Inquiry-based leading and learning

Inquiry-based working by school boards, school leaders and teachers and students’ inquiry habit of mind

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Inquiry-based leading and learning in primary education

Inquiry-based working by school boards, school leaders and teachers and students' inquiry habit of mind

Op vrijdag 8 september 2017 om 13.00 uur in de Aula van de Universiteit van Amsterdam, Oude Lutherse Kerk, Singel 411, Amsterdam

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Inquiry-based working by school boards, school leaders and teachers and students’ inquiry habit of mind

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Inquiry-based leading and learning
Inquiry-based working by school boards, school leaders and teachers and
students' inquiry habit of mind

ACADEMISCH PROEFSCHRIFT
ter verkrijging van de graad van doctor
aan de Universiteit van Amsterdam
op gezag van de Rector Magnificus
prof. dr. ir. K.I.J. Maex
ten overstaan van een door het College voor Promoties
ingestelde commissie,
in het openbaar te verdedigen in de Aula der Universiteit
op vrijdag 8 september 2017, te 13.00 uur
by Elizabeth Luijk
geboren te Maassluis

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Inquiry-based leading and learning

Inquiry-based working by school boards, school leaders and teachers and students’ inquiry habit of mind

ACADEMISCH PROEFSCHRIFT
ter verkrijging van de graad van doctor aan de Universiteit van Amsterdam op gezag van de Rector Magnificus prof. dr. ir. K.I.J. Maex ten overstaan van een door het College voor Promoties ingestelde commissie, in het openbaar te verdedigen in de Aula der Universiteit op vrijdag 8 september 2017, te 13.00 uur

door Elizabeth Luijk geboren te Maassluis
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Faculteit der Maatschappij- en Gedragswetenschappen
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CHAPTER 1

General introduction

This study addresses inquiry-based working in primary schools, which is a way of working that has become increasingly important in education. It involves having an inquiry habit of mind, being data literate and creating a culture of inquiry in schools (based on Earl & Katz, 2006).

Our society has changed in the past decades from an industrial society into a knowledge society because of globalization, internationalization, and information and communication technologies. At the same time schools are held increasingly accountable for their output in terms of student achievement. Schools are more and more expected to provide stakeholders with data that illustrate the quality of their education and to effectively use this data as the basis for the improvement of student performance (Earl & Katz, 2006; Lai & Schildkamp, 2013; OECD, 2013; Vanhoof, Vanlommel, Thijs & Vanderlocht, 2014). Inquiry-based working makes schools more aware of their educational quality, educators are better able to perceive weak spots in instructional processes, and more focused adjustments are made to attain educational improvements (Krüger, 2010a). This way of working implies that school leaders and teachers use data as a basis for collaborative inquiry and that they base educational decisions on the results of this inquiry. Next to using data for school improvement themselves, school leaders also have the new role of giving guidance to a culture of inquiry in which teachers use data to understand the effects of their actions, to act on their learning and to share their findings with others (Earl & Katz, 2006; Krüger, 2014).

When inquiry-based working is typical for the way of working in a school as a whole, it can be said that there is a culture of inquiry in the school; team members are engaged in using data to understand the effects of their actions, to act on their learning and to share what they learn with others (Earl & Katz, 2006). Research in the field of inquiry-based working in schools is relatively new. Existing research in this area predominantly focuses on conducting research and using data, while other aspects of inquiry-based working, such as contributing to a culture of inquiry and working with an inquiry habit of mind are not addressed. Neither is there a lot of research on the way in which educators at different levels in the school organization influence each other in their inquiry-based working (Schildkamp, Ehren & Lai, 2012).
CHAPTER 1

General introduction

Introduction

This study addresses inquiry-based working in primary schools, which is a way of working that has become increasingly important in education. It involves having an inquiry habit of mind, being data literate and creating a culture of inquiry in schools (based on Earl & Katz, 2006). Our society has changed in the past decades from an industrial society into a knowledge society because of globalization, internationalization, and information and communication technologies. At the same time schools are held increasingly accountable for their output in terms of student achievement. Schools are more and more expected to provide stakeholders with data that illustrate the quality of their education and to effectively use this data as the basis for the improvement of student performance (Earl & Katz, 2006; Lai & Schildkamp, 2013; OECD, 2013; Vanhoof, Vanlommel, Thijs & Vanderlocht, 2014). Inquiry-based working makes schools more aware of their educational quality, educators are better able to perceive weak spots in instructional processes, and more focused adjustments are made to attain educational improvements (Krüger, 2010a). This way of working implies that school leaders and teachers use data as a basis for collaborative inquiry and that they base educational decisions on the results of this inquiry. Next to using data for school improvement themselves, school leaders also have the new role of giving guidance to a culture of inquiry in which teachers use data to understand the effects of their actions, to act on their learning and to share their findings with others (Earl & Katz, 2006; Krüger, 2014).

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This study examines the role of school boards, school leaders and teachers in creating an inquiry-based culture in their schools. We were interested in what encourages educators to work in an inquiry-based manner and the effect of working this way on the inquiry habit of mind of students. Earlier studies have shown the importance of psychological factors in explaining different aspects of working in an inquiry-based manner (Ikemoto & Marsh, 2007; Krüger & Geijsel, 2011; Schildkamp & Kuiper, 2010; Vanhoof et al., 2014). Therefore, this study firstly examined how several psychological factors (attitude, experienced social pressure, self-efficacy and collective efficacy regarding inquiry-based working) relate to school leaders’ and teachers’ inquiry-based working. In addition, the role of the teacher in stimulating students’ inquiry habit of mind was investigated. Finally, to further investigate how an inquiry-based culture is established in schools, we examined the interplay between school board, school leaders and teachers regarding inquiry-based working.

Theoretical background

Inquiry-based working

As mentioned in the introduction, inquiry-based working involves working with an inquiry habit of mind, being data literate, and creating a culture of inquiry (Earl & Katz, 2006). School boards, school leaders, and teachers who work with an inquiry habit of mind value deep understanding, take a range of perspectives, and reserve judgement (Earl & Katz, 2006). According to Van der Rijst, Kijne, Verloop, and Van Driel (2008), it includes being passionate and persistent (an inclination to achieve), being honest and critical to self and others (an inclination to be critical), being curious and excited (an inclination to know), and having overview and wanting to scrutinize (an inclination to understand). Data literate school boards, school leaders, and teachers have the skill to transform data into information into knowledge into action (Marsh & Farrell, 2014). This means that school boards, school leaders, and teachers understand and use data effectively to inform decisions. This includes the skills of knowing how to identify, collect, organize, analyse, summarize, and prioritize data. It also includes knowing how to develop hypotheses, identify problems, interpret the data, and determine, plan, implement, and monitor courses of action. To create a culture of inquiry, boards and leaders engage others in interpreting data, they stimulate an internal sense of urgency to use data, make time, use critical friends, and communicate a clear vision on working with data in the school (Earl & Katz, 2006; Jimerson, 2014; Krüger & Geijsel, 2011; Wayman & Stringfield, 2006).
For teachers, this third aspect means contributing to a culture of inquiry by collaborating with other teachers in conducting research in the school and using data to improve their own teaching. In addition, teachers can create a culture of inquiry in their classroom in order to stimulate students’ inquiry habit of mind. This involves creating an environment where pupils are curiosity-driven, ask questions, make discoveries, and test these discoveries in a search for new understanding (Chin, 2002; Al-Sabbagh, 2009).

**Attitude, experienced social pressure, self-efficacy and collective efficacy regarding inquiry-based working**

According to the Theory of Planned Behavior of Ajzen (1991, 2002b) human behavior and human intentions to perform a specific behavior can be predicted by three psychological factors: attitude towards the behavior, experienced social pressure with respect to a given behavior, and self-efficacy in relation to the behavior. The more favourable the attitude and experienced social pressure, and the greater the self-efficacy, the stronger should be the person’s intention to perform the behavior in question. People are expected to carry out their intentions when the opportunity arises (Ajzen, 2002b).

**Attitude** towards inquiry-based working can be defined as the tendency to respond with some degree of (un)favour towards inquiry-based working – an evaluative dimension that ranges from negative to positive (based on Fishbein & Ajzen, 2010). Research on school leaders has shown a relationship between such an attitude and data use (Ikemoto & Marsh, 2007; Schildkamp & Kuiper, 2010; Vanhoof et al., 2014). School leaders’ positive attitude towards data use appears to have a positive relationship with their actual use of data (Vanhoof et al., 2014). **Social pressure** has two aspects: social approval and normative pressure (Fishbein & Ajzen, 2010). Social approval refers to the belief that others do or do not want us to perform a given behavior (for example, believing that parents want school leaders to lead the school in an inquiry-based way). Normative pressure refers to the perception of how others engage in a particular behavior (for example, believing that other school leaders are also leading their schools in an inquiry-based way). This study focuses on both of these aspects of experienced social pressure. **Self-efficacy** is receiving continued attention in educational research (Kleinsasser, 2014). It is defined as believing for oneself that a specific behavior can be performed successfully and the conviction and self-belief that it is possible to organize and execute the actions required in order to produce given levels of attainment (Bandura, 1997).
Vanhoof et al. (2014) found that self-efficacy has an effect on data use by school leaders. In addition, self-efficacy appears to have a strong positive influence on the inquiry habit of mind and data literacy of secondary school teachers (Krüger & Geijsel, 2011). Since inquiry-based working requires teachers to work together in teams (Coburn & Turner, 2011; Earl & Katz, 2006; Katz & Dack, 2014), teachers’ beliefs about the ability of his or her team to work in an inquiry-based manner are also relevant. Such beliefs represent perceived collective efficacy (Bandura, 1997; Goddard, Hoy, & Woolfolk Hoy, 2004; Skaalvik & Skaalvik, 2007). This study investigates what the relationship is between attitude, experienced social pressure, self-efficacy and collective efficacy regarding inquiry-based working and different aspects of inquiry-based working by teachers and school leaders.

Students’ inquiry habit of mind

The concept “inquiry habit of mind” is strongly related to concepts such as “researcherly disposition” (Tack & Vanderlinde, 2014), “inquiry as stance” (Cochran-Smith, 2003), and “scientific research dispositions” (Van der Rijst, 2009). There does not appear to be a consistent definition of students’ inquiry habit of mind. All studies agree, however, that an inquiry habit of mind involves being both curious and critical. Both of these aspects are important components of a student’s inquiry habit of mind. Curiosity can be defined as a desire to know, see, or experience that motivates exploratory behavior directed towards the acquisition of new information (Litman, 2005). Critical thinking is not only a set of processing skills but also a habit of using those skills to guide behavior. It refers to an intellectually disciplined process of conceptualizing, applying, analyzing, synthesizing, and/or evaluating information to guide beliefs and actions. (Scriven & Paul, 2008). This study did not focus on critical thinking as a skill. Rather, it emphasizes its role as a habit of mind, which we call critical thinking habits. This means that we do not interpret being critical as the practice of processing several scientific skills. Instead, we understand it as the attitude necessary for performing these skills.

The interplay between school boards, school leaders and teachers regarding inquiry-based working

School boards are expected to monitor and enhance the educational quality of their schools (Hooge & Honingh, 2014; Lee et al., 2012). Members of school boards in the Netherlands
Vanhoof et al. (2014) found that self-efficacy has an effect on data use by school leaders. In addition, self-efficacy appears to have a strong positive influence on the inquiry habit of mind and data literacy of secondary school teachers (Krüger & Geijsel, 2011). Since inquiry-based working requires teachers to work together in teams (Coburn & Turner, 2011; Earl & Katz, 2006; Katz & Dack, 2014), teachers' beliefs about the ability of his or her team to work in an inquiry-based manner are also relevant. Such beliefs represent perceived collective efficacy (Bandura, 1997; Goddard, Hoy, & Woolfolk Hoy, 2004; Skaalvik & Skaalvik, 2007). This study investigates what the relationship is between attitude, experienced social pressure, self-efficacy and collective efficacy regarding inquiry-based working and different aspects of inquiry-based working by teachers and school leaders.

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The interplay between school boards, school leaders and teachers regarding inquiry-based working

School boards are expected to monitor and enhance the educational quality of their schools (Hooge & Honingh, 2014; Lee et al., 2012). Members of school boards in the Netherlands hardly spend any time directly working with teachers. Instead their influence works via school leaders. A supporting school leader appears to be an important factor in enabling teachers to effectively use data (Schildkamp & Kuiper, 2010). However, according to Daly (2012), many studies suggest that leaders may not have the skill sets to enact the leadership necessary to support data use and create a culture of inquiry in schools.

Research on the interplay between boards, leaders and teachers regarding inquiry-based working appears to be rare. So far, little attention in literature has been paid to the fact that when boards (leaders) and leaders (teachers) work together there is not only a top-down influence from board (leaders) on leaders (teachers), but there is also a bottom-up influence from teachers (leaders) on leaders (boards). To investigate this mutual influence, this study focused on the interplay between these 3 types of educators.

This dissertation

Our main goal was to provide insight in the way school boards, school leaders and teachers collaborate in an inquiry-based culture, what encourages them to do so, and what this means for the inquiry habit of mind of students. We investigated how psychological factors (attitude, experienced social pressure, self-efficacy and collective efficacy regarding inquiry-based leadership) are related to inquiry-based working by school leaders and teachers of primary schools in the Netherlands. In addition, we examined how teachers’ inquiry-based working is related to students’ inquiry habit of mind. Finally, we studied the interplay between school boards, school leaders, and teachers regarding inquiry-based working. The main question of this research is fourfold:

1. How are attitude, experienced social pressure, and self-efficacy regarding inquiry-based working related to primary school leaders’ inquiry-based leadership?
2. How are attitude, experienced social pressure, self-efficacy, and collective efficacy regarding inquiry-based working related to primary school teachers’ inquiry-based working?
3. What is the relationship between teachers’ inquiry-based working and students’ inquiry habit of mind?
4. How can the interplay between school boards, school leaders, and teachers regarding inquiry-based working be characterized?
CHAPTER 1

The conceptual model showing the key elements of these questions is shown in Figure 1.1. The blue arrows represents research question 1, the red arrows represents research question 2, the green arrow represents question 3, and the two yellow arrows represent question 4.

