerstrategie, richt het onderhavige onderzoek zich op de waarde van collectief leren voor hogescholen. De studie tracht een antwoord te vinden op de volgende vragen: hoe ziet deze vorm van leren (ofwel, het concept) eruit, tot welke uitkomsten leidt het, en hoe kan het worden gestimuleerd? Om tot een antwoord op deze vragen te komen hebben we drie empirische studies uitgevoerd: een vragenlijstonderzoek, een gevalstudie en een spelsimulatie. We bestuderen 'collectief leren', het aanverwante concept 'sociaal individueel leren', hun onderlinge relatie en hun relatie met 'transformationeel leiderschap' in de drie academies die door Kuijpers en Meijers (2012) zijn geïdentificeerd als 'best practice cases'. In hun studie bleken de teams in deze academies bovengemiddeld succesvol in het ontwikkelen en invoeren van een innovatief programma voor studieloopbaanbegeleiding. Zodoende onderzoeken we 'collectief leren' in een concrete innovatiecontext. We onderzoeken de beschreven relaties ook in een bredere context, uitgaande van een kwantitatieve onderzoeksopzet. We maken gebruik van een steekproef om de veronderstelde relaties tussen 'collectief leren', 'sociaal individueel leren' en 'transformationeel leiderschap' te toetsen in de dagelijkse werksituatie van docenten. Tot slot maken we gebruik van een spelsimulatie om de relatie te onderzoeken tussen de collectieve leerprocessen van teams en hun innovatieve prestaties.

Het vragenlijstonderzoek

In de eerste empirische studie (Studie 1, Hoofdstuk 3) ontwikkelen, optimaliseren en toetsen we een meetinstrument voor het begrip collectief leren. Op grond van een literatuuronderzoek (Hoofdstuk 2) definiëren we dit begrip als volgt:

> *De werkgerelateerde leerprocessen die ontstaan wanneer de leden van een collectief samenwerken, waarbij zij bewust streven naar het bereiken van gezamenlijke leren/of werkresultaten. Dergelijke leerprocessen kunnen leiden tot lange-termijn veranderingen in vaardigheden, kennis, houding en leervermogen, en uiteindelijk in veranderingen in werkprocessen en de resultaten daarvan; we spreken dan van respectievelijk ontwikkeling en verandering.*

We vullen 'collectief leren' vervolgens in als een ervaringsleerproces dat bestaat uit de onderdelen 'gedeelde visie', 'informatie verzamelen', 'informatie verspreiden', 'onderzoekende dialoog', 'collectief handelen' en 'evaluatie en reflectie'. We ontwikkelen een meetinstrument (een vragenlijst), dat we optimaliseren en testen door middel van multilevel confirmatieve factoranalyse (MCFA). Bij dit onderzoek vatten we de onderdelen van 'collectief leren' op als factoren van het gelijknamige, overkoepelende construct. We maken gebruik van een steekproef van 495 docenten, werkzaam bij één van de 30 aan het onderzoek deelnemende HBO-opleidingen. Zodoende zoeken we een antwoord op de volgende vraag:

Onderzoeksvraag 1: Hoe kan de veronderstelde factorstructuur en het (nieuw ontworpen) meetinstrument voor Collectief Leren worden verbeterd? Wat is de kwaliteit van het resulterende model wanneer dit getest wordt in de HBO-context (ofwel: is de veronderstelde structuur van het begrip geschikt)?

In de analyses vinden we vier van de zes veronderstelde factoren van 'collectief leren' terug: (1) 'gedeelde visie', het mentale beeld dat de leden van een groep hebben over de toekomst die zij gezamenlijk willen creëren (Senge, Cabron-McCabe, Lucas, Smith, Dutton & Kleiner, 2000), (2) 'onderzoekende dialoog', een dialoog waarin mensen elkaars ideeën, vragen en mogelijke activiteiten verkennen (Watkins & Marsick, 1993, p. 73, zie ook Savelsbergh, 2010); (3) 'collectief handelen', het opleggen van een gedeelde realiteit aan de omgeving door middel van de activiteiten van de groep (Weick, 1979, Lipshitz et al., 2007), en (4) 'evaluatie en reflectie', het expliciet evalueren van (de resultaten van) werkprocessen en het reflecteren op de leerprocessen en de uitkomsten daarvan. In reactie op tekortkomingen in de operationalisering van de factor 'informatie verzamelen' verwijderen we deze factor, voorafgaand aan de analyses, uit de dataset. Verder voegen we de factoren 'informatie verspreiden' en 'evaluatie en reflectie' samen, omdat deze sterk blijken samen te hangen en omdat de items van de bijbehorende meetinstrumenten ('schalen') overlap vertonen.

In de volgende stap ontwerpen en toetsen we verschillende modellen voor het verbinden van de vier (overblijvende) factoren van 'collectief leren'. Daarmee zoeken we een antwoord op de volgende vraag:

Onderzoeksvraag 2: Welke modellen verbinden de factoren van Collectief Leren (hierbij uitgaand van de geoptimaliseerde factorstructuur) op een manier die theoretisch logisch is? Vertonen deze modellen een goede fit met de data die we hebben verzameld over Collectief Leren?

