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The effects of distributed leadership and inquiry-based work on primary teachers' capacity to change: testing a model

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ABSTRACT

This article studies the relationship between teachers' perceptions of distributive leadership and inquiry-based work in primary schools and the resulting impact on those teachers' capacity to contribute to educational change. The path analysis that tests the proposed model relies on questionnaire data collected from 787 teachers in 65 primary schools. The results indicate a direct, positive effect of distributive leadership on teachers' collaboration and collegiality, as well as on their motivation to contribute to educational change. Inquiry-based work positively mediates the effect of such leadership styles on three aspects of teachers' capacity to change: collaboration, professional learning activities, and motivational factors. Therefore, all three promising aspects can be reinforced if teachers adopt leadership roles and combine these roles with inquiry-based work practices.

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Leadership; distributive perspective; inquiry-based work; capacity to change

Introduction

Schools worldwide confront demands to improve their instructional practices and better serve the needs of different students. To meet these demands, they need teachers who possess strong skills to monitor, develop, and adapt their own teaching methods continuously. Reinforcing teachers' capacity to change is challenging though; it likely requires an inquiry-based approach to working (Deppeler & Ainscow, 2016). Teachers who work according to an inquiry-based method systematically collect, analyze, and interpret various types of available data to improve the educational quality they provide and maximize the potential and capabilities of their students and schools. It also enables teachers to adapt their instruction and learning to students' needs (Earl & Katz, 2006).

Developing and maintaining an inquiry-based work practice in turn requires strong coordination. Leadership may be crucial, in that school leaders can organize, encourage, and facilitate inquiry-based work by prompting teachers to perceive their ownership of the change process (Seashore Louis & Lee, 2016). Leadership in this sense is a feature of the organization, rather than of a single person, so we approach it from a distributed perspective, focusing on both formal and informal leadership methods, how leadership roles

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shift and get appropriated, and how such a distributive infrastructure might be supported by relevant teams (Spillane, 2012). Research on the role of leadership in primary schools that encourages teachers to work in an inquiry-based way is scarce (Cranston, 2016; Uiterwijk-Luijk et al., 2017). We adopt the distributive perspective to explore how leadership and inquiry-based work together might affect teachers' capacity to change.

Theoretical framework

Teachers' capacity to change

The *capacity to change* is the degree to which people can develop and implement innovations; for teachers, those new ideas might come from the government, the school board, or the teachers themselves. It also implies educators' ability to connect these innovations to individual and collective learning processes that in turn lead to further change (Geijsel et al., 1999; Harris et al., 2015). Engaging in educational change generally requires a collegial work setting, in which teachers can discuss their practices and provide interpersonal support, which enhances their connection to common goals, self-confidence, and job satisfaction (Heck & Hallinger, 2009; Thoonen et al., 2012). Accordingly, we investigate three elements underlying teachers' capacity to change: (a) collaboration, (b) participation in professional learning activities, and (c) motivational factors.

First, teachers' capacity to change through collaboration implies their readiness to engage in joint work. According to Little (1982), joint work features high levels of task interdependency; it is a far-reaching configuration of collaboration, unlike storytelling, aid, assistance, and sharing, which constitute lower levels. Joint work means that teachers collectively engage in instructional planning and solve problems by exchanging experiences, ideas, and methods, such that they develop shared, innovative teaching practices (Meirink et al., 2010). It also encourages teacher learning. Task interdependency in this context refers to teachers' perceptions of the extent to which the task performance of one team member depends on the task performance of others (Runhaar et al., 2013). In work settings, teachers need their colleagues to stand behind them, respect their opinions, and support them when problems occur; change requires that teachers join forces (Geijsel et al., 1999; van Geel et al., 2017).

Second, when they engage in professional learning activities, teachers stay informed about new developments and new issues in teaching practices (Thoonen et al., 2011). Teachers who undertake such activities also dare to experiment, share knowledge, and can reflect better on their own functioning (Camburn & Han, 2017; Geijsel et al., 2009). Therefore, they also are more capable of change.

Third, teachers' capacity to change depends on motivational factors. A positive emotional state – manifested as job satisfaction and a strong sense of self-efficacy – along with an ability to embrace school-level goals as personal objectives reinforces teachers' awareness of current educational trends and fortifies their inclination to investigate and apply these developments to their classroom practices (Geijsel et al., 2009; Kapa & Gimbert, 2018). In turn, teachers should be more motivated to participate in learning and changing. Teachers with strong efficacy beliefs also experience a sense of "yes, I can" with regard to their work (Pajares, 1996), such that they tend to be more persistent and find helpful solutions more readily, reflecting the task- and situation-specific nature of self-efficacy perceptions; that is, people apply these perceptions to certain goals (Pajares,

1996). Teachers' sense of self-efficacy, job satisfaction, and the extent to which they internalize school goals thus likely relate to their ability to change (Geijsel et al., 2009; Hulpia et al., 2009; Kapa & Gimbert, 2018).

