

Supporting intrinsic motivation of knowledge workers within teams

Distributed leadership and a climate for informal learning as social conditions for facilitating competence and relatedness satisfaction

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Abstract

Problem – As the importance of knowledge creation and its continuous application to work keeps rising, the field of HRD must accommodate this process of knowledge productivity. A key variable contributing to knowledge productivity is employees' intrinsic motivation.

Purpose – The purpose of this study is to link the social contextual variables of distributed leadership and climate for informal learning to the satisfaction of basic motivational needs of competence and relatedness within knowledge intensive teams.

Method – Motivational needs are operationalized through the self-determination theory and measured with a survey. Distributed leadership is operationalized using a novel social network approach and an 8-item scale measuring climate for informal learning is developed. Multilevel and regression analysis of data from a sample of 163 child welfare workers in 21 teams from a Dutch child welfare organization is used to test the hypotheses.

Findings – Significant main effects were found of individual's relative social influence within the team's network on satisfaction of the need for competence. In addition, main effects were found of the equality of social influence of team members, team network density and climate for informal learning on the satisfaction of the need for relatedness. Team level effects on competence were not found.

Contribution – The main findings show that distributed leadership and a positive climate for informal learning may prove fruitful in supporting intrinsic motivation. In addition, this study yields new operationalizations for these two constructs and is sensitive to effects of the team level because of the multilevel approach.

Introduction

During the past decade it has become evident that a worldwide knowledge economy has emerged (Burton-Jones, 2001; Drucker, 1993). Productivity and competitiveness of businesses have become increasingly dependent on the application of knowledge to products and services. Subsequently, the proportional value of the triumvirate of capital, material resources and labour has been subject to de-emphasis (Castells, 1996; Drucker, 1993; Kessels, 1996a)). A trend extending the shift towards a knowledge economy has been the increasing prevalence of teams in organizations (Kozlowski & Ilgen, 2006) and an emphasis on perpetual learning as the answer to dealing with the uncertainties and demands of tomorrow (Kessels, 1996b; Schein, 2010; Senge, 1990)

Kessels (1996b) coined the term *knowledge productivity*, seeking to describe the process by which organizations add value to products and services by applying knowledge to them. He describes knowledge productivity as: “[It] *involves signalling, absorbing and processing of relevant information, generating and disseminating new knowledge and applying this knowledge to the improvement and innovation of processes, products and services.*” (Kessels, 2001, p. 498).

The shift towards knowledge productivity as one of the main determinants of economic value brings forth a fundamental shift in the way organizations need to accommodate their employees. The traditional top-down management approaches based on planning and control do not seem to accommodate the needs of knowledge workers (Adler, 2001; Osterloh, Frost, & Frey, 2002). The concept of knowledge productivity propels learning and educational activities to the forefront of organizational development issues. If applying knowledge to products and services has become the dominant strategy in business, this raises the question of how employee’s knowledge can be developed and how its practical application can be supported. It is this reason why the field of human resource development (HRD) has shifted from traditional classroom training and instruction towards an integrated approach of learning at the workplace and a focus on learning climates (Eraut, 2004; Kessels, 1996b; Keursten, 1999; Mankin, 2009; Poell, van Dam, & van den Berg, 2004). In essence, the HRD specialist seeks to create corporate environments, which increase employee’s access to knowledge as well as opportunities for its application to products and services.

A tested and tried factor which can help us understand and support learning, creativity and productivity at work is intrinsic motivation (Deci &

Ryan, 1985, 2000; Deci, 1975). Work by Deci & Ryan (2000) shows that autonomous motivation contributes the most to being productive, especially when considering cognitively complex tasks and creativity. In contrast, motivating knowledge workers with external motivators such as (cash) rewards and other incentives has proven dramatically counterproductive. For example, in a meta-review of 128 peer reviewed studies by Deci, Koestner and Ryan (1999) the researchers conclude that rewards consistently undermine intrinsic motivation across-the-board and cause people to neglect their responsibility to motivate and regulate themselves. That being said, in a context of knowledge work and an increasing emphasis on self-management, incentivizing does not seem to be a viable strategy to accomplish long-term knowledge productivity. How then, can we support intrinsic motivation amongst knowledge workers? Deci & Ryan’s (1985, 2000) Self-Determination Theory (SDT) provides direction. By satisfying three basic psychological needs, people can sustain their natural tendencies towards development and thrive in a context of knowledge work. Deci and Ryan (2008; 2000) suggest that the answers to supporting intrinsic motivation may lie in the social context of individuals.

One social contextual factor that has enjoyed undying attention during the past decades, from academics as well as in the popular literature, is leadership (Avolio, Walumbwa, & Weber, 2009; Storey, 2004). It has been suggested that leadership is crucial for enabling team effectiveness (Cohen & Bailey, 1997) and some researchers have even argued that it is the most critical component (Zaccaro, Rittman, & Marks, 2002). The connection between leadership processes and the satisfaction of the basic psychological needs supporting intrinsic motivation has not yet been made. A second organizational contextual factor that seems relevant in supporting employees’ intrinsic motivation is the climate for informal learning within teams. Increasingly, the field of HRD has sought to accommodate workers to learn on-the-job (Mankin, 2009) and the importance of informal learning in the workplace is being stressed (Eraut, 2004; Marsick & Volpe, 1999; Poell et al., 2004). Marsick, Volpe, and Watkins define informal learning as “learning that is predominantly experiential and noninstitutional” (1999, p. 11). In the context of teams working within knowledge intensive organizations, learning together is one of the key activities helping employees to overcome obstacles in their work and engage in reflective activity (Marsick et al., 1999).

The Present Study

It is clear that within the context of knowledge intensive firms, the question of sustainable knowledge productivity is of prime importance, which places an emphasis on the employees' intrinsic motivation to learn. When considering the literature, it is evident that both leadership and a positive learning climate for informal learning are regarded as crucial for knowledge work in teams. However, the empirical links between these concepts and the satisfaction of the basic motivational needs has not yet been established. In summary, we can compose the following research question from the current trends in practice and literature:

How do leadership and a climate for informal learning relate to the satisfaction of the basic motivational needs of knowledge workers?

The exploration of this question is not only worthwhile from the viewpoint of scientific endeavor. In addition to theory building, exploring these conceptual relationships may yield clues on how to provide an attractive working environment for knowledge workers. In practice, the increase in teamwork (Kozlowski & Ilgen, 2006) and trend towards trust based organizational systems (Adler, 2001) has led to a demand for new HRD strategies (Mankin, 2009). The very same processes that speed up the demand for organizational change, also put the clock on the field of HRD to change its practice (Swanson & Holton III, 2009). The question of whether the field will be able to keep up remains, as we have no fully developed idea yet on how to provide knowledge workers with an attractive environment that supports sustainable knowledge productivity. The theoretical building blocks we draw upon in this study may provide an answer.