We toetsen drie modellen: een tweede-orde factormodel en twee procesmodellen. Het tweede-orde factormodel blijkt goed bij de data te passen. In dit model neemt de variabele 'collectief leren' de centrale plaats in, die als onderliggende variabele de relaties tussen de vier factoren, zoals die zijn geïdentificeerd in de MCFA, verklaart. Als alternatief toetsen we twee procesmodellen van 'collectief leren'. Omdat dialoog een belangrijk onderdeel is van het leren door teams (Savelsbergh, 2010) stellen we in beide modellen de factor 'onderzoekende dialoog' centraal, waarbij we een positief verband veronderstellen tussen deze factor en de overige drie factoren. Omdat het hebben van een gezamenlijke intentie van groot belang is voor collectieve leerprocessen (Senge, 1990) veronderstellen we in het tweede model aanvullend een positief verband tussen de factor 'gedeelde visie' en de factoren 'collectief handelen' en 'evaluatie en reflectie'. Hoewel beide procesmodellen goed bij de data blijken te passen, vinden we in het tweede model geen significante relaties tussen 'gedeelde visie' aan de ene kant en 'collectief handelen' en 'evaluatie en reflectie' aan de andere kant. Wanneer we in beide modellen alleen de significante effecten in beschouwing nemen hebben we daardoor twee identieke modellen. De resultaten ondersteunen de invulling van het begrip 'collectief leren' als een sociaal proces van ervaringsleren, waarbij de onderzoekende dialoog een centrale rol speelt.

In onze literatuurstudie onderscheiden we naast 'collectief leren' een tweede type werkgerelateerd leren gebaseerd op sociale interactie. Dit type leren noemen we 'sociaal individueel leren'. Gebruik makend van het kader van De Laat en Simons (2002) beargumenteren we dat 'collectief leren' tot collectieve resultaten leidt, terwijl 'sociaal individueel leren' tot individuele resultaten leidt. Deze laatste vorm van leren omschrijven we als:

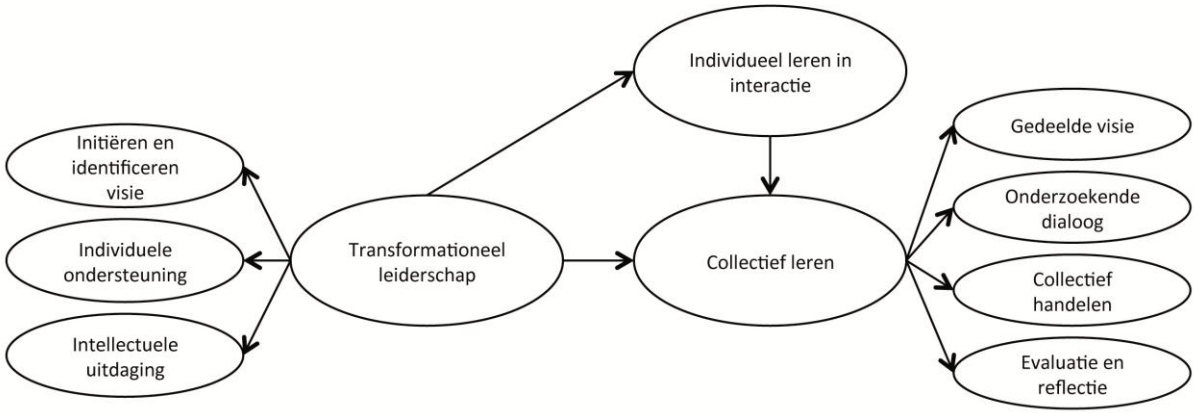
> *De werkgerelateerde leerprocessen die ontstaan wanneer een individu met anderen communiceert om de kwaliteit van zijn of haar werk te verbeteren, om verandering te realiseren, en/ of om persoonlijke doelen te bereiken. Dergelijke leerprocessen kunnen leiden tot veranderingen in vaardigheden, kennis, houding en leervermogen, en uiteindelijk in veranderingen in werkprocessen en de resultaten daarvan; we spreken dan van ontwikkeling en verandering.*