Method

We started this study with a nationwide quantitative survey. Responses were received of 36 members of school boards, 79 school leaders, 249 teachers and 1,104 students from 71 different primary schools. We used a different questionnaire for each group of participants. The instruments used to measure the aspects of school boards’, school leaders’, and teachers’ inquiry-based working (i.e. inquiry habit of mind, data literacy and creating a culture of inquiry) were based on existing instruments of Krüger (2010b) and Krüger & Geijsel (2011). To measure the psychological factors (i.e. attitude, experienced social pressure, self-efficacy, and collective efficacy) we based our scales on the work of Krüger (2010b), Krüger and Geijsel (2011), Visser-Wijnveen, Stes, and Van Petegem (2012), and Fishbein and Ajzen (2010). Since there were no existing scales available to measure students’ inquiry habit of mind (i.e. curiosity and critical thinking habits), we designed an instrument with propositions and vignettes specifically for this study.

Subsequently, we used an embedded multiple-case study design (Yin, 2012) to investigate three schools that scored average to high on inquiry-based working in the survey. Within each school we studied: (1) members of the school board, (2) school leaders, (3) teachers teaching in grade 5 to 8, and (4) students from grade 5 to 8. We used semi-structured interviews, observations, and an analysis of documents.

The results of the survey were used to answer our first and second research question. To answer our third research question on the relationship between teachers’ inquiry-based working and students’ inquiry habit of mind, we combined results of the survey with results of the case study. The data of the case study were used to help explain the survey responses, explore and understand teachers’ perceptions, and provide a more complete picture of students’ inquiry habit of mind. Finally, the case study data were used to answer our fourth question on the interplay between school boards, school leaders, and teachers. We used the qualitative data to identify multiple ways in which educators can encourage each other to work in an inquiry-based manner.

Outline of the dissertation

The general aim of this study was to provide insight in the way school boards, school leaders and teachers work in an inquiry-based manner, how an inquiry-based culture is established in schools and what this means for the inquiry habit of mind of students.
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The general aim of this study was to provide insight in the way school boards, school leaders and teachers work in an inquiry-based manner, how an inquiry-based culture is established in schools and what this means for the inquiry habit of mind of students.

*Chapter 2* reports on how the psychological factors attitude, experienced social pressure, and self-efficacy relate to aspects of inquiry-based school leadership (research question 1, represented by the blue arrow in Figure 1.1). This chapter addresses two gaps in the existing
CHAPTER 1

literature, by focusing on inquiry-based leadership instead of data use and on psychological factors instead of knowledge and skills that are related to inquiry-based leadership.

In addition, Chapter 3 provides insight in the relationship between psychological factors and inquiry-based working by teachers (research question 2, represented by the red arrow in Figure 1.1). For teachers, we not only investigated attitude, experienced social pressure and self-efficacy regarding inquiry-based working, but also collective efficacy. Because inquiry-based working requires teachers to work together in teams, teachers’ beliefs about the ability of his or her team to work in an inquiry-based manner are also relevant. Such beliefs represent perceived collective efficacy.

In Chapter 4, to answer research question 3 (represented by the green arrow in Figure 1.1), our mixed-method study is described which examined the relationship between teachers’ inquiry-based work and students’ inquiry habit of mind. We investigated how teachers create a culture of inquiry in their classroom with students and students’ curiosity and critical thinking skills.

Chapter 5 presents the key findings from the qualitative case study in three primary schools, focused on the interplay between school boards, school leaders, and teachers regarding inquiry-based working (research question 4, represented by the yellow arrows in Figure 1.1). We were interested in good practices regarding inquiry-based working. Therefore, we selected schools at which leaders and teachers gave themselves average to high scores on inquiry-based working in the survey.

Chapter 6 contains a summary of this dissertation and a discussion of the main findings. Additionally, methodological considerations are discussed as well as the limitations of the study and directions for further research. Chapters 2, 3, 4, and 5 were written as independent articles, which have been published in, or submitted into different journals. As a consequence, the chapters differ in reference style and some sections partly overlap.

Additional information on the used scales described in Chapter 2 and 3 can be found at: https://www.marnixonderwijscentrum.nl/onderzoek-uiterwijk.
CHAPTER 2

Inquiry-based leadership: the influence of attitude, experienced social pressure and self-efficacy¹

Abstract

**Purpose** - The purpose of this research is to improve our understanding of psychological factors that influence inquiry-based leadership. This study investigates how attitude, experienced social pressure, and self-efficacy relate to aspects of inquiry-based school leadership. A school leader’s inquiry habit of mind, data literacy, and the extent to which he or she creates a culture of inquiry in the school are each identified as aspects of inquiry-based leadership.

**Design/methodology/approach** - Data were collected from questionnaires completed by a sample of 79 school leaders.

**Findings** - A significant relationship was found between self-efficacy regarding inquiry-based leadership and all aspects of inquiry-based leadership. Attitude towards inquiry-based leadership was significantly related to creating a culture of inquiry. There was no unique relationship between experienced social pressure and inquiry-based leadership.

**Practical and social implications** - Administrators and educators of school leaders who aim to stimulate inquiry-based school leadership should not only focus on increasing the capacity of school leaders to lead their school in an inquiry-based way, but they should also focus on leaders’ self-efficacy and on fostering leaders’ positive attitude towards inquiry-based school leadership. Administrators and educators can, for example, give positive feedback, emphasize the added value of inquiry-based leadership, encourage working with critical friends, and stimulate collaboration with other leaders.

**Originality/value** - This study addresses two gaps in the existing research, by focusing on inquiry-based leadership instead of data use and on psychological factors instead of knowledge and skills that are related to this type of leadership.

¹ This chapter is based on Uiterwijk-Luijk, L., Krüger, M., Zijlstra, B., & Volman, M. (accepted). Inquiry-based leadership: the influence of attitude, experienced social pressure and self-efficacy. *Journal of Educational Administration*.
CHAPTER 2

Introduction

Schools are held increasingly accountable for their output in terms of student achievement. In countries worldwide, schools are more and more expected to provide stakeholders with data that illustrate the quality of their education and to effectively use this data as the basis for the improvement of student performance (Earl and Katz, 2006; Lai and Schildkamp, 2013; OECD, 2013; Vanhoof, Vanlommel, Thijs and Vanderlocht, 2014). At the same time, schools in the Netherlands are more and more allowed to make their own decisions with regard to the education they provide in order to reach these results. As a result, school leaders and teachers are expected to use data as the basis of their decisions at school and classroom level (Schildkamp and Kuiper, 2010; Vanhoof et al., 2014).

Using data as the basis for school improvement implies that school leaders and teachers should engage in collaborative inquiry and that they should base educational decisions on the results of this inquiry. Next to being able to use data for school improvement themselves, school leaders also need to be able to create and give guidance to a culture of inquiry in which teachers are stimulated to collaboratively use data. They will have to communicate a clear vision on inquiry-based working and stimulate teachers’ inquiry-habit of mind and data literacy. Several studies have focused on factors that promote and hinder data use in schools (e.g. Ikemoto and Marsh, 2007; Jimerson, 2014; Katz and Dack, 2014; Schildkamp, Karbautzki and Vanhoof, 2014; Schildkamp and Kuiper, 2010; Schildkamp, Rekers-Mombarg and Harms, 2012). Others have focused on the influence of district leadership (e.g. Lee, Seashore Louis and Anderson, 2012; Levin and Datnow, 2012; Wayman, Jimerson and Cho, 2012) or on the way that school leaders may best support an increasing capacity for data use (e.g. Anderson, Leithwood and Strauss, 2010; Daly, 2012; Ikemoto and Marsh, 2007; Mandinach, 2012; Schildkamp, Ehren and Lai, 2012).

All of these international studies emphasize the importance of effective leadership and school culture for encouraging an increased use of data in schools. However, inquiry-based leadership differs from the more standard ‘data use by school leaders’ in the sense that it does not focus on leaders using data but, instead, encourages an approach within schools where inquiry together with the use of data is at the center. This requires school leaders to work with an inquiry habit of mind, to be data literate, and to create a culture of inquiry (Earl and Katz, 2006; Krüger and Geijsel, 2011). None of the aforementioned studies have explicitly studied the capacities that school leaders need for leading inquiry-based working in schools, nor the psychological factors that might influence this type of leadership.
Inquiry-based leadership: the influence of attitude, experienced social pressure and self-efficacy

Research on school leaders’ capacities for inquiry-based leadership in schools appears to be rare. This study addresses two gaps in the literature. Firstly, while data use by school leaders is well researched, studies on school leaders leading inquiry-based working have hardly been done. Focusing on inquiry-based leadership instead of data use by school leaders will add to the existing knowledge base of effective leadership for school improvement associated with data use in schools. This research will give more insight in the way school leaders stimulate data use by teachers and in the way they create a culture of inquiry. Secondly, while the knowledge and skills of school leaders using data have been studied, little is known about the psychological factors that may influence the extent to which inquiry-based school leadership is carried out.

Numerous studies have shown that psychological factors such as attitude, experienced social pressure, and self-efficacy influence people’s performance, persistence and motivation when carrying out tasks (e.g. Ajzen, 2002b; Bandura, 1997; Fishbein and Ajzen, 2010; Geijsel, Sleegers, Stoel and Krüger, 2009; Sanbonmatsu and Fazio, 1990). Research on such psychological factors in school leadership is scarce, but the study by Vanhoof et al. (2014) found that attitude and self-efficacy have a significant relationship to data use by principals. They also found that there is a small positive correlation between external expectations and the use of data by principals. Systematic research in which psychological factors are investigated in relation to inquiry-based leadership is lacking.

To address the two gaps in research so far, this study examines how the psychological factors attitude, experienced social pressure, and self-efficacy regarding inquiry-based leadership relate to the following aspects of inquiry-based leadership: a) working with an inquiry habit of mind, b) being data literate, and c) creating a culture of inquiry. The purpose of this study is to improve our understanding of inquiry-based leadership, and to provide administrators and educators of school leaders with knowledge about how to stimulate school leaders’ inquiry-based leadership.

**Theoretical framework**

**Inquiry-based leadership**

Inquiry-based leadership is an aspect of leadership which can complement leading concepts such as transformational, transactional, instructional, or distributed leadership. It is not a new type of leadership, but a quality that can accompany existing leadership styles. For example
Daly (2012) in his literature review on data use and social networks, points out that several studies indicate the importance of a more distributed approach to data use in schools, implying that distributed leadership can very well be combined with inquiry-based leadership. In addition, Halverson, Grigg, Prichett and Thomas (2007) combine leading data use in schools with instructional leadership. They introduce ‘new instructional leadership’ which involves the ability of leaders to meet the demands of external accountability. New instructional leaders will require knowledge and frameworks to guide their schools in the use of accountability data and structures that result in systematic improvements in student learning (Halverson, et al., 2007). Also research of Lachat and Smith (2005) provides evidence that school leaders can play mutual roles in fostering widespread use of data in schools.

Daly (2012) points out that many studies suggest that leaders may not have the skill sets to model and enact the leadership necessary to support data use. This might be because leaders are primarily driven by their necessary data skills and not by developing social relations in enacting the use of data (Daly, 2012). According to Earl and Katz (2006) and Krüger and Geijsel (2011), inquiry-based leadership requires the following capacities: to be able to work with an inquiry habit of mind, to be data literate, and to be able to create a culture of inquiry. A capacity is defined as the ability to perform specific behavior (Fishbein and Ajzen, 2010). A school leader’s capacity includes more than knowledge and skills, as Fullan (2008) points out. It also involves using resources wisely, and committing to get important things done collectively and continuously. A capacity refers to a combination of skills and knowledge, attitudes and actions taken together, aimed at generating results.

The first capacity - being able to work with an inquiry habit of mind - means having a mindset in which the leader always wants to know more. According to Earl and Katz (2006), school leaders with an inquiry habit of mind value deep understanding, tend to reserve judgment, examine a range of perspectives, and systematically pose increasingly focused questions. In addition, research by Van der Rijst, Kijne, Verloop, and Van Driel (2008) distinguishes characteristics such as an inclination to achieve (being passionate and persistent), an inclination to be critical (being honest and critical to self and others), an inclination to know (being curious and excited), and an inclination to understand (taking an overview and wanting to scrutinize). In this study, the inquiry habit of mind is examined in a behavioral sense such as showing a tendency to systematically pose questions or to read literature to gain knowledge. Therefore, the inquiry habit of mind is different from the concept “attitude”, which, in this research, is used as a psychological factor.
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The second capacity that is required for inquiry-based leadership is to be data literate. This can be defined as the ability to understand and use data effectively to inform decisions (Mandinach and Gummer, 2013). According to Krüger (2010a), school leaders, to some extent, must be able to collect data, which they should be able to read, understand, analyze, and interpret.

In their study on the purposes for which school leaders use data, Schildkamp and Kuiper (2010) found that school leaders do collect and analyze data, for example for policy development and to evaluate the functioning of teachers. However, they do not systematically apply the outcomes to innovate school-wide curricula or improve school performance. Mandinach and Gummer (2013) point out that data literacy requires a specific skill set: “These skills include knowing how to identify, collect, organize, analyze, summarize, and prioritize data. They also include how to develop hypotheses, identify problems, interpret the data, and determine, plan, implement, and monitor courses of action” (Mandinach and Gummer, 2013, p. 30).

In this current study, school leaders’ perceptions of their own data literacy are measured. Being data literate in this study means setting a goal before gathering data, being able to analyze and interpret data, and report results to others (based on Earl and Katz, 2006). For the purpose of this study, data is defined broadly and includes all the relevant information that teachers and schools need for decision-making, including both qualitative and quantitative data at the school, class, and individual student levels.

For the third capacity of inquiry-based leadership - being able to create a culture of inquiry - the question is no longer whether teachers should use data, but how they can be supported to use data well (Jimerson, 2014). This is, according to Jimerson (2014), because data alone cannot answer questions. By collaboratively synthesizing and organizing data in different ways, it is transformed into information, knowledge and ultimately into constructive action (Earl and Katz, 2006; Jimerson, 2014). According to Daly (2012) the interpretation and use of data takes place not only within the individual but also in social processes between educators who, through interaction, co-construct and make sense of data. This requires school leaders to lead internal research processes and to organize dialogue in the school in order to make sense of data as a team (Krüger, 2010a). School leaders who create this kind of culture of inquiry in schools communicate a clear vision on inquiry-based working and stimulate both teachers’ inquiry habit of mind and data literacy (Earl and Katz, 2006; Krüger, 2010a). Therefore, this study measures the capacity of school leaders to create a culture of inquiry in
school by examining the following three aspects: communicating a vision on inquiry-based working, stimulating teachers’ inquiry habit of mind, and stimulating teachers’ data literacy.