Leadership and a distributive perspective

The success of educational changes also depends on the degree of autonomy teachers have to innovate and be creative. Leadership that enables teachers to use their educational expertise, affinity, and creativity is a key factor for the success of educational changes (e.g., Buske, 2018; Seashore Louis & Lee, 2016). When leadership reflects a distributive perspective, it can foster commitment, such that the more leadership is distributed in a school, "the more likely it is that everyone will get a chance to use their talents fully and the more committed everyone is likely to be" (Williams, 2009, p. 32).

In a review of the literature, Tian et al. (2016) showed that no consensus definition of distributive leadership exists, although some core elements distinguish it from other leadership concepts; that is, distributed leadership implies that leadership in the organization entails a dynamic, interactive process among individuals who form groups. Their objective is to lead and influence one another to accomplish the school's goals. This process involves both upward and downward hierarchical influences. As such, distributed leadership refers to the leadership infrastructure at the school level, and the context defines how leadership is distributed, to whom, and by whom (Spillane, 2012; Spillane & Healey, 2010).

Depending on the problems that need to be addressed, different teachers might take responsibility and provide leadership (Spillane, 2012). In particular, some team members might take formal roles that imply leadership; they constitute the leadership team (Spillane, 2012). Other team members instead may have informal leadership roles, because they are the best equipped or most skilled when it comes to realizing some particular goal or organizational necessity. Thus, even in a distributed leadership context, a formal leader still has an important function. Using established trust, this leader leverages the teachers' expertise and affinity and encourages them to exercise responsibility. He or she also initiates and orchestrates the necessary conditions in the school structure and culture for distributed leadership to succeed (Harris, 2014).

Collective decision making in turn reflects how the leadership is distributed; all team members' contributions to educational improvement at the school level must be taken into account (Heck & Hallinger, 2009). In this way, leadership is a collective characteristic of the whole team, and the team's emphasis is on interactions among leaders and followers, rather than on individual actions. In such interactions, leaders' and followers' roles change constantly, in a simultaneous, ongoing influence process, because team members possess various forms of specific knowledge and expertise (Spillane & Healey, 2010). Accordingly, we investigate distributed leadership by examining the extent to which formal and informal leaders share authority and execute their leadership roles.

Inquiry-based work

With inquiry-based work, teachers systematically collect and analyze various data (e.g., quantitative, qualitative, input, output, process, satisfaction-related) that can suggest ways to maximize the potential and capabilities of students and schools (Marsh & Farell,

2015). They also consult evidence-based information to acquire insights into effective teaching and learning strategies. These data support accountability, which is a global requirement for school development. However, the data are raw and unprocessed, so teachers also need to be able to transform them into information and knowledge; knowledge based on data highlights the need to focus on development. Teachers' ability to prioritize specific aspects of their teaching practices then increases, because inquiry-based work offers insights into effective teaching and learning strategies (Earl & Katz, 2006; Faber et al., 2018; Krüger, 2010b).

As Earl and Katz (2006) and Uiterwijk-Luijk et al. (2017) propose, inquiry-based work involves four key elements: (a) working with an inquiry habit of mind, (b) demonstrating data literacy, (c) using data at the school level to improve educational quality, and (d) using data in classrooms. Teachers who *work with an inquiry habit of mind* are curious, ask questions, and engage in deep learning. They are aware of their routines and can shift to new perspectives (Earl & Katz, 2006). *Data literacy* implies an ability to comprehend and use data to make informed decisions. Therefore, teachers need skills to objectively collect, organize, analyze, summarize, and prioritize data (Mandinach & Gummer, 2013). When they *use data at the school level*, teachers collectively review data and learn how to reinforce educational quality, which results in new understanding. As such, working in an inquiry-based way leads to deeper learning across the school, which supports reform and change (Bangs & Frost, 2016; Katz & Dack, 2014; Van Gasse et al., 2017). By *using data in their classrooms*, teachers also can adapt their instruction and learning to student needs, based on the available data (Earl & Katz, 2006).

Thus, inquiry-based work supports the development of knowledge, skills, and collaborative efforts, and it leads to collective learning (Earl & Katz, 2006; Seashore Louis & Lee, 2016). Available data induce teachers to reflect on ongoing routines, such that they develop higher quality teaching methods by absorbing, improving, and adapting new strategies. In this way, their capacity to change and their feelings of empowerment become enhanced, especially if those teachers also have the authority to make changes (Park & Datnow, 2009).