This study is part of a broader research and further focuses only on the satisfaction of the needs for competence and relatedness. From the work of Deci and Ryan (2000) we know that autonomy is crucial in knowledge work. Without autonomy, professional knowledge work is simply not possible. However, what exactly is the relationship between the satisfaction of the needs for competence and relatedness in the context of teams performing knowledge work? And how can these two needs be optimally supported by HRD professionals? These questions are the focus of this study. For the results and discussion on the satisfaction of the needs for autonomy and competence, we refer to the work of Van Langevelde (2013).

The present study explores these conceptual relationships within the context of teams of an

organization for child and youth care in the Netherlands. The employees working in this type of public service sector can be described as *frontline workers* (Bruining, 2005). Frontline workers are "public service workers who interact directly with citizens in the course of their jobs, and who have a substantial discretion in the execution of their work" (Bruining, 2005 p. 300). Bruining also directly connects frontline work and knowledge work by stating that in order for organizations to flourish, frontline workers should be appreciated as knowledge workers. To a certain degree the teams of knowledge workers in the youth and child care organization are self-managing and can best be described by the definition of teams from Tjepkema:

A permanent group of employees who work together on a daily basis, who, as a team, share the responsibility for all interdependent activities necessary to deliver a well-defined product or service to an internal or external customer. The team is, to a certain degree, responsible for managing itself and the tasks it performs, on the basis of a clear common purpose. In order to do so, the team has access to relevant information, possesses relevant competences and other resources, and has the authority to independently make decisions with regard to the work process (e.g. solving problems) (Tjepkema, 2002, p. 6).

To explore the theoretical constructs we build a framework of theories that are relevant in the context of knowledge work. This framework provides a point of departure for several concrete hypotheses, which will guide our inquiry.

Theoretical Framework

Self-determination theory of motivation

Before we elaborate on the theory underpinning leadership distribution and the climate for informal learning, we delve deeper into the Self-Determination Theory (SDT) and the concept of intrinsic motivation. The SDT attempts to explain the observation that human beings can either be proactive and interested, pursuing development, or can alternatively be passive and devoid of interest in activities (Ryan & Deci, 2000). The SDT is based on a positive view of human beings: it suggests that humans have a natural tendency towards integration and adaptation, an inborn focus on engaging in interesting and social activities, being part of a larger group and exercising their capabilities (Deci & Ryan, 2000). The human being as conceptualized in the SDT is an active and growth-oriented individual

by nature. The social context surrounding the individual can either support or hinder their natural tendencies towards well-being, development and growth by affecting the satisfaction of three basic psychological needs: the need for *autonomy*, for *competence* and for *relatedness* (Deci & Ryan, 1985, 2000).

Deci and Ryan define these needs as “innate psychological nutriment that are essential for ongoing psychological growth, integrity, and well-being” (2000 p. 229). The satisfaction of these needs is a prerequisite for high quality motivation to (continue to) exist. Also, the satisfaction of these needs is linked to the quality of someone’s performance and creativity in the context of work (Deci & Ryan, 2000).

The need for autonomy reflects a person’s need for volition, experiencing freedom of choice, and acting without pressure. It is distinctly different from feelings of independence. Where independence means to act alone and not relying on others, autonomy refers to a sense of acting out of one’s own free will. The two can exist apart from each other and independence is not necessary a satisfaction of the need for autonomy. For example, a person can readily comply with the requests of someone else because he/she thinks they are very important. In this case the person would not be acting independently, but completely out of free will (Deci & Ryan, 2000), hence satisfying their need for autonomy. Competence refers to people’s need to feel good at what they are doing, capable of handling their tasks and feel challenged. Positive feedback is one of the ways through which the need for competence can be supported (Deci et al., 1999; Ryan & Deci, 2000). Relatedness is about building meaningful connections with other people. Employees can experience relatedness when they are part of a close-knit team or group, and when they have the ability to support others and feel supported by others. Of the three, the satisfaction of the needs for autonomy and competence seem to be tied the strongest to intrinsic motivation, whereas the need for relatedness plays a more distal role (Deci & Ryan, 2000).

Vallerand (2000) suggests that even though relatedness may seem to play a more distal role in general theory, the importance of the different motivational needs may shift depending on the context that individuals are in. Relatedness may therefore play an instrumental role especially in those circumstances where activities and tasks are inherently social in nature. Extending Vallerand’s (2000) argument, it is reasonable to assert that needs for relatedness will be more determinant of intrinsic motivation in a context of team work, especially when there is interdependence on tasks and the work itself (youth and child support), which

is social in nature. A review of literature in the health care sector by Toode, Routasalo, and Suominen (2011) underlines this relationship. Additionally, a person is not always able to act exclusively on the basis of intrinsic motivation. In the context of work, extrinsic motivators (e.g. organizational targets, reward schemes) are inevitably present as a driving force. Deci & Ryan (2000) show that the primary reason for people to perform these extrinsically motivated tasks is because the behaviours are modelled or seem to be valued by significant others to whom the person feels (or wants to feel) related. Based on these arguments it seems that relatedness should play an important role in supporting employees’ intrinsic motivation, instead of a more distal one. This would apply especially in the context of teams of knowledge professionals who share common goals and a socially oriented workspace. When considering competence, the same process of accepting externally motivated behaviors seems to apply. For example, Gagné and Deci (2005) state that the satisfaction of the need for competence with regard to a specific behaviour is also instrumental in the process of accepting that behaviour. Additionally, Deci and Ryan (2000) propose that the need for competence provides an advantage to individuals and groups when regarded from an evolutionary perspective. They state that the need for competence allows individuals to maximize their talents in niche-relevant ways when they are embedded in groups and this differentiation may in turn benefit the entire group. Competence would therefore facilitate flexibility and adaptation to group needs and help human functioning specifically in the context of cooperating groups. In this regard, it is easy to link the need for competence to the dynamic and interactive group processes of leadership (DeRue & Ashford, 2010; Gronn, 2002; Spillane, 2006) which are the subject of the present study.

Distributed leadership

The concept of leadership currently receives a lot of attention in businesses, as modern theorists strive to accommodate the changing nature of work. Historically, the concept of leadership is associated with ‘great men’ who have, seemingly without important interactions with others, singlehandedly saved organizations from dire situations (Carlyle, 1840; Gronn, 2000; Spillane, 2006). These stories carry a saucy subtheme of heroism and great force of will, and have caused this paradigm to become designated as ‘hero leadership’ by authors such as Spillane (2006) and Yukl (1999). However, we know that leaders do not exist without followers and that sometimes, as situations require, different leaders or even groups of leaders are needed. This idea is reflected especially in Van Vugt’s work on

evolutionary leadership (2008), who posits that under different circumstances groups need different types of leadership qualities to thrive and survive. It is this long standing realization, combined with the current shifts in organizational structures and relationships that has inspired the field of leadership to move beyond individualist and psychological traits conceptions and onto a more integrated approach centered around (social) interactions (e.g. Dijkstra & Feld, 2012; Gronn, 2000; Spillane, 2006; Uhl-Bien, Marion, & McKelvey, 2007).