The first aspect of creating a culture of inquiry is communicating a vision on inquiry-based working. The capacity of school leaders to communicate a vision has been found to be of great importance in influencing teacher behavior. For example, research by Geijsel et al. (2009) indicates that the extent to which teachers perceive school leadership to involve initiating and identifying a vision has an influence on the degree to which they are willing to constructively change their practice. Wayman, Brewer, and Stringfield (2009) found in their study that successful leaders tend to be strong supporters and promoters of data use, they search for ways to demonstrate value in data, they disseminate findings from data and they make clear the benefits and efficiencies of using data. In line with this, Schildkamp and Kuiper (2010) found that communication of a clear vision as well as established norms and goals for data use is an important factor in encouraging data use by teachers. In addition, Schildkamp and Kuiper (2010) point out that a vision should be incorporated into goals set both for student progress and for teachers’ and school leaders’ own professional learning. In line with the above, the concept of communicating a vision in this study is interpreted as: spreading and strengthening positive values and norms related to inquiry-based working in school.

The second aspect of creating a culture of inquiry in school - stimulating the inquiry habit of mind of teachers - involves encouraging teachers to adopt a mindset that is characterized by a constant wish to know more, by an honest and critical approach to self and others, and by an inclination to seek understanding and to achieve (based on Van der Rijst et al., 2008). School leaders can stimulate the inquiry habit of mind of teachers, for example, by encouraging the use of research literature and the data that is available in school (Earl and Katz, 2006; Krüger, 2010a). A supporting school leader appears to be an important factor in enabling teachers to effectively use data (Schildkamp and Kuiper, 2010). In line with the first capacity (working with an inquiry habit of mind oneself), based on Van der Rijst et al. (2008), in this study stimulating teachers’ inquiry habit of mind is interpreted as: stimulating an internal sense of wanting to understand, wanting to know, and wanting to share.

The third aspect of creating a culture of inquiry - school leaders stimulating data literacy among teachers - draws on the findings of Schildkamp and Kuiper (2010) that teachers experience difficulty in analyzing and interpreting data. Wayman et al. (2009) point out that teachers need professional support and leadership to help them to turn student data into information that can inform classroom practice. Also Schildkamp and Kuiper (2010) found in
their study that teachers seem to be more effective in data use when support and encouragement is given by school leaders. School leaders stimulating teachers’ data literacy in this study is interpreted as: encouraging teachers to conduct research on their own classroom practice, and organizing forms of professionalization for teachers aimed at enabling them to become competent in using data.

**Attitude, experienced social pressure and self-efficacy regarding inquiry-based leadership**

The second gap in research on inquiry-based leadership is caused by the focus on knowledge and skills to use data, while psychological factors that may influence inquiry-based leadership are neglected. According to the Theory of Planned Behavior (TPB) of Ajzen (1991, 2002b) human behavior and human intentions to perform a specific behavior can be predicted by three psychological factors: attitude towards the behavior, experienced social pressure with respect to a given behavior, and self-efficacy in relation to the behavior. The more favorable the attitude and experienced social pressure, and the greater the self-efficacy, the stronger should be the person’s intention to perform the behavior in question. People are expected to carry out their intentions when the opportunity arises (Ajzen, 2002b).

The specific behavior which is investigated in this study is inquiry-based leadership. This behavior is subdivided in three capacities. The capacities working with an inquiry habit of mind and creating a culture of inquiry both refer to a specific set of behaviors. Data literacy of school leaders should rather be understood as a skill than as a behavior. However, for the purpose of this study, we investigated the relationship between the psychological factors and all three capacities of inquiry-based leadership.

A school leader’s attitude towards inquiry-based leadership can be defined as the tendency to respond with some degree of favor towards it: an evaluative dimension with respect to inquiry-based leadership that ranges from negative to positive through a neutral point. Vanhoof et al. (2014), who make the distinction between cognitive and affective attitude, note that the affective dimension of attitude has a major influence on data use by principals. A positive affective attitude towards data use appears to have a positive influence on the degree to which school leaders use data (Vanhoof et al., 2014). Because the broader inquiry-based leadership differs from data use by school leaders, this study investigates whether attitude also relates to the extent to which school leaders lead their schools in an inquiry-based manner.
CHAPTER 2

A second factor that may play a role in the extent to which school leaders lead their school in an inquiry-based way is that school leaders may feel under pressure to do so. Different types of pressure can be distinguished, for example, the pressure of accountability, caused by demands from administrators or the inspectorate. Schildkamp and Kuiper (2010) found that this type of pressure, combined with support, stimulates schools to use data. In addition, Vanhoof et al. (2014) found a positive indirect relationship between accountability-orientated external expectations and the use of data by school principals. These results seem quite logical - when schools are mandated to use data, school leaders have no alternative, other than to do so. This differs, however, from another type of pressure that school leaders may feel, namely social pressure. Social pressure has two aspects: social approval and normative pressure (Fishbein and Ajzen, 2010). Social approval refers to the belief that others do or do not want us to perform a given behavior (for example, believing that teachers or parents want school leaders to lead the school in an inquiry-based way). Normative pressure refers to the perception of how others engage in a particular behavior (for example, believing that other school leaders are also leading their schools in an inquiry-based way). This study focuses on both of these aspects of experienced social pressure.

The third psychological factor studied that may be related to inquiry-based leadership is self-efficacy. Self-efficacy is receiving continued attention in educational research (Kleinsasser, 2014). It is defined as believing for oneself that a specific behavior can be performed successfully and the conviction and self-belief that it is possible to organize and execute the actions required in order to produce given levels of attainment (Bandura, 1997). As Fisher (2014) points out, self-efficacy is task-specific and differs from self-esteem of self-concept, which reflect more general affective evaluations. Evidence suggests (Bandura, 1997; Geijsel et al., 2009) that people with a high sense of self-efficacy set themselves challenges, and are more likely to take risks and to experiment. They are also more creative in their learning, thinking, and work. Self-efficacy also appears to play a major role in explaining behavior in schools. For example, research by Vanhoof et al. (2014) shows that self-efficacy has an effect on data use by school leaders. Self-efficacy appears to have a strong positive influence on the inquiry habit of mind and data literacy of secondary school teachers (Krüger and Geijsel, 2011). In line with this, it may be expected that self-efficacy has an impact on school leaders’ tendency to work with an inquiry habit of mind and to be data literate. It is likely that it affects the capacity of school leaders to create a culture of inquiry. In this study school leaders’ self-efficacy is interpreted as: belief in the likely personal success of conducting inquiry-based leadership.
**Background characteristics**

A meta-analysis of 95 studies by Paustian-Underdahl, Walker, and Woehr (2014) on gender and leadership effectiveness shows that, when asked to rate their personal effectiveness, men tend to rate themselves significantly more highly than women do. However, when the ratings of others are used, women tend to be rated more highly. They also found that female leaders were rated as significantly more effective than male leaders in business organizations, whereas male leaders were rated more effective in government organizations. Other studies that focus on leaders in school organizations also show a relationship between gender and leadership (e.g. Brinia, 2012; Chaturvedi, Zyphur, Arvey, Avolio and Larsson, 2012; Krüger, Witziers and Sleegers, 2007). In line with this, it may be expected that gender also has a relationship to inquiry-based leadership. In addition, it should be noted that this study includes age and educational level as background characteristics. There may be a difference between younger and older school leaders or between school leaders who either do or do not have their master’s degree.

Primary schools in the Netherlands usually have one principal and at least one middle manager. In this study, both of these functions are included when referring to school leaders. To indicate the amount of time that a person is employed, the unit full-time equivalent (FTE) is used in the Netherlands. An FTE of 1.0 is equivalent to a full-time worker. Both aspects (function and FTE) are taken into account in this study as background characteristics.

**Current study**

This study investigates the relationship between the explanatory variables of attitude, experienced social pressure and self-efficacy regarding inquiry-based leadership and the dependent variables of aspects of inquiry-based leadership by school leaders of primary schools in the Netherlands. The research question is: “how are attitude, experienced social pressure and self-efficacy related to inquiry-based leadership of primary schools?” The conceptual model is shown in Figure 2.1.

Based on the theory mentioned in the theoretical framework and given the background characteristics, this paper has hypothesized the following: a) school leaders with positive attitudes towards inquiry-based leadership will lead their schools to a larger extent inquiry-based than school leaders with less positive attitudes. b) school leaders who experience more
social pressure regarding inquiry-based leadership will lead their schools to a larger extent inquiry-based than school leaders who experience less social pressure. c) school leaders with a high sense of self-efficacy towards inquiry-based leadership will lead their schools to a larger extent inquiry-based than those school leaders who have a lower sense of self-efficacy.

**Figure 2.1.**

Conceptual model. For the ease of presentation the variables of inquiry-based leadership by school leaders are presented in one rectangle as well as the different psychological factors

**Dutch educational system**

In the Netherlands, children attend primary school between the ages of four to twelve years. The Dutch primary school has eight grades. Primary education is characterized by a variety of management structures. There can be a diversity of structures with several layers of management but there are also traditional schools with one school leader. In addition to the traditional director (principal) there can be school leaders in the function of for example a deputy director, a location manager, or a unit leader (leading e.g. grade 5 to 8). Different boards describe these functions differently, but all agree these functions are in the layer of middle management.

One of the essential characteristics of Dutch education is that schools are relatively autonomous. Dutch schools are free to choose the religious, ideological and pedagogical principles on which they base their education, as well as how they organize their teaching activities. There are both public and private schools, which are both funded by the government. In primary education, students with a potential educational disadvantage are given a weighting based on the parents’ level of education. On the basis of these weightings, schools receive extra
Inquiry-based leadership: the influence of attitude, experienced social pressure and self-efficacy

staff and other resources. This means that disadvantaged students bring almost twice as much funding as regular students (Ladd and Fiske, 2011).

All schools are overseen by a school board that monitors progress and provides support. Almost half of the school boards in the Netherlands (46%) are responsible for only one school each, whereas large boards might have several dozen schools under supervision. As Ladd and Fiske (2011) point out, this means that there are many boards in one city. For example, Amsterdam has 43 separate boards operating from one to sixteen schools. School board members are appointed, and are therefore more like trustees than representatives (Scheerens, 2016).

There is no national curriculum in the Netherlands, consequently there is a variety in the way the curriculum is shaped. This freedom may also influence the extent to which schools work in an inquiry-based manner. The Ministry of Education, Culture and Science has set quality standards that apply to all schools: the subjects to be studied, the attainment targets, the number of teaching hours per year, the qualifications required for teachers, and so on. The Education Inspectorate is responsible for maintaining the quality of education and holds schools accountable for their education.

Method

Participants

We used a two-step method to invite schools to participate in this study. Because a low response was expected as a result of research fatigue in Dutch schools, in step one all 1,046 school boards of primary schools in the Netherlands were invited to participate with their schools in this study. Invitations were sent twice by mail, social media was used to draw attention to this study, and the researchers’ networks were used to more personally invite school boards. In total, 33 school boards (3.2%) responded positively. In step two, after the permission was granted by the school board, a web-based survey was sent out to school boards, school leaders, teachers and students. Responses were received from 27 school boards (82%). For this part of the study, the responses received were from 79 school leaders from 61 schools.

Most of the participating schools (66%) were situated in the east and south of the Netherlands. This is in line with the national average: 69% (source: www.stamos.nl). Forty-six participants indicated to have the function of ‘principal’. From these principals forty-four
percent were female, which is also in line with the national average (43%) (Ministerie van Onderwijs, Cultuur en Wetenschap, 2013). In the Netherlands, the most sizable primary school types are: public (33%), Protestant Christian (30%) and Roman Catholic (30%) (Ministerie van Onderwijs, Cultuur en Wetenschap, 2013). The schools participating in this study are 9% public, 48% Protestant Christian and 32% Roman Catholic. The proportion of public schools represented in this study is not in line with the national figures and so this requires a careful interpretation of results regarding public schools.

Table 2.1 shows the background characteristics of the participants. It shows that most participants are female (60%). Most of them work more than 0.8 FTE (65%) and almost half of them (48%) have a master’s degree. Participants are primarily in their thirties (29%), forties (25%), or fifties (36%), and their function is mostly principal (58%).

Table 2.1.
Background characteristics of sample

<table>
<thead>
<tr>
<th>Background characteristics</th>
<th>Outcomes</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
<td>31</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>47</td>
<td>60</td>
</tr>
<tr>
<td>Age</td>
<td>≤20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>21-30</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>22</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>19</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>51-60</td>
<td>28</td>
<td>36</td>
</tr>
<tr>
<td></td>
<td>≥61</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Function</td>
<td>Principal</td>
<td>46</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Deputy principal</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Location manager</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Other leaders</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>FTE</td>
<td>≤0.2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>&gt;0.2 and ≤0.5</td>
<td>9</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>&gt;0.5 and ≤0.8</td>
<td>19</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>&gt;0.8</td>
<td>51</td>
<td>65</td>
</tr>
<tr>
<td>Educational level</td>
<td>Bachelor’s degree from a university of applied sciences</td>
<td>40</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Master’s degree from a university of applied sciences</td>
<td>34</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s degree from a research university</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Master’s degree from a research university</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
Inquiry-based leadership: the influence of attitude, experienced social pressure and self-efficacy

**Instruments**

The explanatory and dependent variables measured in this survey consisted of 41 items rated on a 4-point Likert scale: completely disagree, partly disagree, partly agree, completely agree. To verify the content validity of the items, experts (i.e. four teachers, two school leaders and two educational consultants) reviewed item formulations. The instruments used to measure the aspects of inquiry-based leadership were based on existing instruments of Krüger (2010b). The original validated scales had Cronbach’s alpha coefficients between .76 and .89 (Krüger, 2010b). Item formulation was adjusted from teacher perspective to school leader perspective where necessary. The scale being data literate was complemented with one item of Earl and Katz (2006) and one newly formulated item.