Background characteristics

Engaging in distributed leadership and inquiry-based work may require certain characteristics of teachers, such as job qualifications. Most teachers earn at least a bachelor's degree, some have master's degrees, and a very small percentage of teachers have no university degrees at all. In our study setting, Dutch educational authorities recently have assigned more importance to primary teachers' education levels; that is, in the past teachers mainly received a bachelor's degree after undergoing vocational training in a university of applied sciences. Today though, schools seek candidates with graduate degrees, anticipating that teachers with master's degrees have developed an inquiry habit of mind and thus will be better able to apply new knowledge in action and contribute to educational development at the school level (Frost, 2012). They also should possess data literacy skills and recognize the importance of inquiry-based work. Teachers with more education also might be more interested in complex innovative operations that require research and discovery, which may increase their preference to work jointly with colleagues with similar interest in complex tasks or processes (Jaquith, 2013).

According to Day et al. (2007), as they gain experience, teachers move through several concerns. In early phases, their focus shifts from the self to the task, and then later – generally after at least 15 years of teaching experience – expert teachers experience comfort in their role and confidence in their abilities. In this phase, teachers may be more interested in learning about role effectiveness and experimenting with new teaching methods (Kyndt et al., 2016). However, Richter et al. (2011) indicate that more experienced teachers may be less interested in professional learning activities related to subject content, pedagogies, or psychology.

Another personal characteristic that might exert an effect is the gender of the teachers. Rubie-Davies et al. (2012) studied the links of gender with teacher efficacy and goal orientation and found that female teachers tend to express stronger feelings of efficacy related to new instructional strategies and classroom management, whereas male teachers often are more performance oriented and exhibit higher levels of task interdependency. The substantial gender gap in many school teams – in many countries, men are strongly underrepresented in education – might produce a distorted view though (Mistry & Sood, 2016).

In the Dutch primary education context, second-career teachers have become very common. Therefore, it is not appropriate to assume that years of teaching experience correlate precisely with teachers' age. Instead, we follow Richter et al. (2011) and predict that older teachers may be more likely to take leadership roles. We use teachers' age as another background characteristic.

Study overview

As the preceding discussion reveals, extant empirical research suggests that leadership with a distributed perspective and inquiry-based work relate to teachers' capacity to change; however, this relationship has not been thoroughly investigated. It remains unknown whether and how distributed leadership and inquiry-based work might influence, directly or indirectly, teachers' capacity to change. Nor do we know whether and how teachers' characteristics, including their education and years of teaching experience, affect these constructs.

Hypotheses

On the basis of our literature review, we predict that both distributed leadership and inquiry-based work exert direct, positive effects on teachers' capacity to change. As Park and Datnow (2009) indicate, we also anticipate that the positive effect of distributed leadership gets mediated by teachers' inquiry-based work, such that it can strengthen their capacity to change even more. Day et al. (2007) also offer insights on teacher development, leading us to expect that background characteristics directly affect leadership and inquiry-based work. Specifically, more years of experience and a master's degree should enhance teachers' inquiry-based work and cause them to be more likely to adopt distributed leadership roles. In Figure 1, we present our proposed model of the effects of distributed leadership and inquiry-based work on teachers' capacity to change and the expected effects of the background characteristics.

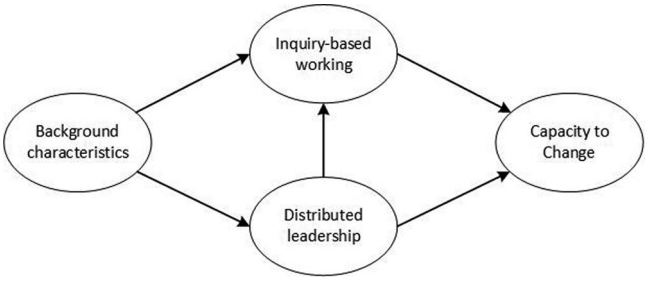

Figure 1. Model of the expected effects of distributed leadership and inquiry-based working on the capacity to change and the expected effects of teachers' background characteristics.

The Dutch education system

According to current Dutch educational policy, schools are autonomous in their pedagogical approaches, personnel, and financial management. Most primary schools are government-funded private organizations. In the Dutch system, education is intended for children between the ages of 4 and 12 years. No national curriculum is provided; school-level teams shape the educational and instructional quality to their students' needs, which influences the extent to which teachers work in routine or non-routine ways. However, quality standards (e.g., student results, teacher qualification requirements, number of teaching hours per year) apply to all schools, and schools are held accountable for student outcomes by the national inspectorate. The common quality standards, absence of a national curriculum, and requirements to serve the needs of different groups of students all highlight the strong demand for teachers with a good capacity to change.