Distributed leadership theory attempts to connect social interplay with individual agency (Gronn, 2000, 2002; Spillane, 2006). Gronn (2000) asserts that, while existing social structures as well as individual agency are indeed important, neither can be usefully studied as an isolated construct. Shared and distributed leadership theories attempt to connect these two and have grown in popularity quickly (Bennett, Wise, Woods, & Harvey, 2003; Harris, 2007). They are widely regarded by many theorists and practitioners as the answer to the question of how to lead a knowledge intensive organization (e.g. Dijkstra & Feld, 2012; McBeth, 2008; Uhl-Bien et al., 2007), however evidence remains thin (Harris, Leithwood, Day, Sammons, & Hopkins, 2007).

The distributed leadership theory regards leadership as the product of social interactions between leaders (individual agents), followers and their context. It represents a bottom-up conception of leadership (Gronn, 2000; Spillane, 2006) and focuses on social influence. At the core of the distributed leadership process is the claiming and granting of social influence by organizational members (DeRue & Ashford, 2010; Hulsbos, Andersen, Kessels, & Wassink, 2012). Such a process allows for influence to be located at those individuals and groups who have relevant expertise, competencies and motivation for the job at hand (Kessels, 2012). Allowing professionals to take responsibility for their own actions (thus, self-determined) may in turn contribute significantly to the satisfaction of the basic psychological needs for motivation.

To operationalize the concept of distributed leadership, we draw on the definition of leadership provided by Spillane:

Leadership refers to activities tied to the core work of the organization that are designed by organizational members to influence the motivation, knowledge, affect, and practices of other organizational members or that are understood by organizational members as intended to influence their motivation, knowledge, affect, and practices (Spillane, 2006, p. 11)

In this definition, two aspects stand out which require elaboration. Firstly, we need to determine which units of observation are 'activities tied to the core work of the organization'. Secondly, we need some way to operationalize the concept of influence, which must also encompass any potentially perceived influence that wasn't necessarily intended by the influencer.

To solidify the activities related to the core work of the organization, we turn to *leadership functions*. Both Gronn (2000, 2002) and Spillane (2006) state that leadership occurs only when the social influence is tied to the core work of the organization. Morgeson, DeRue & Karam (2010) write that "... *team leadership can thus be viewed as oriented around team need satisfaction [...] Whoever (inside or outside the team) assumes responsibility for satisfying a team's needs can be viewed as taking on a team leadership role.*" (2010, p. 8). In Morgeson, et al's (2010) definition it is also clear that influence on core functions is what constitutes leadership. This brings up the question of what the most important and overarching leadership functions are, which are relevant for teams of professionals operating in knowledge intensive organizations.

Current research by Derksen (Derksen, de Caluwé, & Simons, 2011; Derksen, n.d.) shows that within teams, that are innovative and successful at applying knowledge to novel problems, four essential functions need to be fulfilled. Teams who fulfill all four of these functions seem to do well on cognitively complex and creative tasks. By contrast, teams who spend attention on only one or two of these leadership functions seem to do more poorly on the same tasks (Derksen, n.d.). As these four functions look to be crucial for knowledge productive teams to pay attention to we further refer to these four functions as *leadership functions*. The four functions described by Derksen, et al. (2011) are: 1) *Organizing* - making appointments, scheduling, making sure the work is divided, who, when and how, 2) *Creating Future* - formulating a shared vision for the future, defining the mutual cause and asserting the added value that the team needs to deliver, 3) *Reflecting* - taking a perspective on one's work and social processes, rethinking habits, processes and collaborations. Also known as 'taking the helicopter view', and 4) *Dialoguing* - conducting a conversation in which norms, values and visions are shared and explored while postponing judgment.

The second element from the definition provided by Spillane (2006) is influence. One aspect of distributed leadership theory is that team members can claim and grant influence based on what the situation demands (DeRue & Ashford, 2010; Hulsbos et al., 2012). The assumption is that if this process of taking and granting influence is dynamic, teams

can respond to situations by drawing on the relevant expertise of all of their members, instead of relying on the same leadership patterns in every situation. Dynamism refers to the flexibility of leader and follower roles, which may change over time to accommodate shifting demands of the team (DeRue & Ashford, 2010). This dynamism allows teams to break away from the force of habit and in theory can allow them to respond more effectively to new situations (DeRue & Ashford, 2010; Van Vugt et al., 2008).

In order to capture this claiming and granting process, we operationalize influence taking by using a social network approach (Fombrun, 1982; Tichy, Tushman, & Fombrun, 1979). A social network approach has several advantages. First, it allows us to highlight the relational aspect of distributed leadership. Second, the social network approach offers tools and methods to analyze these social relationships. Third, distributed leadership is about social influence processes and the social network perspective has an extensive background in examining the nature and structure of influence networks. Research applying a social network approach to leadership is limited (Carson, Tesluk, & Marrone, 2007; Mehra, Smith, Dixon, & Robertson, 2006; Pastor & Mayo, 2002), but shows promise of identifying informal leadership through social influence networks within teams. Measures that stand out and might carry relevance in this study are those of *centrality* and *density*.

The distributed leadership theory connects with the needs of competence and relatedness especially when considering the duality of social interplay and individual agency that the theory strives to accommodate (Gronn, 2002). As Deci & Ryan (2000) stated, satisfying the need for competency is tied to behaving in niche-relevant ways and maximizing one's talent in specific working groups. This process of adaptation requires individual agency from the actor (claiming influence based on e.g. talents). From the perspective of distributed leadership, an individual's competency and talents are theoretically tied to their ability to claim influence on specific tasks and functions. This process in turn emphasizes the aspect of social interplay, because influence also needs to be granted by others in order for leadership and followership roles to successfully develop (DeRue & Ashford, 2010; Kessels, 2012). A social network measure that reflects the successful claiming and granting of influence is the *individual centrality* (Freeman, 1978; Pastor & Mayo, 2002). We hypothesize that an individual's central position in the influence network of the team will, in turn, lead to the satisfaction of the need for competence because being granted influence can be perceived as feedback information about one's competence. In addition, being granted influence by other team

members conveys a basic message of trust and benevolence towards the actor and we hypothesize that this creates a positive tie with the satisfaction of the need for relatedness.

Hypothesis 1a: An individual's centrality in the team network is positively tied to satisfaction of the need for competence.

Hypothesis 1b: An individual's centrality in the team network is positively tied to satisfaction of the need for relatedness.