The instrument used to measure self-efficacy regarding inquiry-based leadership was based on an existing scale from Krüger (2010b) (with Cronbach’s alpha = .84) supplemented with one item from Visser-Wijnveen, Stes, and Van Petegem (2012). Again item formulation was adjusted from teacher perspective to school leader perspective.

The items used to measure attitude towards inquiry-based working were created by the researcher, through reformulating items from a scale regarding a more general attitude towards teaching that had previously been used in the Netherlands (Visser-Wijnveen et al., 2012). Item formulations were adjusted to inquiry-based leadership. The scale for experienced social pressure was based on the work of Fishbein and Ajzen (2010). Ajzen (2002a) only gives sample items for illustrative purposes. Based on these sample items a new scale was constructed. One item of the scale experienced social pressure was negatively formulated: “Whether or not I lead my school in an inquiry-based way is completely up to me”. This item was eliminated from the scale due to a negative correlation with the other four items, after recoding. Because new scales were formed for attitude and experienced social pressure, Cronbach’s alpha coefficients can only be reported for the current sample. The preliminary analyses show that scale reliability for experienced social pressure is relatively low (Cronbach’s alpha = .59). The reliability of all other scales is reasonable or good. All scales were constructed by averaging the item scores. Table 2.2 shows the number of items and the Cronbach’s alpha of each scale and includes a sample item per scale. The reliability scores demonstrate that these scales can be trusted for use in the analyses in this study.
Table 2.2.
Overview of the survey instrument

<table>
<thead>
<tr>
<th>Scale</th>
<th>Number of items</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with an inquiry habit of mind</td>
<td>5</td>
<td>.67</td>
</tr>
<tr>
<td><em>In my work I value deep understanding</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being data literate</td>
<td>6</td>
<td>.79</td>
</tr>
<tr>
<td><em>I am knowledgeable about statistical concepts</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creating a culture of inquiry by:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- communicating a vision on inquiry-based working</td>
<td>4</td>
<td>.80</td>
</tr>
<tr>
<td><em>I explain to the team the relationship between available data and the school’s vision</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- stimulating the inquiry habit of mind of teachers</td>
<td>6</td>
<td>.80</td>
</tr>
<tr>
<td><em>I involve teachers in interpreting data about the school</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- stimulating data literacy of teachers</td>
<td>5</td>
<td>.80</td>
</tr>
<tr>
<td><em>I stimulate teachers to research their own teaching and / or issues at school level</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude towards inquiry-based leadership</td>
<td>5</td>
<td>.84</td>
</tr>
<tr>
<td><em>I enjoy inquiry-based leadership</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experienced social pressure regarding inquiry-based leadership</td>
<td>4</td>
<td>.59</td>
</tr>
<tr>
<td><em>Most people whose opinion I value think I should lead my school in an inquiry-based way</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy regarding inquiry-based leadership</td>
<td>5</td>
<td>.84</td>
</tr>
<tr>
<td><em>I am confident I have the skills to lead my school in an inquiry-based way</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The text in italics is a sample item for the scale in question.

The background characteristics were measured with five additional items. Gender was coded as 0 = female and 1 = male. To measure age, respondents chose between five ordered options: ≤20; 21-30; 31-40; 41-50; 51-60; ≥61 and these were coded, respectively as 0, 1, 2, 3, 4, and 5. As noted above, primary schools in The Netherlands normally have one principal and at least one middle manager. Schools may use different terms for middle managers such as deputy principal or location manager. Therefore, to measure function, respondents could answer “principal”, “deputy principal”, “location manager”, or “other leaders”. Principal was coded as
Inquiry-based leadership: the influence of attitude, experienced social pressure and self-efficacy

1 while the other three answers were coded as 0. This facilitates the ability to discern whether or not the respondent is a principal.

FTE was measured using the scale: ≤0.2; >0.2 and ≤0.5; >0.5 and ≤0.8; >0.8. The answer >0.8 is interpreted as working full-time and was coded as 1. The other options were interpreted as working part time and were coded as 0. Educational level was measured by asking what the respondents’ highest level of education is. The answer categories were in line with the Dutch educational system: bachelor’s degree from a university of applied sciences, master’s degree from a university of applied sciences, bachelor’s degree from a research university, master’s degree from a research university. The responses were coded as 0 = bachelor’s degree; 1 = master’s degree.

**Statistical Analysis**

Since school leaders are sometimes employed within the same school board, their observations could be dependent. However, intraclass correlations reflecting possible dependence between observed scores of school leaders from the same school board were not significant (working with an inquiry habit of mind: $F(57,21) = .75$, $p = .81$; being data literate: $F(57,21) = .72$, $p = .84$; communicating a vision on inquiry-based working: $F(57,21) = .92$, $p = .62$; stimulating the inquiry habit of mind of teachers: $F(57,21) = 1.01$, $p = .51$; stimulating data literacy of teachers: $F(57,21) = 1.47$, $p = .17$). Therefore, first a standard regression was performed between the background characteristics as independent variables and the aspects of inquiry-based leadership as dependent variables.

Subsequently, a standard regression was performed between the three predictors from the hypothesis (attitude, experienced social pressure, and self-efficacy regarding inquiry-based leadership) and the aspects of inquiry-based leadership as dependent variables, with significant background characteristics as observed from the first analysis as additional predictors. To investigate the correlation between attitude, experienced social pressure, and self-efficacy and the aspects of inquiry-based leadership, Pearson product-moment correlation coefficients were computed. Results were called statistically significant for $p$-values at or below .05.
CHAPTER 2

Results
The mean scores of the scales measuring the different aspects of inquiry-based leadership are between 3.08 and 3.39, as can be seen in Table 2.3. For the three psychological factors with regard to inquiry-based leadership, the mean scores are between 2.95 and 3.48. Bearing in mind that the midpoint of the assessment scale is 2.5, the results indicate that respondents score as moderately positive on the scales measuring inquiry-based leadership as well as the measured psychological factors. Since school leaders filled out the questionnaire themselves, all scores measure the school leaders’ perceptions.

Table 2.3.
Descriptive statistics of used scales

<table>
<thead>
<tr>
<th>Scale</th>
<th>n</th>
<th>m</th>
<th>Sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquiry-based leadership</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working with an inquiry habit of mind</td>
<td>79</td>
<td>3.39</td>
<td>.38</td>
</tr>
<tr>
<td>Being data literate</td>
<td>79</td>
<td>3.37</td>
<td>.41</td>
</tr>
<tr>
<td>Creating a culture of inquiry by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- communicating a vision on inquiry-based working</td>
<td>79</td>
<td>3.16</td>
<td>.54</td>
</tr>
<tr>
<td>- stimulating the inquiry habit of mind of teachers</td>
<td>79</td>
<td>3.29</td>
<td>.46</td>
</tr>
<tr>
<td>- stimulating data literacy of teachers</td>
<td>79</td>
<td>3.08</td>
<td>.57</td>
</tr>
<tr>
<td>Psychological factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>79</td>
<td>3.48</td>
<td>.45</td>
</tr>
<tr>
<td>Experienced social pressure</td>
<td>79</td>
<td>2.95</td>
<td>.47</td>
</tr>
<tr>
<td>Self-efficacy regarding inquiry-based leadership</td>
<td>79</td>
<td>3.03</td>
<td>.52</td>
</tr>
</tbody>
</table>

Notes. Answer categories: 1 = completely disagree; 2 = partly disagree; 3 = partly agree; 4 = completely agree. n = sample size, m = mean item scores, sd = standard deviation.

Table 2.4 displays the regression coefficients (b), the standard errors (s.e.), the p-values (p), and the proportions of explained variance ($R^2$) of the regression analyses of aspects of inquiry-based leadership on the background characteristics. Since all background characteristics were entered in the regression equations simultaneously, any parameter for the separate characteristics should be interpreted as the estimated relationship with the dependent variable, given the other characteristics. The results show a statistically significant positive relationship between age and all aspects of inquiry-based leadership, except being data literate.
A one-way analysis of variance with post-hoc comparisons between-groups using the Tukey HSD test was conducted to further explore these significant relationships to age. The results show significant differences for working with an inquiry habit of mind between respondents aged 31-40 ($M = 3.25$, $SD = .28$) and respondents aged 51-60 ($M = 3.58$, $SD = .34$). In addition, communicating a vision on inquiry-based working showed significant differences between respondents aged 31-40 ($M = 2.87$, $SD = .49$) and respondents aged 51-60 ($M = 3.42$, $SD = .44$). Stimulating an inquiry habit of mind showed significant differences between respondents aged 51-60 ($M = 3.53$, $SD = .36$) and respondents aged 21-30 ($M = 2.71$, $SD = .39$), respondents aged 31-40 ($M = 3.14$, $SD = .41$), and respondents aged 41-50 ($M = 3.17$, $SD = .47$). Furthermore, a significant difference was found between respondents aged 21-30 ($M = 2.71$, $SD = .39$) and respondents aged $\geq 61$ ($M = 3.75$, $SD = .17$). Stimulating data literacy showed significant differences between respondents aged 51-60 ($M = 3.40$, $SD = .51$) and both respondents aged 31-40 ($M = 2.81$, $SD = .50$) and respondents aged 41-50 ($M = 2.92$, $SD = .53$).

The results indicate that participants in the age group 51-60 score themselves significantly higher than participants in the age group 31-40 on working with an inquiry habit of mind and on communicating a vision for inquiry-based working. For stimulating an inquiry habit of mind, participants in the age group 51-60 score significantly higher than participants in all three younger age groups. In addition, for stimulating data literacy, participants in the age group 51-60 score themselves significantly higher than participants in the age groups 31-40 and 41-50.
Educational level has a significant positive relationship to working with an inquiry habit of mind and also to communicating a vision for inquiry-based working as part of creating a culture of inquiry. This indicates that school leaders with a master’s degree score higher on these aspects than leaders with a bachelor’s degree. FTE has a significant relationship to data literacy and to communicating a vision for inquiry-based working. This indicates that school leaders who work full-time score higher on being data literate and on communicating a vision for inquiry-based working. Gender and Function appeared to have no significant relationship to any aspect of inquiry-based leadership, given the other predictors.

Table 2.5 shows the correlation (r) and the p-values (p) between the measured psychological factors and inquiry-based leadership. There is a strong positive correlation between all independent and all dependent variables, suggesting quite a strong relationship between the measured psychological factors and inquiry-based leadership.

### Table 2.5.

Correlations between psychological factors and inquiry-based leadership

<table>
<thead>
<tr>
<th>Attitude</th>
<th>Social pressure</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with an inquiry habit of mind</td>
<td>.57 &lt;.01</td>
<td>.45 &lt;.01</td>
</tr>
<tr>
<td>Being data literate</td>
<td>.49 &lt;.01</td>
<td>.47 &lt;.01</td>
</tr>
<tr>
<td>Communicating a vision on inquiry-based working</td>
<td>.67 &lt;.01</td>
<td>.55 &lt;.01</td>
</tr>
<tr>
<td>Stimulating the inquiry habit of mind of teachers</td>
<td>.63 &lt;.01</td>
<td>.60 &lt;.01</td>
</tr>
<tr>
<td>Stimulating data literacy of teachers</td>
<td>.59 &lt;.01</td>
<td>.60 &lt;.01</td>
</tr>
</tbody>
</table>

There were also strong, positive relationships between attitude and experienced social pressure (r = .63, n = 79, p <.001), between attitude and self-efficacy regarding inquiry-based leadership (r = .69, n = 79, p <.001), and between experienced social pressure and self-efficacy regarding inquiry-based leadership (r = .67, n = 79, p <.001). This indicates that high scores on attitude, high scores on experienced social pressure and high scores on self-efficacy regarding inquiry-based leadership are associated with each other.
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Table 2.6 shows the results of the regression analyses of the measured psychological factors on inquiry-based leadership, taking into account the significant background characteristics (age, FTE, and educational level) from the previous regression analyses. In all models, the proportion of explained variance (R²) additionally explained by the psychological factors was significant. The regression analyses show that self-efficacy is significantly related to all aspects of inquiry-based leadership with one exception within the area of creating a culture of inquiry: stimulating the inquiry habit of mind of teachers. This means that the higher their self-efficacy, the higher school leaders score on leading their school in an inquiry-based way. Attitude is related to two aspects of creating a culture of inquiry, namely communicating a vision on inquiry-based working and stimulating the inquiry habit of mind of teachers. This implies that leaders who are positive regarding inquiry-based leadership, score higher on these two aspects than leaders who are less positive towards inquiry-based leadership. Experienced social pressure is not significantly related to any aspect of inquiry-based leadership, given the other predictors.

Table 2.6.

Regression of inquiry-based leadership on significant background characteristics and psychological factors

<table>
<thead>
<tr>
<th></th>
<th>Working with an inquiry habit of mind</th>
<th>Being data literate</th>
<th>Communicating a vision on inquiry-based working</th>
<th>Stimulating an inquiry habit of mind</th>
<th>Stimulating data literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b (s.e.)</td>
<td>p</td>
<td>b (s.e.)</td>
<td>b (s.e.)</td>
<td>b (s.e.)</td>
</tr>
<tr>
<td>Intercept</td>
<td>1.77 (.28)</td>
<td>.00</td>
<td>1.73 (.32)</td>
<td>.00</td>
<td>.38 (.35)</td>
</tr>
<tr>
<td>Age</td>
<td>.05 (.04)</td>
<td>.20</td>
<td>.01 (.04)</td>
<td>.81</td>
<td>.07 (.05)</td>
</tr>
<tr>
<td>FTE</td>
<td>.02 (.08)</td>
<td>.78</td>
<td>.12 (.09)</td>
<td>.17</td>
<td>.15 (.09)</td>
</tr>
<tr>
<td>Educational level</td>
<td>.09 (.08)</td>
<td>.26</td>
<td>.03 (.09)</td>
<td>.69</td>
<td>.14 (.09)</td>
</tr>
<tr>
<td>Attitude</td>
<td>.22 (.12)</td>
<td>.07</td>
<td>.06 (.13)</td>
<td>.64</td>
<td>.33 (.14)</td>
</tr>
<tr>
<td>Social pressure</td>
<td>.01 (.11)</td>
<td>.95</td>
<td>.09 (.13)</td>
<td>.50</td>
<td>.10 (.14)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>.22 (.11)</td>
<td>.04</td>
<td>.34 (.12)</td>
<td>.01</td>
<td>.32 (.13)</td>
</tr>
<tr>
<td>R²</td>
<td>.41</td>
<td>&lt;.01</td>
<td>.39 &lt;.01</td>
<td>.57 &lt;.01</td>
<td>.55 &lt;.01</td>
</tr>
<tr>
<td>R² change**</td>
<td>.20</td>
<td>&lt;.01</td>
<td>.23 &lt;.01</td>
<td>.27 &lt;.01</td>
<td>.24 &lt;.01</td>
</tr>
</tbody>
</table>

Notes. Significant p-values (<.05) are reported in bold type.