Method

Sample and context

Nearly 500 schools were invited to participate in this study. A total of 65 schools, located in the midwestern and eastern regions of the Netherlands, agreed to take part. The data we used to test our theoretical model (Figure 1) were generated from a questionnaire, distributed to 1,209 primary teachers working at these schools (their students are aged 4–12 years). Digital data collection took place from April–June 2016; 963 teachers returned the questionnaire, for a response rate of 79%. In screening these data, we removed teachers with item non-response patterns, leaving a final sample of 787 teachers, of whom 89.4% were women and 10.6% were men. This gender imbalance reflects the Dutch primary school context; in primary schools in the Netherlands overall, approximately 13% of teachers are men (www.statline.cbs.nl). Furthermore, many of our study respondents were younger than 35 years (32%), and a majority of them had more than 10 years of experience (60%), while only 6% of the teachers in our sample had master's degrees.

Variables

To operationalize and measure the capacity to change, we used items pertaining to collaboration (i.e., joint work, task interdependency, and collegial support), professional learning

activities (i.e., keeping up to date, experimenting, reflecting, and sharing knowledge and experience), and motivational aspects (i.e., internalization of school goals as personal goals, sense of self-efficacy, and job satisfaction). The distributed leadership items spanned four scales: (a) teachers adopting leadership roles based on knowledge, (b) teachers granting one another leadership roles, (c) teachers' participation in decision making, and (d) active involvement in school development. Then for inquiry-based work, we included items that measured working with an inquiry habit of mind, demonstrating data literacy, using data in classrooms, and using data at the school level. To determine teachers' background characteristics, the study included questions about respondents' level of education, age, gender, and years of experience.

Instruments

The scales measuring the capacity to change and inquiry-based work were derived from existing questionnaires (Geijsel et al., 2001; Krüger, 2010a; Oude Groote Beverborg et al., 2015; Schildkamp et al., 2012). We formulated the scales to measure distributed leadership from research by Spillane and Healey (2010). To verify the validity of the items, we conducted pilot tests with 10 primary school teachers who were not otherwise connected to this research. All items used 5-point Likert scales, ranging from 1 (*totally disagree*) to 5 (*totally agree*). The background characteristics required distinct measures, as follows: Gender was binary (1 = female; 2 = male). For age, respondents could choose from five categories (1 = younger than 25 years; 2 = 25–34 years; 3 = 35–44 years; 4 = 45–54 years, 5 = 55 years or older). Education level was measured by two dummy variables: bachelor's degree versus no bachelor's degree and master's degree versus no master's degree. And for years of experience, respondents could choose from four categories (1 = less than 4 years, 2 = 4–10 years, 3 = 10–15 years, and 4 = 15 years or more).

Analysis

We performed a factor analysis in SPSS Version 23 to confirm that the survey items loaded on the pertinent factors. As illustrated in Table 1, the principal component analysis with Varimax rotation indicated that the items that we used to indicate certain factors grouped together. The reliability of the scales ranged from 0.72 to 0.92. These results support the viability of our proposed model.

To determine how distributed leadership and inquiry-based work affect teachers' capacity to change, as well as to grasp the influence of teachers' background variables, we conducted a series of path analyses in LISREL 8.52 (Jöreskog & Sörbom, 1996). In an effort to clarify the effect sizes of the background variables, we converted the variables pertaining to leadership, inquiry-based work, and the capacity to change into *z* scores. The scores of the background variables remained unchanged. We then conducted path analyses using a covariance matrix with all the relevant variables. Thus, we could address the validity of our theoretical model by comparing discrepancies between the covariance matrix of the observed data and the covariance matrix resulting from the theoretical model. The extent to which both matrices are compatible determines whether the theoretical model is feasible, considering the relations among the data. We used χ^2 values and the associated *p* values, along with the root-mean-square error of

Table 1. Survey instrument.

Scale		Number of Items	Cronbach's Alpha
Collaboration (Cronbach's alpha = 0.78)	Joint work *Within our team, we discuss how we can improve instructional strategies.*	6	.84
	Task interdependency *The work of one teacher influences the task performance of collegial teachers.*	4	.72
	Collegial support *My colleagues permit me to sit in on their lessons.*	6	.85
Undertaking professional learning activities (Cronbach's alpha = 0.74)	Keeping up to date *I regularly search for new information about education.*	6	.86
	Experimenting *I make my own instructional materials.*	4	.74
	Reflecting *With a focus on the goals toward which I am working, I monitor my own development.*	5	.80
	Sharing knowledge and experience *Within our team, teachers share knowledge and experiences related to educational quality.*	6	.89
Motivational variables (Cronbach's alpha = 0.76)	Internalization of school goals into personal goals *Our school goals challenge me to develop myself.*	4	.80
	Self-efficacy *When I want to realize something in my work, I know I will manage it.*	5	.81
	Job satisfaction *Working as a teacher is the most enjoyable job.*	5	.88
Distributed leadership (Cronbach's alpha = 0.86)	Teachers adopting leadership roles *In our school, teachers with specific qualities take a leading role.*	4	.88
	Teachers granting one another leadership roles *In my school, on the basis of specific expertise, my teacher colleagues may tell others in the school how all teachers can improve student outcomes.*	6	.92
	Teachers' participation in decision making *In our school, we collectively make decisions according to new educational goals.*	3	.72
	Teachers' active involvement in school development *In our school, teachers undertake initiatives of their own accord.*	4	.77
Inquiry-based working (Cronbach's alpha = 0.79)	Working with an inquiry habit of mind *In my work, I want an in-depth understanding of what I am doing.*	5	.82
	Demonstrating data literacy *I am capable of interpreting data.*	6	.79
	Using data at the school level *We improve our educational quality by comparing our student outcomes to those of other schools.*	6	.89
	Using data in classrooms *In considering the special educational needs of my students, I use data on my students.*	4	.81