The concept *team centrality* takes the individual centrality construct to a higher hierarchical (team) level and compares the relative differences in social influence between team members (Freeman, 1978; Pastor & Mayo, 2002). Team centrality allows us to determine whether social networks are strictly hierarchical and centred around a select few, or whether they show a more distributed leadership pattern where team members share equal amounts of influence. According to Deci & Ryan (2000) people derive information about their competence by making comparisons with equals on the same tasks, as well as receiving other forms of feedback information. We hypothesize that when team members are equal in their social influence this will contribute to feelings of competence, as the group seems to value everyone's contribution to the leadership task in an equal fashion. Additionally, we propose a strong tie between team distribution of influence (high centrality) and the satisfaction of the need for relatedness, because sharing influence and contributing equally to the shared goals of the team (during meetings, daily work, reflective moments) promotes feelings of friendship, trust and mutuality.

Hypothesis 2a: Team centrality is positively related to the satisfaction of the need for competence.

Hypothesis 2b: Team centrality is positively related to the satisfaction of the need for relatedness.

The third and last measure of leadership networks is the *network density*. Network density regards the relative number of present social relationships within the team and is an indicator of the amount of social activity that team members have during their work (Pastor & Mayo, 2002). Baumeister and Leary (1995) illustrate that an abundance of social activity is at the base of building meaningful relationships with colleagues. This may hold true especially in the context of a health care organization where the work is social in nature and where team members are dependent on each other for carrying out their professions. However, similar to the concept of team centrality, we hypothesize that an abundance of social relationships does not necessarily need to support feelings of competence, since even with relatively little social interaction it is

still well possible to feel up to the task and receive positive feedback, strengthening an individual's feelings of competence.

Hypothesis 3a: Network density is neither positively, nor negatively, related to the satisfaction of the need for competence.

Hypothesis 3b: Network density is positively related to the satisfaction of the need for relatedness.

Informal learning climate

The second organizational contextual factor that we explore in this study is the climate for informal learning within teams. Research by Eraut (2004) has shown that for early- as well as mid-career workers, learning at work is facilitated or constrained by the organization and allocation of work, as well as relationships and the social climate. Eraut goes on to highlight the importance of "creating a climate that promotes informal learning" (Eraut, 2004 p. 271). Other work on informal learning has also stressed the importance of learning climates, such as Kessels' (1996a, 2001) theory on the corporate curriculum, or Marsick's theories on informal learning (Marsick et al., 1999; Marsick & Volpe, 1999). These authors have linked the presence of a learning climate to employee learning in knowledge intensive organizations and have described key elements of these environments.

A climate for informal learning reflects the presence of a basic trust in which people know that asking a question or making a mistake will not be punished or misunderstood (Marsick & Volpe, 1999). It is also a climate in which colleagues are easily accessible ('open doors'), in which learning is the norm instead of the exception, and in which colleagues are willing to act as sounding boards for ideas and new takes on problems (Van der Heijden,

2003). Professionals who create a favourable climate for informal learning are intentional about learning, reserving time and space for learning, viewing collaboration as a learning activity and being intentionally reflective (Marsick et al., 1999). Additionally, Schein (2010) emphasizes the importance of the absence of a strong socializing culture which inhibits learning by its enforced norms, habits and routines.

A large part of learning in everyday work situations originates from social interactions among people (Cheetham & Chivers, 2001; Eraut, 2004). When the team context provides an inviting and stimulating environment where knowledge is clearly shared and learning is the norm, new knowledge can be acquired and applied easily. The need for competence regards the perception that one will be able to carry out different (challenging) tasks proficiently (Deci & Ryan, 2000) and therefore the presence of a positive climate for informal learning seems likely to contribute to the satisfaction of this need. Additionally, well established collegial bonds which are necessary for knowledge sharing are based on mutual trust and cooperation (Marsick & Volpe, 1999) and therefore are very likely to be conducive to the satisfaction of the need for relatedness.

Hypothesis 4a: A higher score on climate for informal learning will be tied to a higher score on competence

Hypothesis 4b: A higher score on climate for informal learning will be tied to a higher score on relatedness

All of the previously hypothesized relationships are summarized in the research model displayed in figure 1.

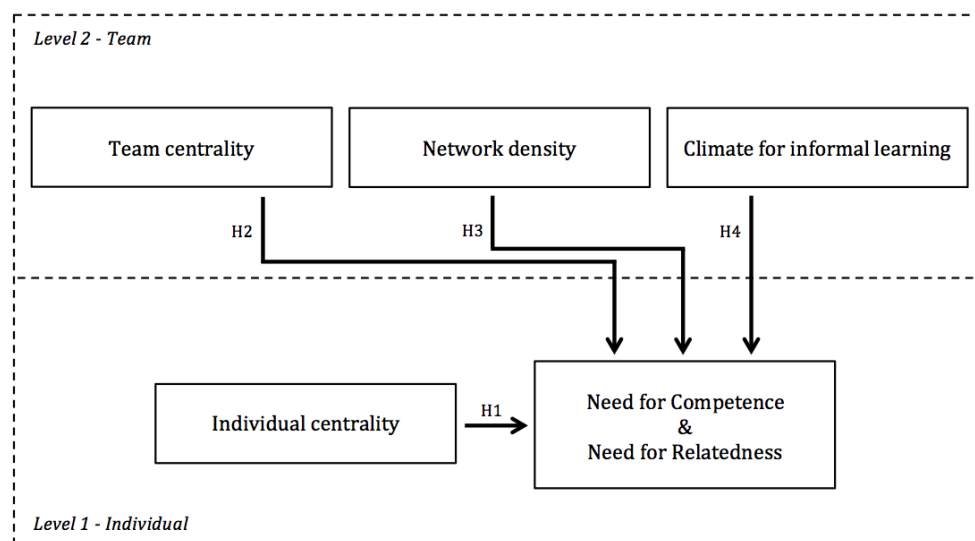


Figure 1. Hypothesized relationships featured in a research model

Method

Context

The research was conducted in an organization for child and youth support in the east of the Netherlands. The organization is medium sized with a total of about 400 employees and around 30 teams, 22 of which are active in the primary process of youth care activities. The type of professionals working in this organization follows the definition of *frontline workers* by Bruining (2005).

The data used in this research was gathered as a part of a one-year consultancy project focused around supporting teams to become increasingly self-organizing. 14 of the participating teams were part of this consultancy project and had met the researchers at least thrice before going into data gathering. These teams all volunteered for this consultancy project after an open invitation to all teams. No use was made of external roles (e.g. management) to persuade teams to participate in the research project.