*R² total amount of variance in inquiry-based leadership that can be explained by all predictors

*R² change due to inclusion of psychological factors (added to the model with predictors age, FTE, and educational level)
From the background characteristics, only the school leader’s age appears to be significantly related to stimulating the inquiry habit of mind of teachers and stimulating data literacy, given the factors attitude, experienced social pressure and self-efficacy regarding inquiry-based leadership. Older school leaders tended to report a greater confidence that they were stimulating the inquiry habit of mind and the data literacy of teachers than younger school leaders.

**Discussion and conclusions**

This study shows a positive correlation between attitude, experienced social pressure and self-efficacy on the one hand and inquiry-based leadership on the other hand. However, some predictors appear to make a unique and significant contribution to aspects of inquiry-based leadership and others do not. From a theoretical perspective, these findings narrow the two mentioned gaps in research and offer new insights in how psychological factors are related to whether and how school leaders lead their schools in an inquiry-based manner. The predictor that stands out to the greatest degree is self-efficacy. In line with earlier research that shows the impact of self-efficacy on educators in schools (Krüger and Geijsel, 2011; Geijsel *et al*., 2009; Vanhoof *et al*., 2014), this study hypothesized that school leaders with a high sense of self-efficacy towards inquiry-based leadership would lead their schools in a more inquiry-based way. This study, indeed, shows a significant relationship between self-efficacy and all three aspects of inquiry-based leadership. The sole (sub-)aspect for which self-efficacy regarding inquiry-based leadership has no significant unique contribution is stimulating the inquiry habit of mind of teachers.

This study also hypothesized, based on the theory of Fishbein and Ajzen (2010) and on research by Vanhoof *et al*., (2014), that school leaders with a positive attitude towards inquiry-based leadership would lead their schools in a more inquiry-based way. The findings reveal that the hypothesis is partly correct. Indeed, there is a significant and unique relationship between attitude and two sub-aspects of creating a culture of inquiry: these are communicating a vision on inquiry-based working and stimulating the inquiry habit of mind of teachers. This means that school leaders with a stronger positive attitude towards inquiry-based leadership also score more highly on communicating a vision on inquiry-based working and stimulating the inquiry habit of mind among teachers. This study shows no unique relationship (given the other predictors) between attitude and working with an inquiry habit of mind, being data literate and
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the third sub-aspect of creating a culture of inquiry: stimulating data literacy of teachers. The findings indicate that a positive attitude towards inquiry-based leadership differs in relation to a) creating a culture of inquiry and b) working with an inquiry habit of mind and being data literate. It seems as if the school leader’s attitude does not influence his or her own behavior (working with an inquiry habit of mind and being data literate), but it does affect the school leader’s thinking about stimulating an inquiry-based culture in the school by communicating a vision and encouraging teachers’ inquiry habit of mind.

This study finally hypothesized, based on Fishbein and Ajzen (2010), Schildkamp and Kuiper (2010) and Vanhoof et al. (2014), that the social pressure that school leaders experience to lead their schools in an inquiry-based way would be related to inquiry-based leadership. Given the other predictors, experienced social pressure appears to have no unique significant relationship to any aspect of inquiry-based leadership. However, the strong positive correlation among the three predictors and between a) each psychological factor and b) all aspects of inquiry-based leadership indicates that none of these hypotheses should be rejected. This means that self-efficacy, attitude and experienced social pressure with regard to inquiry-based leadership are, indeed, related to all aspects of inquiry-based leadership - although some aspects have a unique significant relationship and others are related through the other predictors.

This study also investigated the role of the background characteristics of gender, age, function, fulltime-equivalent (FTE), and educational level. Taking into account the psychological factors, only age appears to have a significant relationship to two aspects of inquiry-based leadership: school leaders in the age group 51-60 score higher than others on stimulating the inquiry habit of mind and on stimulating data literacy among teachers. Since the results are based on the perception of school leaders themselves, this could mean that participants in the age group 51-60 either have a tendency to score their own capacities more highly than others do, or that they, indeed, do lead their schools in a more inquiry-based way than younger participants, for example due to experience. Since other studies show differences between male and female leaders (Paustian-Underdahl et al., 2014), it is somewhat unexpected that, taking into account the other background characteristics, gender is not indicated as being related to inquiry-based leadership. This study indicates that male and female school leaders do not differ to any significant degree in the extent to which they lead their schools in an inquiry-based way.

While the used literature might suggest causality of relationships between variables, it is important to emphasize that the methods used in this study were not intended to validate the
causal nature of these relationships. This means caution is advised with regard to the interpretation of the findings. The findings show correlations instead of causalities.

A limitation of this study is that only a small number of the invited school boards participated with their schools. Although the amount of participants is adequate for the quantitative analyses undertaken, in future research in might be a better option to invite school leaders themselves instead of their school boards to participate in this type of research. It is also possible that school boards and school leaders who agreed to participate were already more focused on inquiry-based leadership and inquiry-based working than others. This is in line with the relative high scores with regard to inquiry-based leadership that are indicated by the descriptive results of this study. However, since this study has attempted to relate aspects of inquiry-based leadership to psychological factors, it could be regarded as an advantage that those school leaders participating in this research showed a certain degree of inquiry-based leadership.

Another limitation concerns the fact that self-reports were used (see e.g. Schwartz, 1999). Self-reports reflect school leaders’ own perceptions and the common-method bias might lead to high correlations (see e.g. Batista-Foguet, Revilla, Saris, Boyatzis and Serlavós, 2014).

According to Ajzen (1991, 2002b, 2011), attitude, experienced social pressure and self-efficacy are assumed to predict behavioral intentions. On the basis of this theory, a qualitative follow-up study is in progress to reach a more grounded measure of actual inquiry-based leadership. This research tries to explore the relationship between the three psychological factors used in this study on the one hand and intentions and actual behavior on the other hand. The use of qualitative methods in this follow-up - such as observations of school leaders’ actions - and a focus on how teachers experience this type of leadership from their leaders, could contribute to further understanding of the concept of inquiry-based leadership.

From a practical perspective, our findings are directly relevant not only for school boards who would like to stimulate inquiry-based leadership in their schools but also for educators of school leaders for the design of professional development initiatives. Based on the results this study suggests that school boards and educators of school leaders who would like to stimulate inquiry-based leadership should bear in mind the strong relationship of inquiry-based leadership with all three psychological factors. The outcomes of this study indicate that the combination of a strong sense of self-efficacy regarding inquiry-based leadership, a positive attitude towards it and the experience of social pressure regarding inquiry-based leadership,
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tend to result in school leaders leading their schools in a more inquiry-based way. School boards and educators of school leaders could pay attention to these aspects by giving positive feedback, emphasizing the added value of inquiry-based leadership, and stimulating peer-to-peer coaching with other leaders. Cooperating in small peer groups, talking about each other’s capabilities, and discovering each person’s strengths, in particular, could contribute to self-efficacy regarding inquiry-based leadership.
CHAPTER 2

The relationship between psychological factors and inquiry-based working by primary school teachers

Abstract

Inquiry-based working by teachers includes working with an inquiry habit of mind, being data literate, contributing to a culture of inquiry at the school level, and creating a culture of inquiry at the classroom level. Inquiry-based working has been found to contribute to educational improvements and the professionalization of teachers. This study investigates the relationship between psychological factors—attitude, experienced social pressure, self-efficacy, and collective efficacy—and inquiry-based working by teachers.

Questionnaire data were collected from a representative sample of 249 Dutch teachers. The results show a significant relationship between self-efficacy and all aspects of inquiry-based working. In addition, collective efficacy, attitude, and experienced social pressure are all related to aspects of inquiry-based working.

School leaders and teacher educators who aim to stimulate inquiry-based working should not only focus on increasing teachers' inquiry skills, but also on psychological factors related to inquiry-based working.

Keywords: inquiry-based working; teachers; self-efficacy; inquiry; data use

CHAPTER 3

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CHAPTER 3

Introduction

When teachers are asked on what basis they make decisions intended to improve their teaching, many of them indicate that their decisions are rooted in their own experiences. They rarely refer to theories or to instructional models (Elmore 2004). Schools collect a wide variety of data, both quantitative (such as learning outcomes or progression rates) and qualitative (such as interviews or observation reports), but they often do not use this data effectively (Earl and Fullan 2003; Krüger and Geijsel 2011; Lachat and Smith 2005; Wayman and Stringfield 2003). Apparently, teachers make scant efforts to gather and use evidence to improve teaching and learning. According to Earl and Katz (2006), a mind shift is needed: instead of only depending on experience (implicit, tacit knowledge) school leaders and teachers need to also rely on explicit, data-informed knowledge. Employing data for school improvement creates a culture of inquiry centered on the use of data to learn (Katz and Dack 2014). According to Krüger (2010a), inquiry-based schools are more conscious of their educational quality, are better able to perceive weak spots in their instructional processes, and make more focused adjustments to attain education improvements. In this paper we adopt a broad view on inquiry-based working, which involves working with an inquiry habit of mind, being data-literate and contributing to culture of inquiry at the school and classroom level (based on Earl and Katz 2006). This is broader than the much used view that focusses on the use of data in a technical way.

Cochran-Smith (2009) points out that there is a difference between a culture where evidence ‘drives’ decisions (suggesting a linear conception of the relationship between evidence and practice) and a culture where evidence ‘informs’ decisions (implying that evidence must always be interpreted and that evidence alone can never tell us what to do) (Cochran-Smith 2009). This second perspective mentioned by Cochran-Smith (2009) is consistent with our broad view on inquiry-based working.

The field of inquiry-based working in schools is relatively new. Existing research in this area predominantly focuses on conducting research and using data, while other aspects of inquiry-based working, such as contributing to a culture of inquiry and working with an inquiry habit of mind are not addressed. Earlier studies do, however, show the importance of psychological factors in explaining differences in inquiry-based working in the more narrow sense of data use (Ikemoto and Marsh 2007; Schildkamp and Kuiper 2010; Vanhoof, Vanlommel, Thijs, and Vanderlocht 2014). A positive or negative attitude towards inquiry-based working plays an important role in school leaders’ inquiring behavior (Vanhoof et al.
The relationship between psychological factors and inquiry-based working by primary school teachers 2014). Other psychological factors, such as perceptions of external expectations and self-efficacy, also have a relationship with school leaders’ data use (Vanhoof et al. 2014). Self-efficacy regarding inquiry-based working has a significant relationship with both the inquiry habit of mind and teachers’ data-literacy (Krüger and Geijsel 2011). The impact of psychological factors on teachers’ inquiry-based working in a broader sense, however, remains a topic that clearly requires exploration. Therefore, this study investigates psychological factors that could influence inquiry-based working by primary school teachers.

**Theoretical framework**

**Inquiry-based working by teachers**

Earl and Katz (2006) identify three key capacities for inquiry-based school leadership: having an inquiry habit of mind, being data literate, and creating a culture of inquiry. This study uses these capacities as a template for inquiry-based working by teachers. In this template, two aspects of creating a culture of inquiry are distinguished: contributing to a culture of inquiry at the school level and creating a culture of inquiry at the classroom level. This means teachers need four capacities to work in an inquiry-based manner: (1) having an inquiry habit of mind, (2) being data literate, (3) contributing to a culture of inquiry at the school level and (4) creating a culture of inquiry at the classroom level.

The first capacity for inquiry-based working – having an inquiry habit of mind – means that teachers do not base their teaching on tacit knowledge alone. Teachers with an inquiry habit of mind value deep understandings, reserve judgment, take a range of perspectives, and systematically pose increasingly focused questions (Earl and Katz 2006). They have the inclination to achieve (through passion and persistence), the inclination to be critical (through honesty and the ability to be critical to self and others), the inclination to know (through curiosity and excitement), and the inclination to understand (through the ability to take an overview of events and the desire to scrutinize) (Van der Rijst, Kijne, Verloop and Van Driel 2008).

The second capacity needed for inquiry-based working – being data literate – refers to knowledge regarding measurement and statistical concepts. This does not mean that teachers need to become statisticians. Rather, they must think about purposes, recognize different types of data and their quality, make interpretation paramount, and report to others (Earl and Katz
Mandinach and Gummer (2013) define data literacy as the ability to understand and use data effectively so as to inform decisions. According to their theory, data literacy includes knowing how to identify, collect, organize, analyze, summarize, and prioritize data. It also includes the skills to develop hypotheses; identify problems; interpret data; and determine, plan, implement, and monitor courses of action (Mandinach and Gummer 2013). Data literate teachers are able to transform data into information, information into knowledge, and knowledge into action (Marsh and Farrell 2014). Schildkamp, Ehren and Lai (2012) point out that data is often narrowly defined as quantitative, standardized assessment data. Assessment data are only one type of data. Data literacy, however, also requires knowledge about other data, such as perception, motivation, process, and behavior (Mandinach and Gummer 2013). Therefore, our research employs a broader definition of data. It defines data as all the relevant information that teachers and schools need for decision-making, including both qualitative and quantitative data at the school, class, and individual pupil levels.

The third capacity needed for inquiry-based working is creating a culture of inquiry at the school level. In a culture of inquiry, teachers work together and assist one another in making sense of data, in engaging in joint action planning, and in sharing instructional strategies (Datnow, Park, and Kennedy-Lewis 2013). This description is consistent with how Van der Rijst et al. (2008) depict the inclination to share: being open to others and wanting to interact and work together. While working together, teachers are influenced through their interactions and negotiations with others (Coburn and Turner 2011). Van der Linden et al. (2012) and Schenke, Van Driel, Geijsel, and Volman (in press) have shown how this process of working together can also involve external researchers.