Note: The text in italics represents sample items for each scale.

approximation (RMSEA), adjusted goodness-of-fit index (AGFI), and comparative fit index (CFI) as model fit indices. The χ^2 value should be as low as possible, the RMSEA should be close to or lower than 0.05, and the AGFI and the CFI both should be greater than 0.95 (Jöreskog & Sörbom, 1996). In assessing the significance of the path coefficients, we need to account for the fact that teachers in this study are clustered within schools. Ignoring the presence of clustering would lead to smaller estimated standard errors, which in

turn could lead to false conclusions about the presence of significant path coefficients. We dealt with the presence of clustering by conducting the path analysis based on an adjusted sample size. The adjustment was based on the design-effect formula proposed by Snijders and Bosker (2012). We used the average school size (12.11) and the average intraclass coefficient (0.1) of the three dependent variables to compute the design effect and to decrease the sample size accordingly. As such, the effective sample size is 375.

In the first test of the model, we included all predicted causal relationships among distributed leadership, inquiry-based work, and the capacity to change. In this model, four variables – teachers adopting leadership roles based on knowledge, teachers granting one another leadership roles, teachers' participation in decision making, and active involvement in school development – pertain to leadership from a distributed perspective. Four other variables – working with an inquiry habit of mind, demonstrating data literacy, using data in classrooms, and using data at the school level – refer to working in an inquiry-based way (Earl & Katz, 2006; Heck & Hallinger, 2009; Spillane et al., 2009; Uiterwijk-Luijk et al., 2017). The background characteristics – level of education, age, gender, and years of experience – serve as exogenous variables. This theoretical model demonstrates poor fit to the data ($\chi^2(40, \textit{Neffective} = 375) = 621.06$, $p = 0.00$, RMSEA = 0.20, AGFI = 0.60, CFI = 0.77), due to the high correlations among the separate scales in the study.

Therefore, in subsequent analyses, we adopted a path analysis approach based on the total reliability of each component (see Table 1). In the revised model, we aggregated the indicator scales into single variables representing distributed leadership, inquiry-based work, collaboration, professional learning activities, and motivational aspects. We also deleted nonsignificant paths from the model. Notably, the goodness of fit increased when we specified inquiry-based work as a mediator. Thus, with a model that incorporates inquiry-based work as a mediator between distributed leadership and the capacity to change, we attain good fit ($\chi^2(16, \textit{Neffective} = 375) = 7.39$, $p = 0.97$, RMSEA = 0.00, AGFI = 0.99, CFI = 1.0).

To verify the direction of the mediating variable, we compare this model against one that depicts an inverse predictive relationship, such that distributed leadership functions as a mediator variable. In this case, the fit of the model decreases ($\chi^2(16, \textit{Neffective} = 375) = 12.40$, $p = 0.72$, RMSEA = 0.00, AGFI = 0.98, CFI = 1.0). Therefore, the model featuring inquiry-based work as a mediating variable emerges as the best path model, in which the standardized residuals range from 0.03 to 1.11.

Results

Descriptive data

The midpoint of 5-point Likert scales is 3.0; the results indicate positive, relatively high scores for all the variables. The mean item scores for the four aspects of inquiry-based working vary between 4.17 and 4.59. For the four elements of leadership, the mean item scores range between 3.94 and 4.41, and for the capacity to change, they span 3.81 to 4.47. Among the background characteristics, the age range varies from 31.6% (younger than 35 years old) to 26.6% (36–45 years) to 41.8% (older than 45 years), generally in line with the national averages of teachers' age (i.e., 34.2%, 22.9%, and 42.5%, respectively). Whereas in our study, 6% of the teachers had a master's degree, the

Dutch national average is 24% (www.statline.cbs.nl). Age and years of teaching experience correlate significantly ($r = 0.73$). The correlations, means, and standard deviations of the latent variables and background characteristics are displayed in Table 2.