We richten ons op *bewust ondernomen* processen van 'sociaal individueel leren' (in het bijzonder 'leren door kennisdeling', 'leren door feedback' en 'leren door samenwerken'), omdat deze duiden op een actieve leerhouding van individuen. In Studie 1b (Hoofdstuk 4) toetsen we de hypothese dat er een positief verband bestaat tussen een dergelijke leerhouding en de manier waarop individuen collectieve leerprocessen ervaren, ofwel tussen 'sociaal individueel leren' en 'collectief leren' **(Hypothese 1)**. Verder toetsen we de hypothesen dat 'transformationeel leiderschap' (dimensies: 'initiëren en identificeren van een visie', 'individuele ondersteuning' en 'intellectuele uitdaging') een positief effect heeft op 'collectief leren' **(Hypothese 2)** en op 'sociaal individueel leren' **(Hypothese 3)**, en dat al deze positieve effecten blijven bestaan wanneer we een set achtergrondvariabelen (leeftijd, geslacht, opleidingsniveau en aanstellingsomvang) in beschouwing nemen **(Hypothese 4)**. De eerste drie hypothesen toetsen we door middel van multilevel covariantie-structuuranalyse (Hypothesen 1-3), waarbij we gebruik maken van het programma EQS 6.1 (Bentler & Wu, 2002; Bentler, 2005). De vierde hypothese toetsen we door middel van multilevel regressieanalyse (Hypothese 4), waarbij we gebruik maken van het programma MLwiN 2.20 (Rasbash, Charlton, Browne, Healy & Cameron, 2009).

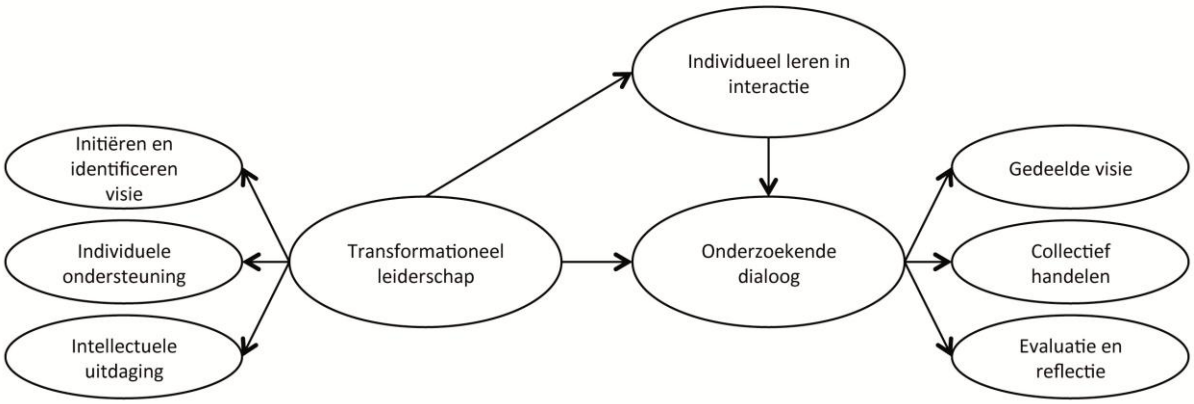
De optimalisering van het meetinstrument van 'sociaal individueel leren' leidt tot een meer beperkte operationalisering van het concept dan waarmee we gestart zijn; we herbenoemen het als 'individueel leren in interactie'. Door het vervangen van de term 'sociaal individueel leren' door 'individueel leren in interactie' passen we de hypothesen enigszins aan. De optimalisering van het meetinstrument van 'transformationeel leiderschap' leidt niet tot veranderingen. In navolging van de aanpak die we hierboven geschetst hebben, toetsen we vervolgens twee modellen: één model waarin 'collectief leren' wordt voorgesteld als een tweede-orde factormodel (Model 1, Figuur 1) en één model waarin het wordt voorgesteld als een proces met het onderdeel (de factor) 'onderzoekende dialoog' in het hart (Model 2, Figuur 2).

Beide modellen passen goed bij de data en vertonen significante, positieve effecten tussen de kernvariabelen zoals weergegeven in Figuur 1 en Figuur 2. De resultaten ondersteunen Hypothese 1, 2 en 3, zowel wanneer 'collectief leren' is gemodelleerd als een tweede-orde factormodel als wanneer het is gemodelleerd als een procesmodel met het onderdeel 'onderzoekende dialoog' in het hart. Deze effecten blijven significant wanneer de achtergrond-

variabelen aan de modellen worden toegevoegd; een resultaat dat Hypothese 4 ondersteunt.



Figuur 1. Model 1: de structurele relaties tussen Transformationeel Leiderschap, de verschillende factoren van Collectief Leren gevat in een tweede-orde factormodel, en Individueel Leren in Interactie.



Figuur 2. Model 2: de structurele relaties tussen Transformationeel Leiderschap, de verschillende factoren van Collectief Leren gevat in een procesmodel, en Individueel Leren in Interactie.