A culture of inquiry is not as much concerned with learning how to use data (as a technical skill) but with how to collaboratively use data to learn (Katz and Dack 2014). Katz and Dack (2014) point out that this collaborative use of data is a way of professional learning that enhances new understandings, which can stimulate improved practices, which in turn can influence student learning. In this inquiry-driven culture, teachers systematically and intentionally research their own teaching and learning as a form of quality improvement. The results of such research are then used to improve their teaching and learning (Ellis and Castle 2010; Van der Linden, Bakx, Ros, Beijaard, and Vermeulen 2012). These cultures of evidence, as Cochran-Smith (2009) calls them, look different depending on the educational setting, the values and beliefs of participants, and the varying purposes and traditions of programs and projects.
Inquiry-based working by teachers at the classroom level – the fourth capacity necessary for inquiry-based working – can be defined as creating an environment where pupils are curiosity-driven, ask questions, make discoveries, and test these discoveries in a search for new understanding (Chin 2002; Al-Sabbagh 2009). A culture of inquiry in the classroom is often referred to as inquiry-based learning. In their study investigating how inquiry-based learning was defined and taught in different fields, Levy, Thomas, Drago and Rex (2013) identify a number of characteristics. These are: focusing on learners’ active investigation and analysis of data, including their pursuit of probing questions; having pupils carry out investigations and collect data to construct evidence-based explanations; encouraging pupils to analyze documents and artifacts to construct accounts of past events; and requiring learners to take ownership of their own learning. Davis, Janssen and Van Driel (2016) found in their review study that the extent to which lessons are inquiry-oriented is heavily influenced by how inquiry-oriented the curriculum materials are. Jones and Eick (2007) describe three forms of inquiry-based learning. The first one is open ended, involving suspending planned instruction to explore students’ questions. The second one is project-based inquiry, involving teachers designing projects for students based on driving questions from class discussions. The third form is guided inquiry, which is teacher centred and involves a curriculum in which science concepts and lessons are fixed (Jones and Eick 2007). These three forms from open to guided inquiry can also be seen as a continuum in which the responsibility that learners have vary. According to Olson and Loucks-Horsley (2000) students should have opportunities to participate in all types of inquiries. They point out that guided inquiry can best focus on the development of science concepts, while a more open inquiry will afford the best opportunities for cognitive development and scientific reasoning. Also Baeten, Dochy and Struyven (2012) point out that there are limited benefits of solely student-centred approaches on students’ achievement, whereas a combination of a student-centred and a teacher-centred approach can provide structured support. In line with Earl and Katz (2006), in this study, creating a culture of inquiry in the classroom means stimulating pupils’ inquiry habit of mind, as well as their data literacy. This can vary in the degree of guidance by teachers.

**Psychological factors influencing inquiry-based working**

It seems that individuals let their attitudes – rather than their knowledge – guide their behavior (Sanbonmatsu and Fazio 1990). A teacher’s attitude towards inquiry-based working can be defined as the tendency to respond with some degree of (un)favor towards inquiry-based
CHAPTER 3

working – an evaluative dimension that ranges from negative to positive through a neutral point (based on Fishbein and Ajzen 2010). Research on school leaders not only has shown a relationship between attitude and data use (Ikemoto and Marsh 2007; Schildkamp and Kuiper 2010; Vanhoof et al. 2014), but also between attitude and aspects of inquiry-based leadership (Uiterwijk-Luijk, Krüger, Zijlstra and Volman forthcoming). Vanhoof et al. (2014) and Uiterwijk-Luijk et al. (forthcoming) point out that attitude relates to respectively data-use and inquiry-based leadership. School leaders’ positive attitude towards data use appears to have a positive relationship with their actual use of data (Vanhoof, et al. 2014). In addition, school leaders’ positive attitude towards inquiry-based leadership appears to have a positive relationship with their creation of a culture of inquiry in their schools (Uiterwijk-Luijk et al. forthcoming). Attitude is, therefore, also expected to be a key factor in explaining inquiry-based working by teachers.

Additionally, it seems that teachers do not use data unless the school leader advocates for its use, stimulating and encouraging them to do so (Earl and Katz 2006; Schildkamp, Lai, and Earl 2013). This can be seen as an instance of social pressure. Therefore, teachers’ perceived social pressure could be expected to be related to their inquiry-based working. Social pressure, or subjective norm, has two aspects: injunctive and descriptive subjective norms (Fishbein and Ajzen 2010). Injunctive norms refer to social approval and to the belief that others do or do not want us to perform a given behavior. Descriptive norms refer to the popularity of the behavior and to the belief that others are performing or not performing a specific behavior.

According to Bandura (1997), self-efficacy can be defined as believing that one can successfully perform a specific behavior and the conviction that one is capable of organizing and executing the actions required to produce given levels of attainments. Significantly, it appears to play a major role in explaining behavior in schools. For example, Geijsel, Sleegers, Stoel, and Krüger (2009) found that teachers’ sense of self-efficacy is an important psychological factor for understanding teacher learning. Self-efficacy regarding inquiry-based working also appears to have a strong positive influence on secondary school teachers’ inquiry habit of mind and on their data literacy (Krüger and Geijsel 2011). Regarding school leaders, research by Uiterwijk-Luijk et al. (forthcoming) shows a strong relationship between self-efficacy and inquiry-based leadership. Furthermore, Vanhoof et al. (2014) found a relationship between self-efficacy and data use by school leaders.

Following this line of reasoning, it could be expected that self-efficacy regarding
The relationship between psychological factors and inquiry-based working by primary school teachers inquiry-based working has an impact on primary school teachers’ inquiry habit of mind and on their data literacy. That said, it is still unclear what the relationship is between self-efficacy regarding inquiry-based working and contributing to a culture of inquiry at the school level. Similarly, uncertain is the relationship between self-efficacy regarding inquiry-based working and creating a culture of inquiry at the classroom level. Given the important role of self-efficacy in explaining behavior in schools, these are topics that clearly necessitate exploration.

Since inquiry-based working requires teachers to work together in teams (Coburn and Turner 2011; Earl and Katz 2006; Katz and Dack 2014), teachers’ beliefs about the ability of his or her team to work in an inquiry-based manner are also relevant. Such beliefs represent perceived collective efficacy (Bandura 1997; Goddard, Hoy, and Woolfolk Hoy 2004; Skaalvik and Skaalvik 2007). It is still unclear what the relationship is between collective efficacy regarding inquiry-based working and aspects of inquiry-based working by teachers.

**Background characteristics related to inquiry-based working**

Given the fact that variables such as gender, age, and class level taught have shown to be relevant variables in studies on teacher capacities (Lam, Tse, Lam and Loh 2010; Mueller 2013; Mullola et al. 2011; Rubie-Davies, Flint and McDonald 2012), it might be expected that background characteristics (such as gender, age, or class level taught) could explain the extent to which teachers work in an inquiry-based way.

**Current study: problem statement, hypotheses, and variables**

This study investigates how psychological factors are related to inquiry-based working by primary school teachers in the Netherlands. The psychological factors investigated in this study are: attitude, experienced social pressure, self-efficacy regarding inquiry-based working, and collective efficacy regarding inquiry-based working. The research question is: “how are attitude, experienced social pressure, self-efficacy regarding inquiry-based working, and collective efficacy regarding inquiry-based working related to inquiry-based working by primary school teachers in the Netherlands?

In this study, inquiry-based working includes the following capacities, which are based on the research of Earl and Katz (2006): (1) working with an inquiry habit of mind, (2) being
data literate, (3) contributing to a culture of inquiry at the school level, and (4) creating a culture of inquiry at the classroom level. Working with an inquiry habit of mind is here interpreted in a behavioral sense, such as reading literature to gain knowledge, or verifying assumptions. Therefore, it is different from the concept ‘attitude,’ which in this research is used as a psychological factor. In this study, being data literate means being able to formulate research questions before gathering data, as well as being able to analyze and interpret data and present the results to others (Earl and Katz 2006). A broad definition of data is used, concerning not just assessment data but multiple types of data, both quantitative and qualitative. Contributing to a culture of inquiry at the school level is interpreted as collaborating with colleagues in a culture of inquiry. In the context of this study, this specifically refers to teachers collaborating to conduct and utilize research (Krüger and Geijsel 2011).

Based on Earl and Katz (2006), creating a culture of inquiry at the classroom level means stimulating pupils’ inquiry habit of mind and pupils’ data literacy. In this study, stimulating pupils’ inquiry habit of mind is interpreted as encouraging curiosity (to seek out new knowledge) and being critical (to ensure the new knowledge is qualitatively good knowledge). Furthermore, stimulating pupils’ data literacy here means systematically teaching research skills, such as asking different kind of questions, practicing research methods, and presenting to others.

Based on the theory outlined above and given the background characteristics, we hypothesized the following: (1) Teachers with positive attitudes towards inquiry-based working tend to work in a more inquiry-based manner than teachers who are less positive. (2) Teachers who feel it is expected of them to work in an inquiry-based manner (experienced social pressure) work in a more inquiry-based manner than teachers who experience less social pressure. (3) A high sense of self-efficacy towards inquiry-based working allows teachers to work in a more inquiry-based manner than a low sense of self-efficacy towards inquiry-based working. (4) Similarly, a strong sense of collective efficacy towards inquiry-based working allows teachers to work in a more inquiry-based manner than a low sense of collective efficacy. Before researching these hypotheses, we will explore the relationships between background characteristics and inquiry-based working.
The relationship between psychological factors and inquiry-based working by primary school teachers

**Background characteristics**

The background characteristics included in this study are gender, age, class level taught, function, fulltime-equivalent (FTE), and highest level of education. Function refers to differences in responsibilities of teachers in the Netherlands, which are related to scales (LA, LB, and LC). Beginning primary school teachers in the Netherlands work in function LA. Teachers with functions LB and LC are more experienced and/or are supposed to have a higher educational background and to be (co-)responsible for school policy and innovation. Therefore, we expected function to be related to inquiry-based working.

To indicate an individual’s workload in terms of time, the unit full-time equivalent (FTE) is used in the Netherlands. An FTE of 1.0 is equivalent to one full-time worker.

**Psychological factors**

This study investigates the impact of four psychological factors on inquiry-based working. First of all, it examines attitude, or, teachers’ positive or negative feelings towards inquiry-based working. Based on Sanbonmatsu and Fazio (1990) and Visser-Wijnveen, Stes, and Van Petegem (2012), attitude concerns to what extent a teacher enjoys inquiry-based working and is interested in it. The second psychological factor is experienced social pressure. This includes believing that others – for example, school leaders – want teachers to engage in inquiry-based working. Furthermore, experienced social pressure incorporates the belief that others – for example, colleagues – are also working in an inquiry-based manner (Fishbein and Ajzen 2010). The third factor is teachers’ self-efficacy towards inquiry-based working. In this study, this factor refers to a teacher’s belief that he or she is capable of successful inquiry-based working. In line with this and as a final factor, collective efficacy towards inquiry-based working is seen as teachers’ beliefs about the ability of their teams to work in an inquiry-based manner.

**Method**

**Participants**

Because of an expected low response rate (due to research fatigue in Dutch schools), this study invited all 1,046 school boards of primary schools in the Netherlands to participate with their schools. In total, 27 school boards with 71 schools responded positively. A web-based survey
was sent out to school boards, school leaders, teachers, and pupils. For this part of the study, respondents were 249 teachers from 61 primary schools, and these teachers taught grade 5 through grade 8. Most schools included in the study (66.2%) were situated in the East and South of the Netherlands. This is in line with the figure for national coverage: 69.4% (source: www.stamos.nl). Most participants (75.3%) were female, which is also in line with national numbers. In the Netherlands, 78% of teachers are female (Ministry of Education 2013). There is no reason to assume that the schools in this study are different than other schools in the Netherlands.

The background characteristics of the participants, as shown in Table 3.1, illustrate that a small majority of the participants (58%) were younger than 40 years and that the majority were female (75%) and had function LA (73%). A small majority of respondents worked more than 0.8 FTE (54%), and the most common educational level was bachelor’s degree (79%).

**Procedures**

After both a school board and the school leader agreed to participate in this study, teachers received a link to the survey. Data collection lasted from November 2012 until March 2013.

**Instruments**

The eight scales measured in this survey consisted of 49 items rated on a 4-point Likert scale: completely disagree, partly disagree, partly agree, and fully agree. To verify the content validity of the items, experts (i.e., four teachers, two school leaders, and two educational consultants) reviewed item formulations. The instruments used to measure working with an inquiry habit of mind, being data literate, and contributing to a culture of inquiry at the school level were based on existing instruments (Earl and Katz 2006; Krüger 2010b). One item included in the instrument, however, was newly formulated. The items that measured creating a culture of inquiry at the classroom level were based on the work of Van Ledden (2011).

Psychological factors were measured using instruments based on the work of Fishbein and Ajzen (2010), Visser-Wijnveen, Stes, and Van Petegem (2012) and Krüger (2010b). Item formulation was adjusted to inquiry-based working.
Table 3.1. Background characteristics of sample.

<table>
<thead>
<tr>
<th>Background characteristics</th>
<th>Outcomes</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>≤20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>21-30</td>
<td>75</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>31-40</td>
<td>72</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>41-50</td>
<td>44</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>51-60</td>
<td>48</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>≥61</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>Gender</td>
<td>Male</td>
<td>61</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>186</td>
<td>75</td>
</tr>
<tr>
<td>Class level taught*</td>
<td>Grade 5</td>
<td>72</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Grade 6</td>
<td>67</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>Grade 7</td>
<td>82</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Grade 8</td>
<td>77</td>
<td>31</td>
</tr>
<tr>
<td>Function**</td>
<td>LA</td>
<td>183</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td>LB</td>
<td>60</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>LC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>FTE</td>
<td>≤0,2</td>
<td>1</td>
<td>.4</td>
</tr>
<tr>
<td></td>
<td>&gt;0,2 and ≤0,5</td>
<td>39</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>&gt;0,5 and ≤0,8</td>
<td>68</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>&gt;0,8</td>
<td>134</td>
<td>55</td>
</tr>
<tr>
<td>Educational level</td>
<td>Master’s degree</td>
<td>49</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Bachelor’s degree</td>
<td>196</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>No master’s nor bachelor’s degree</td>
<td>4</td>
<td>2</td>
</tr>
</tbody>
</table>

Notes. *For Class level taught multiple answers were possible, because some teachers teach in more than one grade.