In assessing the effect sizes, we computed the relative amount of variance explained (Cohen's f^2 measure). The strength of the relationships among the model variables can be evaluated by comparing the path coefficients according to Cohen's f^2 values: 0.02 = small (the variance explained is 2%), 0.15 = medium (the variance explained is 13%), and 0.35 = large effect; then, the variance explained is 26% (Wuensch, 2019). To interpret our data, we use a significance level of $p < 0.05$.

Factors affecting teachers' capacity to change

The path model results demonstrate that both distributed leadership and inquiry-based work affect collaboration, professional learning activities, and motivational aspects; their respective percentages of explained variance are 50%, 66%, and 65%. Figure 2 displays the final path model, in which all path coefficients are significant.

Examining the path coefficients also enables us to address our hypotheses and interpret the effects of the exogenous variables. To facilitate this interpretation, we present the direct, indirect, and total effects of distributed leadership and inquiry-based work in Table 3. Then in Table 4, we provide the direct, indirect, and total effects of the background characteristics on inquiry-based work and distributed leadership; the effects of these characteristics on the endogenous variables in turn are listed in Table 5.

First, we anticipated a direct effect of distributed leadership on the capacity to change. The strongest direct effect of distributed leadership pertains to collaboration (34% of the variance in the collaboration variable scores was explained by distributed leadership) such that it directly and positively affects collaboration, as well as the motivational aspects (28% of the variance in the motivational variable scores was explained by distributed leadership). When distributed leadership increases, teachers' collaborative efforts, sense of self-efficacy, and job satisfaction all expand, as does their tendency to internalize school goals as personal aims. An indirect effect of this leadership perspective, through motivational aspects, also influences teachers' professional learning activities.

Second, we predicted that inquiry-based work would have a direct positive effect on teachers' capacity to change. The paths in the final model suggest that such work

Table 2. Correlations, means, and standard deviations (*Neffective* = 375).

	1	2	3	4	5	6	7	8	9	10
1. Inquiry-based work	1									
2. Distributed leadership	.56	1								
3. Collaboration	.55	.66	1							
4. Motivational aspects	.64	.72	.69	1						
5. Undertaking professional learning activities	.74	.59	.67	.67	1					
6. Level of education, bachelor's degree	.00	−.02	.01	.01	−.01	1				
7. Level of education, master's degree	.02	.01	−.01	−.00	.01	−.06	1			
8. Years of experience	.09	.03	.01	.07	.05	.03	.03	1		
9. Age	.10	.11	.04	.12	.06	−.00	−.00	.71	1	
10. Gender	−.02	.00	−.02	−.01	−.03	.01	−.01	.05	.09	1
M	4.36	4.16	4.03	4.33	4.15	.90	.06	3.09	3.28	1.10
SD	.44	.61	.56	.51	.49	.30	.24	1.04	1.20	.30

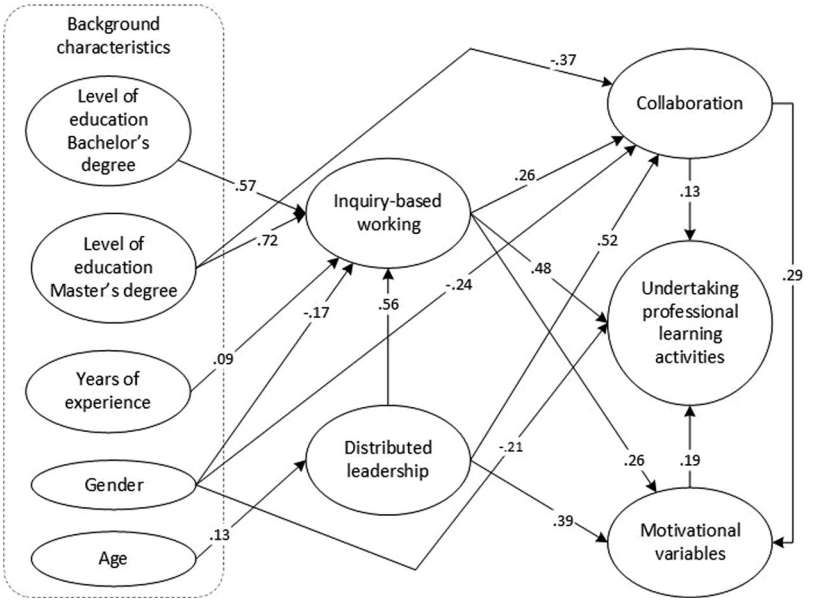

Figure 2. Final path model (with significant standardized effects, $p < .05$).

Table 3. Direct, indirect, and total effects of distributed leadership and inquiry-based work on collaboration, professional learning activities, and motivational aspects for all teachers (*Neffective* = 375).

	Collaboration			Professional Learning Activities			Motivational Variables		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Distributed leadership	.52*	.15*	.67*	–	.58*	.58*	.39*	.34*	.73*
Inquiry-based work	.26*	–	.26*	.48*	.13*	.61*	.26*	.08*	.34*

*Significant at T > 2.