Sample

To collect the data an open invitation was sent via e-mail directly to all teams in the organization. This resulted in 21 participating teams. Teams consisted of approximately 4 to 20 employees, with an average of around 9 ($M = 9.37$, $SD = 4.10$). We initially ran a pilot online questionnaire with four randomly selected teams to gather feedback on the instrument (4 teams, $n = 21$, with 1 missing). Respondents repeatedly used the 'general feedback' comment space to give positive feedback on the instruments, indicating that they recognized the survey content and perceived it as very relevant to their work. However, we noticed that the limited capacity for interaction and explanation caused an initial response rate that was too low for the social network part of the survey, requiring several personalized reminder e-mails before an adequate response rate was reached. Out of practical considerations we therefore decided to make physical appointments with the teams to gather the data on paper during their regular team meetings. The paper data collection resulted in 163 participating individuals (level 1, response rate = 96%) from 21 teams (level 2, response rate = 70%). Level 1 non-response was caused due to sick-leave of individuals. The level 2 non-response was caused mainly by time constraints. Of the 163 respondents, 141 were female (86%, 3 missing). Age ranged from 20 to 64 years, averaging 40.48 ($SD = 12.20$, 8 missing). The education level averaged 6.68 ($SD = 0.97$, 4 missing) indicating that the vast majority of employees completed vocational

education or higher. See table 1 for an overview of the descriptive statistics.

Measures

All the measures described below were combined into a single paper questionnaire. All 89 items were posed in Dutch, the native language of the target group.

Demographics

The first section of the questionnaire consisted of *demographic items* on gender (female = 1, male = 2), age (years), and education (highest finished, ranging from 1 = *primary school* to 8 = *graduate school*).

Climate for informal learning

The second section measured the *climate for informal learning*. The development of this measure was part of this study. A pool of 63 items was generated by Stam (2007) based on the corporate curriculum theory (Kessels, 1996b). Items were based on a 5-point Likert scale (ranging from 1 = *strongly disagree* to 5 = *strongly agree* and 6 = *not applicable*). The whole questionnaire was administered, but for this study only items on the climate for informal learning were used. Data for the validation was collected in two organizations. Organization 1 ($N=163$, response rate = 50%) was the child and youth support organization also used for the rest of this study. Organization 2 ($N=47$, response rate = 37%) was an accountancy software development firm in the center of The Netherlands. The data for organization 2 was collected through an online survey, for which participants were invited by e-mail. Organization 2 only provided data for the validation of this part of the questionnaire and not for the rest of this study.

The first step was to examine the item completeness and the distributions of the item scores using the mean, standard deviation, skewness, and kurtosis. All items showed to meet the criteria (skewness and kurtosis of < 2). All items were normally distributed. Therefore no items were removed during this step.

In the second step an Exploratory Factor Analysis (EFA) was conducted using Principal Axis Factoring and an Oblique rotation (in SPSS v21: Direct Oblimin) (Field, 2009; O'Connor, 2000). The Kaiser-Meyer-Olkin measure ($KMO = .87$) and Bartlett's test of Sphericity ($p < .001$) confirmed that the sample was adequate for factor analysis. The scree plot suggested between three and five factors. Subsequent parallel analysis in combination with item-content analysis (Hayton, Allen, & Scarpello, 2004; O'Connor, 2000) supported a three factor solution, because four and five factors solutions

yielded uninterpretable results and factors with too few items (< 3).

The third step was to select the items which fitted best in the three factor model. Based on Worthington and Whittaker (2006) the following removal criteria were used: factor loading of >.30 onto multiple factors; factor loading of >.30 on one factor and with a distance of <.15 to other factor loadings; a factor loading of >.30 on no factor at all. A total of 47 items were removed in this step. This resulted in three scales: scale 1 consisted of 8 items with 3 reversed items, Cronbach's alpha = .80; scale 2 consisted of 5 items, Cronbach's alpha = .66; scale 3 consisted of 3 reversed items, Cronbach's alpha = .73.

In the fourth and final step the reliability (using Cronbach's alpha) was checked and six researchers theoretically interpreted the factors. Scale 1 was interpreted as measuring the perception of the individual worker on the climate for informal learning within his or her team. One item didn't fit this interpretation and the factor loading was relatively low (.39) compared to the other items. Therefore this item was excluded from scale 1, having no impact on the Cronbach's alpha. Since only climate for informal learning (scale 1) is subject of this study, scale 2 (self-directed innovation) and 3 (stress) were excluded.

Basic psychological need satisfaction

The third section measured the *satisfaction of the SDT needs*. Van den Broeck, Vansteenkiste, Witte, Soenens and Lens (Broeck, Vansteenkiste, Witte, Soenens, & Lens, 2010) developed the Work-related Basic Need Satisfaction scale (W-BNS). This 18-item questionnaire measures to what extent a person feels the need for autonomy, competence and relatedness is satisfied at work. Items were based on a 5-point Likert scale (ranging from 1 =

strongly disagree to 5 = *strongly agree*). Each scale consists of six items and the final score is the average score on these items (see Table 1 for sample items). A higher score indicates greater need satisfaction. The measure relies on self-report, because the SDT considers the degree to which people are able to satisfy their fundamental needs as the most important predictor for optimal functioning and does not focus on individual differences in need strength (Deci & Ryan, 2000). For this study only the results on the scales of autonomy and competence are used. The Cronbach's alpha of the scales for autonomy satisfaction and competence satisfaction are .76 and .74 respectively (see Table 1).

Distributed leadership

The fourth section measured *distribution of leadership* through four social network questions (Fombrun, 1982; Tichy et al., 1979). We developed one question for each leadership function of Derksen, et al. (2011). Each question consists of a short explanation of one of the functions, followed by a list of the respondent's team members from which to select relevant colleagues who incited them to perform these leadership functions (table 1). Team members were allowed to indicate their own name and an option was included to indicate 'no one'.

These social network questions captured the influence that individual team members have with regard to each specific leadership function, in terms of the amount of received nominations (in-degrees). The resulting matrix of answers reflected the leadership network of that particular leadership function. The matrices provided a number of scores to work with which are relevant to the construct of distributed leadership.

Table 1.

Cronbach's alpha's, Means, Standard Deviations, and sample items for all variables.

Variable	μ	σ	α	Sample item
<i>Demographic variables</i>				
Gender	1.11	.36	-	-
Age	40.84	12.20	-	-
Education	6.68	.97	-	-
Team size	9.37	4.10	-	-
<i>Level 1 variables</i>				
Competence	4.03	.45	.74	I am good at the things I do in my job
Relatedness	3.81	.55	.79	At work I feel part of a group
Individual centrality	.50	.23	-	Who in the team incites you to [leadership function]?*
<i>Level 2 variables</i>				
Climate for informal learning	3.87	.53	-	Knowledge and experiences are difficult to access
Team centrality	.34	.14	-	-
Network density	.54	.17	-	-

Note. N = 163 at level 1; N = 21 at level 2. *This sample item is also used for measuring the variables team centrality and network density

Procedure

The survey started with a short oral briefing about the purpose of the survey and a check if all the members were present. Whenever a member was absent a fellow team member was asked to give the survey to him or her and mail the filled in document to the researchers. The survey took about 20 minutes to complete, participants were asked not to interact with each other during this time. The researcher was present for any questions and to collect the finished surveys.