**Since no participant responded LC on the question about their function this item is interpreted as: ‘Does the participant have an LB function?’ With the answers 0=no; 1=yes.

One item of the scale, namely experienced social pressure, was negatively formulated: ‘Whether or not I work inquiry-based is completely up to me.’ After recoding, this item was eliminated from the scale due to a negative correlation with the other four items. The preliminary analysis showed that the scale reliability of experienced social pressure was relatively low (Cronbach’s alpha = .65), while the reliability of all other scales was good. Table 3.2 shows the number of items and the Cronbach’s alpha of each scale. It also includes a sample item per scale. The reliability scores demonstrate that these scales could be trusted for use in
the study’s further analyses.

Table 3.2. Overview of the survey instrument.

<table>
<thead>
<tr>
<th>Scale with example items</th>
<th>Number of items</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with an inquiry habit of mind</td>
<td>5</td>
<td>.70</td>
</tr>
<tr>
<td><em>In my work as a teacher I value deep understanding</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being data literate</td>
<td>6</td>
<td>.77</td>
</tr>
<tr>
<td><em>I am knowledgeable about statistical concepts</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contributing to a culture of inquiry at the school level</td>
<td>5</td>
<td>.82</td>
</tr>
<tr>
<td><em>My colleagues and I discuss about new teaching methods based on available research data</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creating a culture of inquiry at the classroom level</td>
<td>6</td>
<td>.74</td>
</tr>
<tr>
<td>- stimulating pupils’ inquiry habit of mind</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>I stimulate pupils to share knowledge with each other</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- stimulating pupils’ data literacy</td>
<td>6</td>
<td>.70</td>
</tr>
<tr>
<td><em>In certain exercises I let pupils keep a logbook</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude towards inquiry-based working</td>
<td>5</td>
<td>.89</td>
</tr>
<tr>
<td><em>I enjoy inquiry-based working</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experienced social pressure regarding inquiry-based working</td>
<td>5</td>
<td>.65</td>
</tr>
<tr>
<td><em>Most people whose opinion I value think I should work inquiry-based</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy regarding inquiry-based working</td>
<td>5</td>
<td>.87</td>
</tr>
<tr>
<td><em>I am confident I have the skills to work inquiry-based</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collective efficacy regarding inquiry-based working</td>
<td>5</td>
<td>.87</td>
</tr>
<tr>
<td><em>I am confident my team has the skills to work inquiry-based</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The text in italics is a sample item for the scale in question.

The background characteristics were measured with seven items. Gender was coded as: 0 = female, and 1 = male. To measure age, respondents chose between five categories: ≤20, 21-30, 31-40, 41-50, 51-60, and ≥61, and these categories were coded as 0, 1, 2, 3, 4, and 5, respectively. To measure the class level taught, teachers were asked to indicate whether they taught in grade 5, 6, 7, or 8. These grades were dummy coded (i.e., 0 = no, and 1 = yes). To measure function, respondents could answer: LA, LB, or LC, coded with 0, 1, and 2, respectively. These function levels coincide with the different salary scales of primary school teachers in the Netherlands. FTE was measured using the scale: ≤0.2, >0.2 and ≤0.5, >0.5 and ≤0.8, and >0.8, which were coded 0, 1, 2, and 3. Educational level was measured by asking whether teachers had a master’s degree, where 0 = no master’s degree, and 1 = master’s degree.
Statistical analysis

Because the sample of teachers that participated in the present study was collected by first selecting the schools employing them, observations from teachers within the same school could be dependent. However, statistical tests of the intraclass correlations showed that multilevel analysis was not required with the existing dataset (working with an inquiry habit of mind: F(60,180)= .88, p= .71; being data literate: F(60,183)= .93, p= .62; creating a culture of inquiry at the school level: F(60,181)= 1.10, p= .31; stimulating pupils’ inquiry habit of mind: F(60,186)= 1.02, p= .45; stimulating pupils’ data literacy: F(60,185)= 1.24, p= .14). Therefore, a standard regression analysis was performed utilizing the background characteristics as independent variables and the five aspects of inquiry-based working as dependent variables. Next, the relationships between the aspects of inquiry-based working and the four predictors from the hypothesis (attitude, experienced social pressure, self-efficacy regarding inquiry-based working, and collective efficacy regarding inquiry-based working) were explored. The possible effects of the significant background characteristics from the preceding analyses were taken into account.

Prior to the regression analyses, a confirmatory factor analysis was performed on the scales in the regression models to inspect their one-dimensionality. Because the items applied Likert scales, Sattora-Bentler corrected χ2 fit statistics were computed along with their associated robust comparative fit index (CFI) and root mean square error of approximation (RMSEA). Generally, models with a CFI at or above .97 are considered to have a good fit, and models with a CFI between .95 and .97 are considered to have an acceptable fit. RSMEA values at or below .05 indicate a good fit, while values between .05 and .08 indicate a satisfactory model fit. Since all scales mentioned in Section 4.3 had CFI scores above .95 and RMSEA scores below .08, it was concluded that all scales were one-dimensional.

Results

Descriptives

The descriptive statistics of the scales used (shown in Table 3.3) show that, on average, participants scored (moderately) positive on the aspects of inquiry-based working (scale means between 2.66 and 3.20 on a 4-point scale). For the four psychological factors, the mean scores
were between 2.69 and 3.19. Bearing in mind that the midpoint of the assessment scale was 2.5, the results indicated that respondents also scored (moderately) positive on the measured psychological factors.

Table 3.3. Descriptive results of used scales.

<table>
<thead>
<tr>
<th>Scale</th>
<th>n</th>
<th>m</th>
<th>sd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquiry-based working</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inquiry habit of mind</td>
<td>241</td>
<td>3.13</td>
<td>.46</td>
</tr>
<tr>
<td>Being data literate</td>
<td>244</td>
<td>3.20</td>
<td>.46</td>
</tr>
<tr>
<td>Culture of inquiry at the school level</td>
<td>242</td>
<td>2.77</td>
<td>.59</td>
</tr>
<tr>
<td>Culture of inquiry at the classroom level:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Stimulating pupils’ inquiry habit of mind</td>
<td>247</td>
<td>3.02</td>
<td>.45</td>
</tr>
<tr>
<td>- Stimulating pupils’ data literacy</td>
<td>246</td>
<td>2.66</td>
<td>.50</td>
</tr>
<tr>
<td>Psychological factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude towards inquiry-based working</td>
<td>247</td>
<td>3.19</td>
<td>.55</td>
</tr>
<tr>
<td>Experienced social pressure regarding inquiry-based working</td>
<td>242</td>
<td>2.99</td>
<td>.48</td>
</tr>
<tr>
<td>Self-efficacy regarding inquiry-based working</td>
<td>243</td>
<td>2.90</td>
<td>.60</td>
</tr>
<tr>
<td>Collective efficacy regarding inquiry-based working</td>
<td>248</td>
<td>2.69</td>
<td>.57</td>
</tr>
</tbody>
</table>

Notes. Answer categories: 1 = completely disagree; 2 = partly disagree; 3 = partly agree; 4 = fully agree. n = sample size, m = mean item scores, sd = standard deviation.

**Regression analysis**

Table 3.4 displays the regression coefficients (b) with their standard errors (s.e.). It also gives the p-values (p) for the regression analyses between the background characteristics and the five aspects of inquiry-based working.

The results show a significant relationship between teachers working in grade 7 and all aspects of inquiry-based working, except contributing to a culture of inquiry at the school level. The mean score of teachers working in grade 7 were higher on all aspects of inquiry-based working than the mean scores of teachers working in other grades. Furthermore, the results indicate a significant relationship between the two background characteristics of function and educational level and being data literate. Teachers with an LB function scored higher than teachers with an LA function, and teachers with a master’s degree scored higher than teachers without a master’s degree. The background variables of age, gender, and FTE had no significant
The relationship between psychological factors and inquiry-based working by primary school teachers relationship with any aspect of inquiry-based working by teachers.

Table 3.4. Regression analysis of inquiry-based working by teachers on background characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Working with an inquiry habit of mind</th>
<th>Being data literate</th>
<th>Contributing to a culture of inquiry at the school level</th>
<th>Creating a culture of inquiry at the classroom level by:</th>
<th>Stimulating pupils’ inquiry habit of mind</th>
<th>Stimulating pupils’ data literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b (s.e.)</td>
<td>p</td>
<td>b (s.e.)</td>
<td>b (s.e.)</td>
<td>b (s.e.)</td>
<td>p</td>
</tr>
<tr>
<td>Intercept</td>
<td>2.87 (.14)</td>
<td>.00</td>
<td>3.02 (.14)</td>
<td>2.69 (.19)</td>
<td>2.79 (.14)</td>
<td>.00</td>
</tr>
<tr>
<td>Age</td>
<td>.03 (.03)</td>
<td>-.03 (.03)</td>
<td>.20</td>
<td>.04 (.04)</td>
<td>.01 (.03)</td>
<td>.22</td>
</tr>
<tr>
<td>Gender</td>
<td>-.10 (.08)</td>
<td>.23</td>
<td>.78</td>
<td>.11 (.1)</td>
<td>.08 (.08)</td>
<td>1.01</td>
</tr>
<tr>
<td>Grade 5</td>
<td>-.08 (.07)</td>
<td>.24</td>
<td>.03 (.07)</td>
<td>.09 (.10)</td>
<td>.07 (.07)</td>
<td>.87</td>
</tr>
<tr>
<td>Grade 6</td>
<td>-.05 (.07)</td>
<td>.52</td>
<td>-.00 (.07)</td>
<td>-.15 (.09)</td>
<td>.05 (.07)</td>
<td>.51</td>
</tr>
<tr>
<td>Grade 7</td>
<td>.15 (.07)</td>
<td>.03</td>
<td>.13 (.06)</td>
<td>.09 (.09)</td>
<td>.13 (.07)</td>
<td>.04</td>
</tr>
<tr>
<td>Grade 8</td>
<td>-.02 (.07)</td>
<td>.74</td>
<td>.03 (.07)</td>
<td>-.05 (.09)</td>
<td>.12 (.07)</td>
<td>.09</td>
</tr>
<tr>
<td>Function</td>
<td>.13 (.07)</td>
<td>.08</td>
<td>.20 (.07)</td>
<td>.15 (.10)</td>
<td>.13 (.07)</td>
<td>.39</td>
</tr>
<tr>
<td>FTE</td>
<td>.06 (.05)</td>
<td>.16</td>
<td>.05 (.04)</td>
<td>.07 (.06)</td>
<td>.08 (.05)</td>
<td>1.06</td>
</tr>
<tr>
<td>Ed. level</td>
<td>.12 (.08)</td>
<td>.13</td>
<td>.23 (.08)</td>
<td>-.04 (.10)</td>
<td>.01 (.08)</td>
<td>.87</td>
</tr>
</tbody>
</table>

Note. Significant p-values (≤ .05) are reported in bold type.

Table 3.5 shows the correlations (r) and the p-values (p) between the measured psychological factors and inquiry-based working. There is a strong positive correlation between all independent and all dependent variables, suggesting quite a strong relationship between the measured psychological factors and inquiry-based working.

There are also strong, positive relationships between attitude, experienced social pressure, self-efficacy regarding inquiry-based working, and collective efficacy regarding inquiry-based working (ranging from r =.26 to r = 71, all with p <.001). This indicates that high scores on attitude, high scores on experienced social pressure, high scores on self-efficacy regarding inquiry-based leadership, and high scores on collective-efficacy regarding inquiry-based working are associated with each other.
Table 3.5. Correlations between inquiry-based working and psychological factors.

<table>
<thead>
<tr>
<th></th>
<th>Working with an inquiry habit of mind</th>
<th>Being data-literate</th>
<th>Contributing to a culture of inquiry at the school level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attitude</strong></td>
<td>.54 &lt;.001</td>
<td>.54 &lt;.001</td>
<td>.32 &lt;.001</td>
</tr>
<tr>
<td><strong>Experienced social pressure</strong></td>
<td>.54 &lt;.001</td>
<td>.56 &lt;.001</td>
<td>.47 &lt;.001</td>
</tr>
<tr>
<td><strong>Self-efficacy</strong></td>
<td>.61 &lt;.001</td>
<td>.67 &lt;.001</td>
<td>.47 &lt;.001</td>
</tr>
<tr>
<td><strong>Collective efficacy</strong></td>
<td>.27 &lt;.001</td>
<td>.31 &lt;.001</td>
<td>.55 &lt;.001</td>
</tr>
</tbody>
</table>

Creating a culture of inquiry at the classroom level by:

<table>
<thead>
<tr>
<th></th>
<th>Stimulating pupils’ inquiry habit of mind</th>
<th>Stimulating pupils’ literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attitude</strong></td>
<td>.35 &lt;.001</td>
<td>.32 &lt;.001</td>
</tr>
<tr>
<td><strong>Experienced social pressure</strong></td>
<td>.39 &lt;.001</td>
<td>.34 &lt;.001</td>
</tr>
<tr>
<td><strong>Self-efficacy</strong></td>
<td>.45 &lt;.001</td>
<td>.50 &lt;.001</td>
</tr>
<tr>
<td><strong>Collective efficacy</strong></td>
<td>.35 &lt;.001</td>
<td>.37 &lt;.001</td>
</tr>
</tbody>
</table>

Table 3.6 shows the results of the regression analyses of psychological factors on inquiry-based working. The significant background characteristics from the previous analyses were taken into account.

Self-efficacy regarding inquiry-based working appears to be significantly related to all five aspects of inquiry-based working. Collective efficacy regarding inquiry-based working is significantly related to contributing to a culture of inquiry at the school level and to both aspects of creating a culture of inquiry at the classroom level. Attitude and experienced social pressure are significantly related to working with an inquiry habit of mind. Furthermore, the results show a significant relationship between teachers working in grade 5 and stimulating pupils’ data literacy. Function appears to have a significant relationship with stimulating pupils’ inquiry habit of mind, while educational level and being data literate seem to be related to each other as well.
The relationship between psychological factors and inquiry-based working by primary school teachers

Table 3.6. Regression analysis of inquiry-based working by teachers on significant background characteristics and psychological factors.