Table 4. Direct, indirect, and total effects of background characteristics on distributed leadership and inquiry-based work (*Neffective* = 375).

	Distributed Leadership			Inquiry-Based Work		
	Direct	Indirect	Total	Direct	Indirect	Total
Level of education, bachelor's degree	–	–	–	.57*	–	.57*
Level of education, master's degree	–	–	–	.72*	.07*	.79*
Years of experience	−.08	–	−.08	.09*	−.05	.04
Age	.13*	–	.13*	.05	–	.05
Gender	–	–	–	−.17	−.05	−.22*

*Significant at T > 2.

methods directly and positively affect collaboration (14% of the variance in the collaboration variable scores was explained by inquiry-based working), the extent to which teachers engage in professional learning activities (35% of the variance in the undertaking of professional learning activities variable scores was explained by inquiry-based working), and the motivational aspects (17% of the variance in the motivational variable

Table 5. Direct, indirect, and total effects of background characteristics on collaboration, professional learning activities, and motivational aspects for all teachers (*Neffective* = 375).

	Collaboration			Professional Learning Activities			Motivational Variables		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Level of education, bachelor's degree	–	.15*	.15*	–	.35*	.35*	–	.20*	.20*
Level of education, master's degree	−.37	.21*	−.16	–	.36*	.36*	–	.17*	.17*
Years of experience	–	−.03	−.03	–	.01	.01	–	–	−.03
Age	–	.08*	.08*	–	.06	.06	–	.09*	.09*
Gender	−.24	−.06*	−.30*	−.21	−.21*	−.42*	–	−.15*	−.15*

*Significant at T > 2.

scores was explained by inquiry-based working), with moderate to large effects; that is, teachers are more likely to collaborate and participate in professional learning activities when they have a strong commitment to inquiry-based work. This factor likewise enhances their sense of self-efficacy, job satisfaction, and tendency to internalize school goals as personal aims. These direct effects are large.

Third, our theory held that the positive effect of distributed leadership on the capacity to change would be mediated by teachers working in an inquiry-based way. This mediation appears in the path from distributed leadership to inquiry-based work, which suggests that inquiry-based work strongly and positively mediates distributed leadership's effect on the three elements of teachers' capacity to change. Specifically, teachers' collaboration, initiatives to undertake professional learning activities, and motivational aspects are powerfully reinforced when, on the basis of experience, they adopt leadership roles and grant those roles to colleagues, in the presence of inquiry-based work methods.

Fourth, among the background characteristics – educational level (bachelor's or master's degree), years of teaching experience, age, and gender – only gender reveals an influence on teachers' capacity to change, and that significant effect is indirect. Following Mistry and Sood (2016), we interpret this finding cautiously though. Both bachelor's and master's degrees directly and positively enhance teachers' inquiry-based work, and the effect of the master's degree is larger. However, only 5% of the variance in the inquiry-based working scores was explained by the master's degree variable. Teachers' level of education does not affect their distributed leadership. Furthermore, age has a small-sized, direct, positive effect on distributed leadership: With increasing age, teachers appear to be more inclined to adopt this leadership perspective. Yet, age does not significantly affect inquiry-based work. We also find unexpected, indirect, small effects of age on two elements of teachers' capacity to change: collaboration and motivational aspects. The older a teacher is, the more likely they appear to engage in collaboration and the higher their sense of self-efficacy, job satisfaction, and propensity to internalize school goals as personal objectives.

Conclusions and discussion

The study yields three main results: Inquiry-based work mediates the positive effect of distributive leadership on teachers' capacity to change. Both this leadership approach and inquiry-based work affect teachers' capacity to change directly. In particular, collaboration,

the extent to which teachers undertake professional learning activities, and several motivational aspects are critical. Teachers' education levels directly and positively influence their inquiry-based work, and the impact of having a master's degree is even greater than the effect of having a bachelor's degree. As teachers age, they also adopt the distributed leadership perspective more.

Therefore, the more a school leader commits to hiring teachers with expertise and affinity and involving them in school policies, the stronger those teachers' ability to initiate and respond to educational changes. If teachers perceive their school as an organization in which leadership is more distributed, the extent of collaboration reinforces these effects. Teachers' sense of self-efficacy increases, they may be more satisfied in their job, and they tend to internalize school goals. In this sense, our current study extends work by Buske (2018), Greany (2018), and Hulpia et al. (2009) that suggests distributive leadership relates positively to teachers' collaboration, commitment, and sense of self-efficacy.