Data analysis

Social network measures of leadership

Before the analysis we removed all missing data and deleted all self-nominations from the team's leadership matrices. When a person had responded 'no-one' to a leadership question, we filled in a zero for all relationships. A team member was removed from the network data entirely when we could confirm an extended period of absence (e.g. sick leave or maternity leave). A total of 5 persons in 4 teams were removed from their team's network this way. To confirm the person's absence we checked the person's in-degrees, which should be low to none if the person is indeed absent for an extended period. In all cases, this corroborated our decision to remove the data. A second approach was to treat data as missing and replacing it with zero scores (as if the person had marked 'no-one'). We did this when a members' absence went unexplained, but we could confirm the person being a part of the current team. The data of 1 person was replaced in this fashion.

Second, we calculated the team level and individual level scores. Individual centrality and network density were calculated using Freeman's (1978) formulae. Team centrality is calculated using a slightly adapted version of Freeman's formula. Because we have operationalized leadership based on influence relationships we are drawing on the in-degrees only. All out-degrees should be ignored when calculating the team level leadership scores, because they do not provide any information on whether or not an individual is central to the influence network (Pastor & Mayo, 2002). To calculate the team centrality we use Freeman's base

formula and adapt the denominator to reflect only the in-degree counts:

$$Team\ centrality = \frac{\sum_{i=1}^n [C_D(P^*) - C_D(P_i)]}{\max \sum_{i=1}^n [C_D(P^*) - C_D(P_i)]}$$

In this formula, n is the number of team members in that team. $C_D(P_i)$ is the in-degree (number of received nominations) of person i in the team's network and $C_D(P^*)$ is the largest value of $C_D(P_i)$ for any person in that network. To correct for the influence of team size, the denominator should take the maximum value that the numerator can take within that team. Since P_i can only take a maximum value of $n-1$ for each team member the numerator takes the maximum value of $(n-1)^2$. This is because if one team member were to receive maximum number of nominations the maximal distance to the $n-1$ remaining team members will be $n-1$. This yields the following adapted formula:

$$Team\ centrality = \frac{\sum_{i=1}^n [C_D(P^*) - C_D(P_i)]}{(n-1)^2}$$

The individual centrality is a level 1 measure that ranges from 0 (a person has received no nominations) to 1 (a person has received the maximum possible number of nominations). The team centrality measure is a level 2 variable and ranges from 0 (maximally hierarchical) to 1 (total equality of all team members). It expresses the relative equality of the team members' social influence within the network. The network density measure is also a level 2 variable and it ranges from 1 (all possible relationships are present) to 0 (no relationships at all), it expresses the percentage of possible connections within the team.

The three social network measures correlated strongly for all four leadership functions (Table 2) and suggested that the four leadership functions overlapped significantly. We therefore averaged the scores of the four leadership functions, so each team yielded a single score for team centrality and network density and each individual a single score on individual centrality.

Table 2.

Pearson correlations of the four leadership functions.

	Team level				Individual level (individual centrality)			
	CRE	REF	ORG	DIA	CRE	REF	ORG	DIA
CRE	21	.801**	.521*	.558**	163	.751**	.662**	.699**
REF	.850**	21	.526*	.761**		163	.556**	.748**
ORG	.876**	.811**	21	.616**			163	.513**
DIA	.793**	.896**	.781**	21				163

Note. Labels: CRE = creating future; REF = reflecting; ORG = organizing; DIA = dialoguing. Team centrality is displayed above the diagonal, network density below. N is displayed on the diagonal. Significance (two-tailed): * $p \leq .05$; ** $p \leq .01$.

Multilevel analysis

Chen and Kanfer (2006) urged researchers to adapt a multilevel model between individuals and the team context when studying motivational outcomes in teams. Competence satisfaction and relatedness satisfaction are properties of the individual worker and are therefore measured on the individual level (level 1). Distributed leadership is a property of a team and is therefore measured on a higher level, the team level (level 2). Climate for informal learning is also a property of the team, but is measured on the individual level. Statistical analysis showed that the data was suited for aggregation ($ICC = .55, p < .01$). Therefore, the data was aggregated to the team level by using the group mean.

Hierarchical Linear Modeling (HLM) is an appropriate method for examining cross-level main effects where the dependent variable is measured at the lowest level (Hofmann, Griffin, & Gavin, 2000). HLM can estimate the within-team effects (Level 1) and the separate effects of team-level predictors (Level 2) on the intercepts and slopes (of the regression line) at the individual level (Kozlowski & Klein, 2000).

For computing the multilevel models, linear mixed models in statistical software SPSS v21 was used, with the method set to Maximum Likelihood (ML) and covariacy type to Variance Components (VC). Grand mean centering was used on all level 1 and 2 variables to reduce potential collinearity (Hofmann et al., 2000).

To check if the data is suited for HLM we first ran a null model with individuals grouped by team, no independent variables and with competence satisfaction or relatedness satisfaction as the dependent variable. The results indicate significant between-team variances in relatedness satisfaction ($ICC = .39, p = .011$). The null model for competence satisfaction shows that the team level accounts for no significant amount of variance ($ICC = .04, p = .421$). This means that although the scores for competence vary between persons (Table 2), grouping the observations by team does explain any of this variance. Even though a low ICC score is commonly used to justify using ordinary least squares methods such as multiple regression analysis, Nezlek (2008) makes a valid point in stating that the data is still hierarchical in nature and therefore should be treated as such. The hierarchical nature of the data alone justifies the use of HLM as the technique for data analysis (Nezlek, 2008). Since there is no variance to be explained at the team level, all level 2 variables were not entered into the

HLM models for competence since they do not have any explanatory power.

To test for the cross-level main effects of the independent variables on competence and relatedness, we built HLM's by adding variables step by step. In each step we retained the newly added variable(s) only if the model fit improved significantly, as measured by the χ^2 -change statistic. For competence we built three models, with model 1 being the null model. In model 2 and 3 we added the level 1 control variables (age, gender, education) and level 1 independent variable (individual centrality), respectively. For relatedness, model 1 is once again the null model. In model 2 the level 1 control variables (age, gender, education) are added. In model 3 the level 2 control variable team size is added. In model 4 we entered the level 1 independent variable individual centrality. In model 5 the level 2 independent variables (team centrality, network density, climate for informal learning) were added.