De gevalstudie

Door het inzetten van een kwalitatieve onderzoeksaanpak, in het bijzonder een gevalstudie, trachten we in de tweede empirische studie meer inzicht te krijgen in de relaties die we in het kwantitatieve onderzoek hebben gevonden (Studie 2, Hoofdstuk 5). In Hoofdstuk 1 hebben we aangegeven dat de omslag van het dominante, industriële onderwijsmodel naar een onderwijsmodel dat past binnen een kennismaatschappij vraagt om collectieve leerprocessen. We verwachten daarom duidelijke voorbeelden van 'collectief leren' te vinden in innovatieprojecten die hiermee samenhangen. We onderzoeken drie van zulke projecten; projecten die we hebben geselecteerd op grond van het onderzoek van Kuijpers en Meijers (2012). Zoals aangegeven, bleken de teams in deze projecten bovengemiddeld succesvol in het ontwikkelen en invoeren van een innovatief programma voor studieloopbaanbegeleiding. Door

het uitvoeren van een within-case en een cross-case analyse trachten we een antwoord te vinden op de volgende vraag:

Onderzoeksvraag 3: Welke relaties tussen Collectief Leren, Sociaal Individueel Leren, Transformationeel Leiderschap en Teamprestaties kunnen we vinden in de dagelijkse praktijk, in het bijzonder in innovatieprojecten waarbij onderwijsteams succesvol een programma voor studieloopbaanbegeleiding hebben ontwikkeld en geïmplementeerd?

De drie cases vertonen veel overeenkomsten: de innovatieprocessen zijn vormgegeven als processen van samenwerkend, ontwikkelend leren, waarin we elk van de onderdelen van 'collectief leren' herkennen. Deze processen zijn geïnspireerd en geleid door expliciete visies, die ontwikkeld zijn door de teams zelf. De dialogische processen die ten grondslag liggen aan de leerprocessen blijken een belangrijk aspect te zijn, evenals de aanwezigheid van een cultuur die hieraan ondersteunend is. Dit resultaat benadrukt de relevantie van het procesmodel dat we van 'collectief leren' ontwikkeld hebben; het model waarbij de 'onderzoekende dialoog' centraal staat. Als onderdeel van het innovatieproces zijn docenten in elk van de cases gestimuleerd en gefaciliteerd om de vaardigheden die nodig zijn voor sociale leerprocessen (verder) te ontwikkelen.

Wanneer we de innovatietrajecten van de drie cases vergelijken, blijkt dat ze elk sterk informatie-georiënteerd zijn. Het uitwisselen van informatie wordt door de betrokkenen geassocieerd met het creëren van gedeeld begrip, of met (het stimuleren van) sociale leerprocessen. In één case is er daarnaast sprake van een relatief sterke oriëntatie op het onderdeel 'onderzoekende dialoog'. Binnen dit team zijn processen van sociaal leren geïnstitutionaliseerd (bijvoorbeeld door middel van intervisiegroepen) met als doel het innovatieproces en de onderliggende leerprocessen te stimuleren. In een andere case is er sprake van een relatief sterke oriëntatie op het onderdeel 'evaluatie en reflectie'. In dit team wordt het innovatieproces beschouwd als een continu leerproces, dat gestimuleerd wordt door middel van continue evaluatie. In tegenstelling tot de andere twee cases wordt in deze case aangegeven dat niet alleen het 'product' (het programma voor studieloopbaanbegeleiding), maar ook het proces wordt geëvalueerd. In de derde case zien we een relatief sterke oriëntatie op de onderdelen 'gedeelde visie' en 'collectief handelen'. In dit team zijn docenten van meet af aan betrokken geweest bij de ontwikkeling van het nieuwe onderwijsmodel en het creëren van de daarbij behorende onderwijsproducten (zoals het curriculum, projecten en modules). Als onderdeel van het innovatieproces is in dit team ingezet op het ontwikkelen van een cultuur die ondersteunend is aan sociale leerprocessen.

In de twee cases waar het onderwerp leiderschap aan de orde is gekomen zien we zowel een direct verband tussen 'transformationeel leiderschap' en 'innovatie' als een indirect verband via 'collectief leren'. Door het ondernemen van activiteiten die geassocieerd worden met deze leiderschapsstijl lijken managers de collectieve leerprocessen te stimuleren, die op hun beurt weer bijdragen aan de innovatieprestaties van de teams. In de cases ondersteunen managers hun teams door ze te helpen een visie te ontwikkelen en daaraan vast te houden, door de individuele doelen van docenten af te stemmen op de teamdoelen, door sociale leerprocessen te bevorderen, door de dialoog met docenten aan te gaan en door hen te helpen tot een gedeeld begrip te komen.

Tot slot identificeren we nog een aantal factoren die volgens betrokkenen een negatief effect hebben gehad op het innovatietraject en/of op de onderliggende leerprocessen: het niet overeenkomen van de bekwaamheden of voorkeuren van docenten en hun werktaken, beperkte mogelijkheden van managers of een beperkte bereidheid om te investeren in de continuïteit van het programma voor studieloopbaanbegeleiding in zijn huidige (uitgebreide) vorm, tijdgebrek/werkdruk, culturele beperkingen (bv. docenten die niet willen participeren in sociale leerprocessen), organisatorische beperkingen (bv. structurele inflexibiliteit) en weerstand tegen verandering. In de cases blijken deze factoren tot op zekere hoogte in de invloedsfeer van managers te liggen.