The ability to initiate and respond to educational changes increases even more when teachers work, individually and collectively, in an inquiry-based way. When they adopt an inquiry habit of mind and use available data in the school and classroom, thereby transforming the data into information and knowledge (Earl & Katz, 2006), teachers also tend to collaborate and participate in professional learning activities. In turn, their sense of self-efficacy, job satisfaction, and likelihood of internalizing school objectives get reinforced. These effects expand on research by Uiterwijk-Luijk et al. (2017), who identified a positive correlation between inquiry-based work and self-efficacy, and by Bangs and Frost (2016), who found that an effective learning environment marked by constant change encourages joint work based on data and evidence. Teachers and school leaders can learn collectively and increase educational and instructional quality, focused on serving the needs of different groups of students. We did not perform an in-depth analysis of how participating teachers perceive the distribution of leadership roles or the extent to which their colleagues work in an inquiry-based way, yet our finding that inquiry-based work functions as a mediator between leadership and teachers' capacity to change extends research by Park and Datnow (2009) that cites a relationship between collective decision making and data use. In our study, inquiry-based work exceeds data use, and distributed leadership exceeds collective decision making. Although the best fitting model includes inquiry-based work as the mediator variable (not distributed leadership), we might question whether it depicts the only possible direction. In support of this directionality, working in an inquiry-based way affirms the need for innovation, in that data support teachers' choices to pursue innovations and enhance their leadership performance. As such, inquiry-based work should expand teachers' expertise, and this expertise is a key determinant of the success of distributive leadership (Spillane & Healey, 2010). Expertise based on facts also may enhance teachers' willingness and preparedness to share their knowledge and possibly stimulate them to adopt leadership roles.

Finally, we expected their background characteristics to affect teachers' perceptions of leadership and inquiry-based work directly. We find a small difference between bachelor's and master's degrees when it comes to teachers' inquiry-based work, but teachers with either type of degree appear able to transfer new ideas into action, by leveraging their inquiry habit of mind and data use. Therefore, educational authorities should encourage schools to hire employees who have at least a bachelor's degree. Here, our findings contrast with Frost's (2012), although we also acknowledge that our findings derive from a

limited group (i.e., only 6% of our sample had advanced degrees). Furthermore, Frost argues that teachers who realize the importance of inquiry-based work because of their efforts to obtain their master's degree might be better able to contribute to educational development at the school level. However, the Dutch vocational education system trains teachers in the inquiry-based work approach, which might offer a plausible explanation for our findings. In addition, we do not find that teachers' education has any significant impact on their perceptions of leadership. Perhaps expertise with distributive leadership links more closely to specific topics rather than implying a higher level of expertise in general. If so, distributive leadership roles could be independent of teachers' educational level. Furthermore, our results imply that with increasing age, teachers perceive their school as an organization in which leadership is more distributed. We do not find significant effects for years of teaching experience, although we note a strong linear relationship between years of teaching experience and age. Therefore, we turn to Day et al. (2007), who point out that the school leader should pay attention to teachers' welfare and need to be challenged, especially as their years of teaching increase, to reinforce their commitment to learning and change and to prevent boredom.

In the current study, all variables are measured with the same instrument as the teachers all completed the same questionnaire. Although the main effects we found are in line with our expectations with respect to dependency, our results do not provide information about the exact way in which these dependencies were developed. This means caution is advised with regard to potential causal claims. Longitudinal research is needed to further investigate how certain factors specifically contribute to the relationships between the variables. Also, the conventions with respect to the effect sizes we used should be carried out with caution, since a large effect in one context may be a small effect in another context (Wuensch, 2019). Furthermore, due to the design effect, the effective sample size is significantly lower than the number of participants. Follow-up research with a larger number of schools and teachers, allowing for multilevel structural equation modeling, could contribute further to the testing of more complex models and our understanding of the relationships between inquiry-based working, distributed leadership, teachers' collaboration, their professional learning activities, and the motivational variables. Also, as in our study the participants scored relatively high on all variables, such follow-up research may distinguish differences between high- and low-performing schools in the process of building teachers' capacity to change by working in an environment of inquiry-based working and distributed leadership.

Implications

This study offers new insights into the impact of distributive leadership and inquiry-based work on teachers' capacity to change. Overall, our findings suggest that when they focus on serving the needs of different groups of students, schools can realize change successfully if (a) school leaders allow teachers to adopt leadership roles based on their expertise and from a distributed perspective, (b) teachers commit to taking on such roles, and (c) teachers work collectively on assumed problems or issues in an inquiry-based way. School leaders and teachers thus must create a safe, supportive school culture that shares and distributes leadership roles. In such settings, teachers' sense that they can achieve their goals should increase, and they may become more interested in

professionalization and joint work efforts. With a distributive leadership infrastructure, school leaders also should encourage and support teams to perform inquiry-based work and grant them space to collaborate in analyzing their circumstances and determining their priorities accordingly (Buske, 2018; Van Gasse et al., 2017; van Geel et al., 2017). Compatibility across all of these factors may enhance teachers' capacity to change even further.

Disclosure statement

No potential conflict of interest was reported by the authors.

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