Results

Main effects on competence

As displayed in table 3, model 2 in which the level 1 control variables were added fit the data significantly better than the base model 1 ($\chi^2_{change}(3) = 28.39, p < .01$). The fit of model 3 with individual centrality was an improvement over model 2 ($\chi^2_{change}(1) = 18.50, p < .01$), which was therefore accepted as the final and best fitting model. In hypothesis 1a we expressed the expected positive relationship between individual centrality and competence. As shown in Table 3, individual centrality (Est. = .35, $p < .01$) indeed shows a positive relationship, therefore hypothesis 1a can be confirmed. As expressed in hypothesis 3a we expected no relationship between team network density and competence. In hypothesis 2a and 4a, we described the expected positive relationships between team centrality and informal learning climate on satisfaction of the need for competence. However, no relationships with competence as the dependent variable could be established on the team level due to the lack of variance between teams ($ICC = .04$). Therefore, hypotheses 2a, 3a and 4a could not be confirmed or rejected. One of the control variables, age, also showed a significant positive relationship with the satisfaction of competence in the final model (Est. = .02, $p < .01$), however the strength of this effect is very small and negligible when compared to the effect of individual centrality (Est. 35, $p < .01$).

Table 3.

HLM results: The level-1 main effect of individual centrality on the satisfaction of the need for competence.

Variables	Model 1		Model 2		Model 3	
	Est.	SE	Est.	SE	Est.	SE
Intercept	.02	.09	.03	.05	-.48	.67
Level 1 control variables						
Age	-	-	.02**	.01	.02**	.01
Gender	-	-	.24	.25	-.08	.24
Education	-	-	.05	.09	-.04	.08
Level 1 independent variables						
Individual centrality	-	-	-	-	.35**	.08
Statistics						
-2*log likelihood	457.688		429.303		410.807	
Number of Parameters	3		6		7	
χ^2 change (df)	-		28.39 (3)**		18.50 (1)**	

Notes. Est. = Estimate, SE = Standard Error, df = Degrees of freedom for χ^2 change.
Significance (two-tailed): * $p < .05$. ** $p < .01$.

Main effects on relatedness

The results for relatedness are displayed in table 4. Model 2, which included the level 1 control variables, fitted the data significantly better than model 1 (χ^2 change (3) = 20.29, $p < .01$). Model 3 included the level two control variable and did not fit the data better (χ^2 change (1) = 1.21, $p = \text{n.s.}$). The effects of individual centrality were included in model 4, which was also rejected as it didn't fit the data significantly better than model 2 (χ^2 change (1) = 2.29, $p = \text{n.s.}$). Finally, model 5, including the level 2 independent variables, was accepted as the best fitting model over model 2 (χ^2 change (3) = 33.11, $p < .01$). We did not include the models testing for interaction effects because no such effects were found. In hypothesis 1b we posited that individual

centrality would be positively tied to relatedness. Results from model 5 in table 4 suggest that no such relationship exists between individual centrality and relatedness (Est. = .03, $p = \text{n.s.}$). Hypothesis 1b could not be confirmed. At the team level, we hypothesized positive effects of team centrality (hypothesis 2b) and network density (hypothesis 3b) on satisfaction of relatedness. As shown in model 5, we did find support for the connections between team centrality (Est. = .24, $p < .01$) and network density (Est. = .37, $p < .01$), confirming hypothesis 2b and 3b. Hypothesis 4b suggested a positive relationship between a climate for informal learning and relatedness, which was also found (Est. = .39, $p < .01$). Hypothesis 4b was thus supported.

Table 4.

HLM results: The cross-level main effects of distributed leadership and climate for informal learning variables on the satisfaction of the need for relatedness.

Variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Est.	SE	Est.	SE	Est.	SE	Est.	SE	Est.	SE
Intercept	.05	.16	-.02	.69	.36	.76	.33	.71	-.01	.61
Level 1 control variables										
Age	-	-	-.01*	.01	-.01*	.01	-.01*	.01	-.01	.01
Gender	-	-	.03	.23	.01	.23	-.07	.24	-.03	.21
Education	-	-	.09	.09	.09	.09	.05	.09	.07	.07
Level 2 control variables										
Team size	-	-	-	-	-.04	.04	-	-	-	-
Level 1 independent variables										
Individual centrality	-	-	-	-	-	-	.14	.08	-	-
Level 2 independent variables										
Team centrality	-	-	-	-	-	-	-	-	.24*	.10
network density	-	-	-	-	-	-	-	-	.37**	.11
Climate for informal learning	-	-	-	-	-	-	-	-	.39**	.09
Statistics										
-2*log likelihood	426.764		406.474		405.261		404.187		373.364	
Number of Parameters	3		6		7		7		9	
χ^2 change (df)	-		20.29 (3)**		1.21 (1)		2.29 (1)		33.11 (3)**	

Notes. Est. = Estimate, SE = Standard Error, df = Degrees of freedom for χ^2 change.
Significance (two-tailed): * $p < .05$. ** $p < .01$.

Conclusion and discussion

Contributions

The main goal of this study was to connect the concepts of distributed leadership and climate for informal learning to the satisfaction of the motivational needs of competence and relatedness. Even though not all of our expectations were confirmed, the first links are definitely established, and the constructs seem to be tied together. For competence, we found a clear link to team members' individual centrality, thereby confirming our first hypothesis. We also formulated three hypotheses on team level predictors of team centrality, team network density and a positive climate for informal learning, which could not be evaluated. For the satisfaction of relatedness we proposed a positive link with individual centrality, which was not found. However, the hypotheses proposing positive ties with team centrality, team network density and a positive climate for informal learning were all confirmed. All three team level variables correlated significantly with the satisfaction of the need for relatedness as we expected.

The main problem in establishing a relationship between our team level predictors and the satisfaction of the need for competence was the absence of variance on the team level. This means that even though individuals scored differently on the satisfaction of the need for competence, none of this variance could be explained by an individuals' membership of a specific team. Consequentially, any variables added into the model on the team level will not add any explanatory value to the model, because there simply is no variance to be explained. Whether or not this outcome is sample specific, or reflects characteristics of the concept of competence and its operationalization, we can't tell. Future research within teams of knowledge workers may shed light on this issue, and could carry implications for supporting the satisfaction of the need for competence on the work floor.

While the team level variables all show significant relationships with relatedness, the individual level measure we used to get a grip on social influence shows no connection. This finding may be explained by the nature of the relationships we have measured with the social network part of the survey. The social network questions have all focused on leadership tasks, which, by definition (Spillane, 2006), are tied to the core work activities of the team. In social network theory the content which is transferred through links in a social network defines the type of network. Tichy et al. (1979) distinguish between *instrumental networks*, in which influence and/or information is exchanged and *expressive networks*, in which affectual interactions

take place (e.g. liking, friendship). The leadership measures in this study are based on an *instrumental* network, measuring social relationships which are tied to leadership functions. As Baumeister and Leary (1995) have shown, the need for relatedness can be satisfied by two processes: 1) frequent and affectively pleasant interactions with others, and 2) an environment in which people feel an affective concern for one another. Both of these criteria seem to be tied more strongly to expressive networks than to instrumental type networks. If regular affectively pleasant interactions are indeed at the base of satisfying the need for relatedness, then it might be that the strictly work-related influence relationships in the instrumental network that we have measured do not contribute per se to feelings of relatedness towards colleagues. However, these exchanges of information and influence may very well be tied to satisfaction of the need for competence, as Ryan and Deci (2000) have shown that competence is less reliant on affective interactions with others and more on informational interactions. The fact that network density (as a proxy variable for the amount of social interaction) correlates positively with relatedness corroborates this explanation, as the amount of social interaction will influence ties in expressive type networks as well as in instrumental type networks (Tichy et al., 1979).