Door het vergelijken van de cases proberen we daarnaast meer inzicht te krijgen in de tamelijk abstracte begrippen 'sociaal individueel leren', 'collectief leren' en 'transformationeel leiderschap'. Door de rijkheid van de begrippen, zoals deze voorkomen binnen de drie cases, in kaart te brengen zoeken we naar een antwoord op de volgende vraag:

Onderzoeksvraag 4: In welke vormen vinden we Sociaal Individueel Leren, Collectief Leren en Transformationeel Leiderschap terug in bovenstaande innovatieprocessen?

Een belangrijk resultaat hiervan is dat we de begrippen 'sociaal individueel leren' en 'collectief leren' in de cases niet duidelijk van elkaar kunnen onderscheiden. Reflecterend op de verschillen en overeenkomsten tussen beide vormen van leren zien we dat de resultaten van 'sociaal individueel leren' zich niet noodzakelijkerwijs beperken tot het individu (zoals we aanvankelijk veronderstelden in ons theoretisch raamwerk) en dat 'collectief leren' naast groepsresultaten ook individuele resultaten met zich meebrengt. Hierdoor lopen de grenzen van individuele en collectieve resultaten door elkaar. We concluderen dat de intentie van de leerder bepaalt of een sociale leeractiviteit als een individuele of een collectieve leervorm moet worden gezien. In de cases vinden we geen duidelijke voorbeelden van 'sociaal individueel leren'.

Aangaande het collectieve leerproces zien we in de cases dat: (1) de verschillende onderdelen sterk met elkaar verweven zijn, (2) de onderdelen 'informatie verzamelen' en 'informatie verspreiden' moeilijk van elkaar te onderscheiden zijn doordat betrokkenen veelal verwijzen naar processen van informatie-*uitwisseling*, wat gelijktijdige verzameling en verspreiding impliceert, (3) het leerproces het beste gekarakteriseerd kan worden door middel van het onderdeel 'onderzoekende dialoog', omdat dit onderdeel ten grondslag ligt aan alle andere onderdelen, (4) gedeeld begrip gecreëerd wordt in een dialoog die tegelijkertijd respectvol en confronterend is (dat wil zeggen dat conflicterende ideeën niet uit de weg worden gegaan), (5) docenten niet noodzakelijkerwijs hun taken gezamenlijk hoeven uitvoeren om tot collectief handelen te komen; wanneer ze individueel streven naar gedeelde uitkomsten (voortkomend uit de visie van het team) komen de resultaten op één lijn te liggen en is er sprake van een collectief resultaat, (6) het onderdeel 'evaluatie en reflectie' een onderbelicht onderdeel van het leerproces is; een bevinding die aansluit bij het resultaat van het vragenlijstonderzoek, en (7) de 'leeroriëntatie' van de teams, gekenmerkt door een lerende benadering van het innovatieproces en een oriëntatie op de ontwikkeling van docenten als

onderdeel van het innovatieproces, een positieve leeromgeving heeft gecreëerd voor ervaringsleren en sociale leerprocessen.

Aangaande transformationeel leiderschap zien we in de cases dat de dimensies 'individuele ondersteuning' en 'intellectuele uitdaging' sterk samenhangen; een resultaat dat in het vragenlijstonderzoek ook naar voren is gekomen. Uitspraken van betrokkenen kunnen veelal in beide categorieën worden geplaatst en daarom nemen we de categorieën samen. Betrokkenen verwijzen relatief veel naar deze dimensies en relatief weinig naar de dimensie 'initiëren en identificeren van een visie', maar ze benadrukken dat teams de ruimte hebben gekregen om zelf een visie te ontwikkelen. Deze 'empowerment' kan ook als een onderdeel van transformationeel leiderschap worden gezien (Ten Bruggencate, 2009). Het is erop gericht docenten te stimuleren met betrekking tot innovatie en ontwikkeling, aspecten die we beide terugzien in de cases; we brengen ze onder bij de dimensies 'individuele ondersteuning' en 'intellectuele uitdaging', in twee zelfgedefinieerde subcategorieën. Managers stimuleren het innovatieproces door betrokken te zijn bij en toegewijd te zijn aan het innovatieproces (dit brengen we onder bij de subcategorie 'bevorderen van innovatie'), door de kracht van teams en docenten te erkennen, en door hun ontwikkeling te bevorderen (deze brengen we onder bij de subcategorie 'erkennen van de kracht van teams en docenten en stimuleren van hun ontwikkeling'). Verder benadrukken betrokkenen (voornamelijk managers en coördinatoren studieloopbaanbegeleiding) het belang van een 'dialogische leerhouding' en open communicatie in het innovatieproces. Zij geven aan dat zij zich bewust zijn van de kwetsbaarheid van docenten in dit proces.