The results strengthen the case for the importance of distributed leadership, as well as that of a positive learning climate for informal learning. The outcomes are especially relevant when considering Vallerand's (2000) argument that relatedness may play a more significant role in supporting intrinsic motivation than is assumed in the works of Deci and Ryan (2000), especially when the tasks are social in nature and take place within a context of team work.

Secondary contributions of this study have been to apply multilevel analysis to the study of motivation. Chen and Kanfer (2006) have urged researchers to adopt multilevel models in motivational research, in which multilevel analysis is still an underused technique. Our results show that team- as well as individual-level variables can be linked to motivational outcomes, suggesting that multilevel analysis has added value over ordinary least squares methods (Nezlek, 2008). Another contribution of this study is the operationalization of distributed leadership through the social network approach. Research on distributed leadership employing this method is very limited (Mehra et al., 2006) and more social network research is needed to operationalize and investigate the full breadth of the distributed leadership theory. Lastly, we have developed a 7-item scale measuring the informal learning climate within teams. Subsequent research may extend and improve upon this first iteration of

the scale in order to develop a comprehensive measure, which can possibly be used by teams to assess their learning climate.

In conclusion, even though not all of the hypotheses could be confirmed, this study has established empirical links between aspects of distributed leadership networks (individual centrality, team centrality and network density) and the motivational needs of competence and relatedness. The quality of the learning climate for informal learning also seemed to contribute to the satisfaction of the need for relatedness. Despite not being able to confirm any linkage with competence, the theoretical links between the quality of the informal learning climate and satisfaction of the need for competence remain strong and should be subject of further research.

Further research

Subsequent research efforts may be directed at further operationalizing the distributed leadership construct in its broader form. Although the social network approach measures social influence relationships which are at the core of distributed leadership theory, they miss out on the vital interactions that provide a team with the dynamism (Gronn, 2002; Spillane, 2006). This dynamic aspect is also an important part of the distributed leadership theory. This aspect may be especially interesting to investigate in relation to the need for competence, as Deci and Ryan (2000) have claimed that the need for competence can promote finding and specializing in niche-specific behaviors, a process which might be at the base of claiming social influence in groups. Other interesting aspects of distributed leadership could be leadership configurations (Gronn, 2009; Mehra et al., 2006; Thorpe, Gold, & Lawler, 2011), specific social interactions (Spillane, Camburn, Pustejovsky, Pareja, & Lewis, 2008) and different methods of study may provide insights in these additional elements of distributed leadership and its relation to knowledge productivity (for an overview, see: Hulsbos et al., 2012; Spillane et al., 2008).

A second concern for further research is including additional variables to the model in order to explain the variance in motivational outcomes. One such variable is trust, which may be related strongly not only to the process of claiming and granting influence but also to a positive climate for informal learning. There is an extensive literature base on trust, including validated scales which may be used in research linking it to motivation (Schoorman, Mayer, & Davis, 2007). Also, further research should strive to distinguish between instrumental versus expressive type networks (Tichy et al., 1979) and assess the relative importance of

network typology to the distributed leadership and motivational constructs.

Practical implications

For practitioners in the field of HRD, this study yields some clues on how to support teams of knowledge professionals to satisfy their needs for competence and relatedness. Results from this study show that distributed leadership (being granted influence) explains feelings of competence as well as relatedness within the teams. The process of sharing influence in teams seems to be instrumental in supporting intrinsic motivation. Furthermore, facilitating teams in building close (instrumental as well as expressive) networks and helping them to cooperate and share influence to members with relevant expertise may prove an excellent way to support learning. In addition, supporting teams in creating a climate for informal learning has both empirical and theoretical links to knowledge workers' motivation. The aspects of this climate that were discussed in the theoretical framework may therefore provide the HRD professional with a starting point in facilitating such a climate within teams. The question remains however, if the field of HRD will be able to adapt timely to the changing demands of the knowledge professional. Perhaps, the somewhat traditional approach of creating and implementing tools and instruments in order to facilitate learning in the workplace is of lesser value than a style of facilitation based on human interactions, sharing influence and working from a viewpoint of mutual attractiveness.

Limitations

Our operationalization of the distributed leadership construct has been relatively narrow compared to the breadth of the theory. For example, the importance of dynamism in leadership relationships is stressed by many theorists (DeRue & Ashford, 2010; Gronn, 2002; Spillane, 2006; Van Vugt et al., 2008) and it is an element that we have neglected in this study. We have attempted to catch the social interplay of leaders and followers by looking at the different networks of the four leadership functions and examining if different leader and follower structures would emerge on different functions. If different leader/follower structures would emerge on different leadership functions, this could provide a starting point to assess if leadership relations are indeed dynamic (stretched across different actors) or static (single actor on all four functions) within a team. A true longitudinal study would of course shed more light on the aspect of dynamism, but we suggest that the multiple leadership function network approach might be a fruitful starting point for further exploration of the dynamic nature of leadership. Further work on

the operationalization through social network methods may focus on leadership functions that are divided more sharply and might therefore not correlate as strongly as the functions provided by Derksen, et al. (2011). Morgeson, et al. (2010) have provided a taxonomy of leadership functions which may serve as a point of departure for locating more distinctive leadership functions.

A concern that may pose to be a limitation to this study is tied to confounding variables. Although we have checked for the effects of age, gender, education and team size there are other variables that we have left unchecked. For example, as we have theorized, the amount of social activity in the team may explain the findings on individual centrality. One possibly latent factor that may explain different amounts of social interactivity between teams is the relative scope of employment of team members. Employees with a small scope of employment do not get the chance to interact with their colleagues as often as others and this may affect the outcomes on social network measures. Subsequent research employing social network analysis should be aware that in many organizations the scope of employment may differ vastly between employees, even within the same team, and check for any effects this might have on network measures.

The final concern is the directionality of relationships within this study. As this is a cross-sectional study, no causality can be attributed to any of the established links. When connecting the theory on distributed leadership, informal learning and intrinsic motivation, one could also argue for the relationships to move in the opposite way. For example, perhaps a satisfaction of the need for competence can lead to more influence claiming and therefore it might be predictive of distributed leadership patterns and an individuals centrality in the social network. However, as we touched upon these relationships in the theoretical framework, we posit that intrinsic motivation is a credible outcome of distributed leadership practice and a positive climate for informal learning. Perhaps, the situation is even more complex and the different constructs influence each other mutually? More research is needed to establish the chain of causality leading up to intrinsic motivation and, ultimately, knowledge productivity.

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