Spelsimulatie

In de derde empirische studie (Studie 3, Hoofdstuk 6) zetten we een spelsimulatie (gebaseerd op het Kennisspel ontwikkeld door Kessels (zie Kessels, 1998)) in om de relatie tussen 'collectief leren' en de financiële en innovatieve prestaties van teams te onderzoeken. Vijf groepen docenten van verschillende opleidingen nemen deel aan een marktsimulatie, waarin zij als productiebedrijven opereren. Doordat de groepen zelf moeten uitzoeken hoe zij bestaande of nieuwe producten kunnen produceren, is hun commerciële succes sterk verbonden met hun innovatief vermogen. De financiële positie van groepen, het resultaat van hun efficiëntie en innovatief vermogen, dient als uitkomstmaatstaf. Door middel van de spelsimulatie zoeken we allereerst naar een antwoord op de volgende vraag:

Onderzoeksvraag 5: Hoe is Collectief Leren verbonden met de financiële en innovatieve prestaties van groepen docenten in de context van een spelsimulatie waar zij in een competitieve omgeving producten ontwikkelen en produceren?

De financiële en innovatieve prestaties van de groepen kunnen niet volledig eenduidig worden verbonden met de percepties van de teams en de observatoren aangaande 'collectief leren'. Toch lijkt een positieve relatie tussen deze prestaties en de groepen *hun eigen* perceptie van het leerproces op grond van de resultaten waarschijnlijk. De evaluatie van het collectieve leerproces door de observatoren komt grotendeels overeen met de financiële resultaten van de groepen; de beste financiële prestatie van de groepen wordt vaak behaald in de spelronde waar de observatoren de meeste gedragingen kenmerkend voor 'collectief

leren' herkennen. Echter, omdat de evaluaties van de observatoren soms maar weinig verschillen tussen twee spelronden terwijl de groepsprestaties wel sterk veranderen, kan alleen een voorzichtige conclusie worden getrokken.

We zien in het spel dat er vertraging kan optreden tussen 'collectief leren' zoals ervaren door de observatoren en de financiële prestaties van groepen. Sommige groepen starten direct met collectieve leerprocessen, maar hebben wat tijd nodig voordat zij producten kunnen produceren die voldoen aan de specificaties van de markt. Dit resultaat lijkt te impliceren dat groepen direct collectieve leerprocessen kunnen opstarten, maar dat zij soms wat tijd nodig hebben om hun handelen af te stemmen op hun omgeving. De innovatieve prestaties van de teams lopen niet consequent op met de manier waarop de observatoren de collectieve leerprocessen van de teams ervaren.

De relatie tussen 'collectief leren' en de prestaties van de groepen blijkt complexer te zijn dan we aanvankelijk veronderstelden. We vinden aanwijzingen dat: (1) 'creatieve onrust' (Kessels, 2001a) de innovatieve prestaties van teams kan bevorderen, (2) de emotionele en affectieve componenten van het leerproces relevant kunnen zijn voor de prestaties van de groepen (cf. Kessels, 2001a), (3) de referentiekaders van de groep en de observator kunnen verschillen wanneer zij het niveau van 'collectief leren' in de groep beoordelen, en (4) een 'gedeelde visie' de individuele activiteiten van docenten kan verbinden en deze afstemmen in het licht van de doelen die de groep nastreeft.

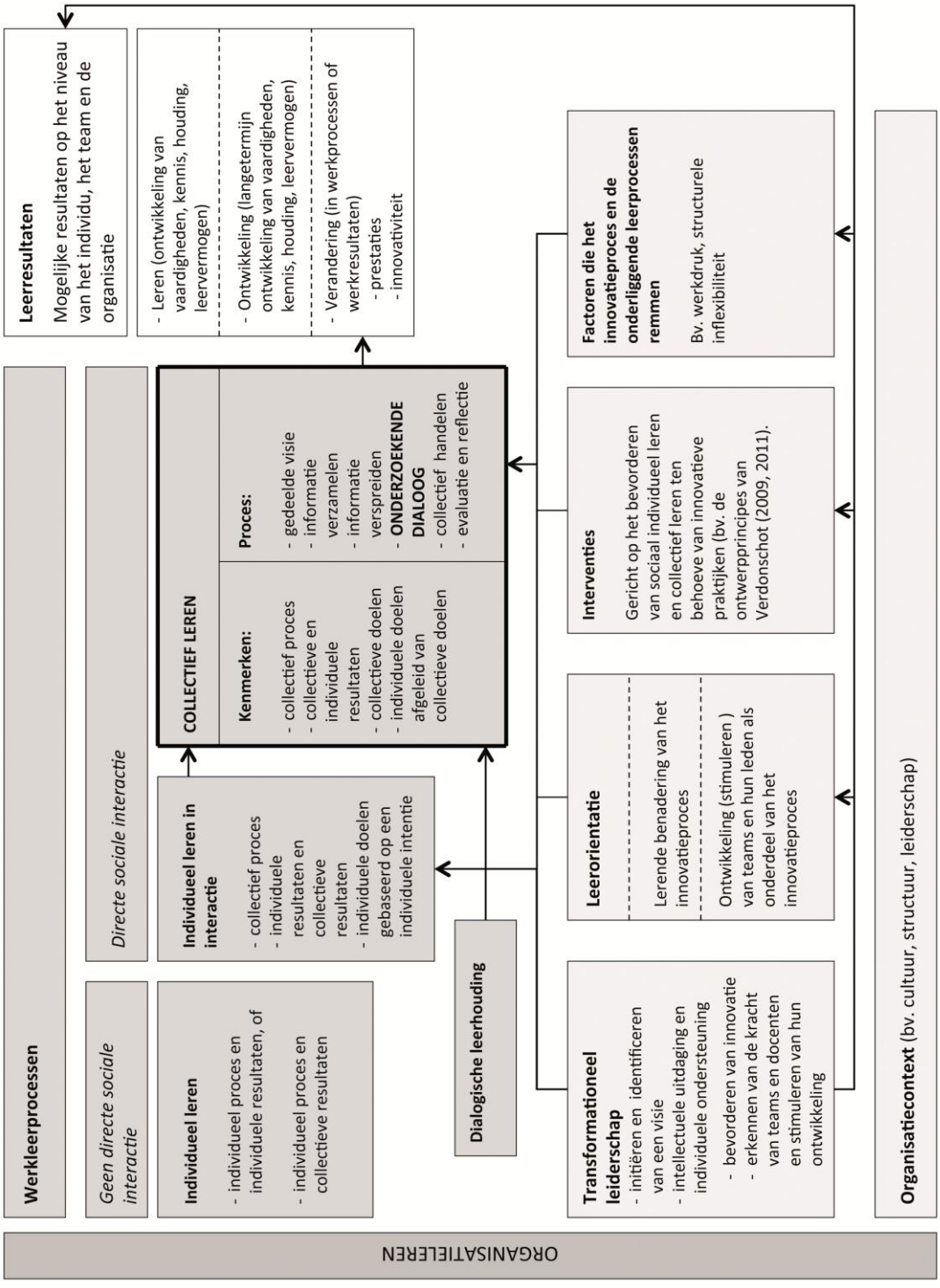
Om ons begrip van 'collectief leren' te vergroten kijken we in de spelsimulatie in de tweede plaats naar de relatie tussen de percepties van 'collectief leren' van groepen en van hun leden. Daarbij zoeken we naar een antwoord op de volgende vraag:

Onderzoeksvraag 6: Hoe verhouden, in de context van de geschetste spelsimulatie, de percepties van 'collectief leren' van groepsleden zich onderling, alsook in relatie tot de groepsperceptie?

De individuele scores van docenten binnen groepen lopen uiteen, maar convergeren gedurende het spel. Een waarschijnlijke verklaring is dat de perceptie van docenten een bijproduct is van het gedeeld begrip dat groepen tijdens het spel opbouwen. De resultaten laten zien dat groepsscores kleinere verschillen vertonen dan individuele scores, dat groepsscores vaak hoger zijn dan het gemiddelde van de individuele scores en dat groepen het niveau van 'collectief leren' vinden stijgen, zelfs wanneer een deel van de leden een daling ervaart. In de groep waarin *alle* leden een daling van het niveau ervaren, zien we wel een daling van de groepsscore. We concluderen dat de groepsbeoordeling van het niveau van 'collectief leren' vaak positiever uitvalt dan de individuele beoordelingen, wat suggereert dat relatief negatieve individuele percepties worden geneutraliseerd wanneer de individuele scores moeten worden vertaald in een groepsscore.

Algemene conclusies

Het resultaat van de drie empirische studies combinerend hebben we een conceptueel raamwerk gecreëerd dat suggesties bevat voor toekomstig onderzoek naar 'collectief leren' (zie Figuur 3).



Figuur 3. Herzien conceptueel model, op basis van de resultaten van het onderzoek.

We beschrijven 'organisatieleren' in termen van de leerprocessen die plaatsvinden binnen organisaties, van de resultaten waartoe deze processen leiden en van de organisatiecontext waarbinnen ze plaatsvinden. In navolging van De Laat en Simons (2002) onderscheiden we vier vormen van leren, uiteenlopend van volledig individueel (individueel proces met individuele resultaten) tot volledig collectief (collectief proces met collectieve resultaten). Het verschil tussen 'individueel leren in interactie' en 'collectief leren' (die beide gekenmerkt worden door een collectief proces en die, in ons raamwerk, kunnen leiden tot individuele en collectieve resultaten) zit in de intentie van de lerende: 'individueel leren in interactie' wordt gekenmerkt door individuele doelen (aangaande werk en/ of leren) gebaseerd op individuele intenties en 'collectief leren' wordt gekenmerkt door de combinatie van collectieve doelen en individuele doelen (waarbij de laatste worden afgeleid van de collectieve doelen van een team). Door individuele en collectieve leervormen in ons raamwerk op te nemen en door de invloed van de organisatie te onderkennen conceptualiseren we 'organisatieleren', in lijn met hedendaagse inzichten, als een multilevel concept (zie Cousins, 1998; Edmondson & Moingeon, 2004; Örtenblad, 2004; Popper & Lipshitz, 2004; Verbiest, 2004; Kozlowski et al., 2010).

In onze studie hebben we gezien dat 'individueel leren in interactie' en 'collectief leren' nauw verwant zijn. In het herziene conceptuele model scharen we ze onder de noemer 'leren door middel van directe, sociale interactie', om hun gemene deler te benadrukken. Het concept 'dialogische leerhouding', wat sterk betrekking heeft op de bereidheid van lerenden om deel te nemen aan open communicatie, zou een belangrijke rol kunnen spelen in collectieve leerprocessen. In vervolgonderzoek zou de relatie tussen dit concept en 'collectief leren' verder onderzocht kunnen worden. Omdat individueel leren kan worden beschouwd als het fundament van 'collectief leren' (Kozlowski et al., 2010) veronderstellen we een positief effect van 'individueel leren in interactie' op 'collectief leren' (hoewel we een wederkerige relatie erkennen). Het is aannemelijk dat naarmate mensen in een team bekwamer zijn in individueel leren door middel van sociale interactie, het team ook bekwamer zal zijn in 'collectief leren'.

De ideeën van Simons en Ruijters (2004) volgend maken we een onderscheid tussen drie typen leerresultaten: leren in de beperkte zin (dit betreft de ontwikkeling van vaardigheden, kennis, houding en leervermogen), ontwikkeling en verandering. Leerresultaten kunnen ontstaan op het niveau van individuen, teams en organisaties. Organisatie*ontwikkeling* doet zich voor wanneer er lange-termijn veranderingen optreden in de vaardigheden, kennis, houding of het leervermogen van individuen, teams en de organisatie; organisatie*verandering* doet zich voor wanneer deze ontwikkeling leidt tot veranderingen in werkprocessen of werkresultaten op elk van deze niveaus. Wanneer organisaties een leerstrategie hanteren om zich voortdurend aan te passen aan interne veranderingen en aan veranderingen in hun omgeving, streven zij doorgaans naar het verbeteren van hun prestaties en het vergroten van hun innovativiteit. Dit laatste vraagt van mensen dat zij het vermogen hebben om samen te werken (De Laat & Simons, 2002). In ons onderzoek vinden we inderdaad een positieve relatie tussen 'collectief leren' en de (innovatieve) prestaties van teams.

We veronderstellen dat organisaties het leren door individuen en teams kunnen faciliteren door ze een structuur, cultuur en leiderschapsstijl te bieden die ondersteunend zijn aan leerprocessen. Een dergelijke omgeving simuleert de ontwikkeling van de bekwaamheid van

individuen en teams. Organisaties kunnen de effectiviteit van leerprocessen vergroten door formele structuren erop af te stemmen en de benodigde middelen beschikbaar te stellen (Kozlowski et al., 2010). In de gevalstudie zien we bijvoorbeeld de bevorderende werking van een 'leeroriëntatie' – een lerende benadering van het innovatieproces en een oriëntatie op de ontwikkeling van teams en docenten – op het innovatieproces. Het heeft een gunstige leeromgeving gecreëerd voor ervaringsleren en sociaal leren en daarmee voor 'collectief leren'. We hebben ook ondersteuning gevonden voor het veronderstelde positieve effect van 'transformationeel leiderschap' op 'collectief leren' en 'individueel leren in interactie'. We hebben aanwijzingen gevonden dat een dergelijke leiderschapsstijl teamresultaten zowel rechtstreeks kan beïnvloeden als indirect, door het stimuleren van 'collectief leren'. Beide effecten zijn opgenomen in Figuur 3. De organisatiecontext kan leer- en innovatieprocessen bevorderen, maar kan deze ook remmen; zo kunnen de factoren 'tijdgebrek' en 'structurele inflexibiliteit' bijvoorbeeld een remmend effect hebben op collectieve leerprocessen. Geïnspireerd door de gevalstudie stellen we dat deze factoren tot op zekere hoogte in de invloedsfeer van managers liggen.

Tot slot staan we, op grond van de patronen die we in de gevalstudie hebben gevonden, stil bij de bevinding dat 'individueel leren in interactie', 'collectief leren', 'transformationeel leiderschap' en de 'remmende factoren' kunnen worden geïnterpreteerd in termen van de 'ontwerpprincipes' van Verdonschot (2009, 2011). De ontwerpprincipes zijn beïnvloedbare factoren die belangrijk blijken als het gaat om het bevorderen van vernieuwend leren. Wanneer we ter ondersteuning van innovatieve praktijken op zoek gaan naar geschikte interventies voor het bevorderen van 'individueel leren in interactie' en 'collectief leren', zouden de ontwerpprincipes richtinggevend kunnen zijn.

CURRICULUM VITAE

Nanda Lodders was born in The Netherlands (Voorburg, 1980). After completing her secondary schooling she studied Business Administration at the Erasmus University Rotterdam, where she specialized in the field of innovation management. In 2002 she finished her study cum laude. After her study she worked as a mathematics/statistics teacher at The Hague University of Applied Sciences. She participated in various innovation projects and as such developed an interest in the learning mechanisms underlying educational innovation. In 2008 she joined the university-level research group 'Pedagogics of vocational development' to further deepen her understanding of this subject.

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