<table>
<thead>
<tr>
<th></th>
<th>Working with an inquiry habit of mind</th>
<th>Being data literate</th>
<th>Contributing to a culture of inquiry at the school level</th>
<th>Creating a culture of inquiry at the classroom level by:</th>
<th>Stimulating pupils’ inquiry habit of mind</th>
<th>Stimulating pupils’ data literacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.34 (.17)</td>
<td>.00</td>
<td>.72 (.23)</td>
<td>.00</td>
<td>1.59 (.19)</td>
<td>.00</td>
</tr>
<tr>
<td>Grade 5</td>
<td>-.10 (.06)</td>
<td>.09</td>
<td>.80</td>
<td>.76</td>
<td>-.06 (.07)</td>
<td>.02</td>
</tr>
<tr>
<td>Grade 6</td>
<td>-.01 (.06)</td>
<td>.82</td>
<td>.60</td>
<td>.40</td>
<td>.09 (.06)</td>
<td>.15</td>
</tr>
<tr>
<td>Grade 7</td>
<td>.05 (.05)</td>
<td>.33</td>
<td>.31</td>
<td>-.01 (.07)</td>
<td>.07 (.06)</td>
<td>.27</td>
</tr>
<tr>
<td>Grade 8</td>
<td>-.07 (.06)</td>
<td>.23</td>
<td>.40</td>
<td>-.13 (.07)</td>
<td>.08 (.06)</td>
<td>.22</td>
</tr>
<tr>
<td>Function</td>
<td>.01 (.07)</td>
<td>.90</td>
<td>.03</td>
<td>.04 (.09)</td>
<td>.06 (.07)</td>
<td>.41</td>
</tr>
<tr>
<td>Ed. level</td>
<td>-.05 (.06)</td>
<td>.39</td>
<td>.68</td>
<td>.04 (.08)</td>
<td>-.18 (.07)</td>
<td>.01</td>
</tr>
<tr>
<td>Attitude</td>
<td>.17 (.07)</td>
<td>.01</td>
<td>.08</td>
<td>-.04 (.09)</td>
<td>.06 (.07)</td>
<td>.42</td>
</tr>
<tr>
<td>Soc. Pressure</td>
<td>.18 (.08)</td>
<td>.03</td>
<td>.10</td>
<td>.12 (.11)</td>
<td>.09 (.09)</td>
<td>.32</td>
</tr>
<tr>
<td>S-efficacy</td>
<td>.29 (.07)</td>
<td>.00</td>
<td>.00</td>
<td>.25 (.09)</td>
<td>.21 (.07)</td>
<td>.01</td>
</tr>
<tr>
<td>C-efficacy</td>
<td>-.03 (.06)</td>
<td>.54</td>
<td>.98</td>
<td>.42 (.08)</td>
<td>.14 (.06)</td>
<td>.02</td>
</tr>
</tbody>
</table>

Note: Significant p-values (≤ .05) are reported in bold type.

Discussion

Inquiry-based working is assumed to contribute to improving educational quality (Krüger 2010a). It is further expected to stimulate professional learning (Katz and Dack 2014). Earlier research has shown that psychological factors can contribute to explaining differences in the use of data between school leaders and between teachers (Ikemoto and Marsh 2007; Schildkamp and Kuiper 2010; Vanhoof et al. 2014). This study adopted a broad perspective of inquiry-based working and, in addition to a focus on data use, looked at aspects of inquiry-based working such as creating or contributing to a culture of inquiry. The study investigated relationships between inquiry-based working in this broad sense and psychological factors that are known to explain people’s behavior (based on Fishbein and Ajzen 2010).

Our research question was: how are the psychological factors attitude, social pressure, self-efficacy and collective efficacy related to inquiry-based working by primary school teachers in the Netherlands? Our first hypothesis was that teachers’ positive attitudes towards
inquiry-based working would make them work in an inquiry-based manner. Earlier research on school leaders has shown a relationship between attitude regarding data use and the actual use of data by school leaders (Ikemoto and Marsh 2007; Schildkamp and Kuiper 2010, Vanhoof et al. 2014). This study reveals that primary school teachers who had strong positive attitudes towards inquiry-based working also scored high on working with an inquiry habit of mind. However, this study did not establish a direct relationship between attitude and other aspects of inquiry-based working.

Based on earlier research (Earl and Katz 2006; Schildkamp, Lai, and Earl 2013), which made clear that teachers do not use data unless it is encouraged by the school leader, our second hypothesis stated that experienced social pressure would be related to inquiry-based working. This study indeed shows that teachers who strongly felt that others expected them to work in an inquiry-based manner also had a stronger inquiry habit of mind. However, experienced social pressure was not found to have a significant relationship with other aspects of inquiry-based working.

In line with research of Krüger and Geijsel (2011), our third hypothesis was that a high sense of self-efficacy towards inquiry-based working should allow teachers to work in a more inquiry-based way. According to our study results, self-efficacy regarding inquiry-based working is a factor that appears to be related to all aspects of inquiry-based working. Teachers with a strong sense of self-efficacy towards inquiry-based working also had a strong inquiry habit of mind, possessed high skills related to data literacy, strongly contributed to a culture of inquiry at the school level and strongly created a culture of inquiry in their classrooms. It seems that in order to work in an inquiry-based manner it is necessary for teachers to belief that they are able to successfully perform behaviour related to the different aspects of inquiry-based working. Teachers need to be convinced that they are capable of organizing and executing the actions required for inquiry-based working.

In addition, and in line with our fourth hypothesis, collective efficacy regarding inquiry-based working appears to be related to three aspects of working in a culture of inquiry: at the school level through collaboration with colleagues in a culture of inquiry and at the classroom level through stimulating pupils’ inquiry habit of mind and through stimulating pupils’ data literacy. Apparently, teachers’ beliefs about the ability of his or her team to work in an inquiry-based manner are relevant for contributing to a culture of inquiry on the school level and for creating a culture of inquiry in the classroom. As opposed to self-efficacy regarding inquiry-
The relationship between psychological factors and inquiry-based working by primary school teachers based working, there was no significant relationship between collective efficacy regarding inquiry-based working and working with an inquiry habit of mind.

We found support for all of our hypotheses in the strong positive correlation among the four predictors and between: (1) each psychological factor and (2) all aspects of inquiry-based working by teachers. It means that attitude, experienced social pressure, self-efficacy and collective efficacy are indeed related to all aspects of inquiry-based working. That said, some of the psychological factors have a unique significant relationship with aspects of inquiry-based working, while others are related through the other predictors.

Looking more closely at the differences and similarities between these psychological factors and their relation with the several aspects of inquiry-based working, the following stands out. It seems that a positive attitude and a high sense of social pressure are both needed for teachers to work with an inquiry habit of mind, whereas these two factors do not make them more data-literate, nor do they contribute to a culture of inquiry at either the school or the classroom level. These results might be interpreted as follows. Teachers who work with an inquiry habit of mind value deep understanding, read literature to gain knowledge, appreciate a thorough understanding and try to verify assumptions. All these aspects are, in one way or another, aimed at the person of the teacher him- or herself. A positive attitude and a high sense of social pressure turn out to affect working with an inquiry habit of mind. They do not necessarily affect one's data-literacy skills, because for the acquisition of such skills training is also needed. However, working with an inquiry habit of mind in itself does not necessarily lead to actual actions to promote an inquiry-based culture at school or classroom level. For this, self-efficacy and collective efficacy are also needed. So, it seems that a positive attitude and social pressure are important for working with an inquiry habit of mind, whereas for teachers to engage in activities at the school or classroom level, self-efficacy and collective-efficacy are needed. The psychological factor that stands out the most is self-efficacy. Self-efficacy has an impact on working with an inquiry habit of mind, on data-literacy, as well as on contributing to a culture of inquiry on school and classroom level. Findings from other research on the impact of self-efficacy on data use or on inquiry-based working confirm that belief in one’s capacities to work inquiry-based contributes to working in such a manner (e.g. Geijsel et al. 2009; Krüger and Geijsel 2011; Uiterwijk-Luijk et al. forthcoming; Vanhoof et al. 2014).

We explored how a number of background characteristics are related to inquiry-based working by primary school teachers in the Netherlands. This study revealed that there is a
relationship between the background characteristics class level taught, function, and educational level, and inquiry-based working by primary school teachers.

What stands out is that teachers who teach in grades 5 and 7 seemed to work in a more inquiry-based way than teachers who teach in grades 6 and 8. When looking solely at the background characteristics teachers in grade 7 seem to work in a more inquiry-based manner than teachers in other grades. However, in interaction with the measured psychological factors the effect of teaching in grade 7 disappeared and the effect of teaching in grade 5 emerged. Teachers in grade 5 seem to stimulate pupils’ data literacy more than teachers who teach in other grades. Perhaps teachers’ expectations of pupils’ inquiry habit of mind and data literacy depend on the grade they teach, or the teaching methods used by teachers differ per grade when looking at the way they stimulate pupils’ to work in an inquiry-based manner. Teachers working in grades 6, 7 and 8 might think pupils already possess skills like keeping a logbook or carrying out an interview. Further research is necessary to find out what causes these differences between teachers teaching in different grades and working in an inquiry-based manner.

In the Netherlands, teachers with function LB are supposed to have a higher educational background than teachers with function LA. In addition teachers with function LB are supposed to be (co-)responsible for school development. Therefore, one might expect function to be related to inquiry-based working. Consequently, it is remarkable that the study only found that teachers with function LB stimulated pupils’ inquiry habit of mind more, but they did not, for example, contribute more to a culture of inquiry than teachers with function LA.

Teachers with a master’s degree appeared to be more data literate than teachers without a master’s degree, but they did not stand out on any other aspect of inquiry-based working. Apparently, having a master’s degree means that a teacher acquired skills to conduct research, but this is not related to having an inquiry habit of mind, contributing to a culture of inquiry at the school level, or creating a culture of inquiry at the classroom level.

**Limitations**

Only a small number of the invited school boards participated in this study with their schools. It is possible that school boards and schools that agreed to participate were already more focused on inquiry-based working than were others. This is in line with the relative high scores regarding inquiry-based working that appear in this study’s descriptive results. However, since
The relationship between psychological factors and inquiry-based working by primary school teachers this study attempted to relate aspects of inquiry-based working to psychological factors, it could be regarded as an advantage that the teachers participating in this research were involved in inquiry-based working to a certain degree.

Another limitation concerns the fact that self-reports were utilized (see e.g. Schwartz 1999). Thus, the results reflect teachers’ own perceptions. The use of qualitative methods – such as observations of teachers’ actions – could overcome this limitation in future research and, thus, contribute to a deeper understanding of inquiry-based working by primary school teachers. The use of qualitative research such as interviews with teachers could also contribute to more data on how teachers understand inquiry-based working at both the school level and the classroom level.

The concept of being data literate was investigated with items such as, ‘I am knowledgeable about statistical concepts,’ and, ‘I am capable of interpreting research data.’ One could question the extent to which teachers should develop this capacity. Do we want all teachers to become scientific researchers and statisticians? Or, is it enough if teachers can interpret and act on pupil achievement data? These are challenging questions. One thing is clear: if we want teachers to be able to make informed decisions, they must at least be able to interpret and use data to some degree. And, if we want teachers to really engage in inquiry-based working, we should also take into account their capacity to work with an inquiry habit of mind and their capacity to create and contribute to an inquiry-based culture.

Conclusions

This study enriches our understanding of inquiry-based working by teachers. From a theoretical perspective, these findings offer new insights in how psychological factors are related to whether and how teachers work in an inquiry-based manner. Valuable conclusions can be drawn about self-efficacy and collective efficacy. Both psychological factors appear to be important for inquiry-based working by teachers. Teachers with a high sense of self-efficacy regarding inquiry-based working tend to be involved in all five aspects of inquiry-based working. Furthermore, teachers who experience a high sense of collective efficacy tend to engage in working in a culture of inquiry, both at the classroom and at the school level. A positive attitude and a strong sense of social pressure are valuable for working with an inquiry habit of mind.

From a practical perspective, these findings are relevant for school leaders who want to
encourage inquiry-based working of teachers in their schools and are applicable to the design of teacher training and professional development initiatives. Our findings confirm the conclusions of Vanhoof et al. (2014) that if we want to increase inquiry-based working by teachers, it is not enough to focus on using data and on providing knowledge and skills regarding data use. We also need to enhance their self-efficacy and collective efficacy, as well as their attitude. Social pressure also helps. Self-efficacy and collective efficacy can be enhanced by teachers collaborating in peer groups. School leaders and educators can, for example, give positive feedback and encourage collaboration among teachers. In order to promote a positive attitude and enact social pressure school leaders and educators can emphasize the value added by inquiry-based working and point out the benefits of it for educational quality.
CHAPTER 4

Teachers’ role in stimulating students’ inquiry habit of mind in primary schools

Abstract

Curiosity and critical thinking skills are essential for life in the twenty-first century. This mixed-method study examined the relationship between teachers’ inquiry-based work and students’ inquiry habit of mind. Teachers who work in an inquiry-based manner create a culture of inquiry in the classroom and contribute to a culture of inquiry at the school level. Students with an inquiry habit of mind are curious and have critical thinking habits. This study consisted of a survey, followed by a case study. Questionnaire data were collected from 1,104 students and 249 teachers at 31 primary schools. The case study was conducted in two primary schools. The survey data revealed a relationship between teachers’ inquiry-based work and students’ curiosity. However, no relationship was found between teachers’ inquiry-based approach and students’ critical thinking habits. The case study results illustrate how teachers’ inquiry-based working can be related to students’ curiosity and critical thinking habits.

3 This chapter is based on Uiterwijk-Luijk, L., Krüger, M., Zijlstra, B., & Volman, M. (submitted). Teachers’ role in stimulating students’ inquiry habit of mind in primary schools.
CHAPTER 4

Introduction

Nowadays, complex thinking and communication skills are in greater demand than more basic skills (Levy & Murnane, 2005; Saavedra & Opfer, 2012). This economic and social necessity encourages a greater appreciation of abilities such as creativity, problem solving, and collaboration. At the same time, children are exposed to an enormous amount of information from many sources, and not all of this information is always accurate (Mills, 2012). As early as 1999, Wells pointed out that young people need to develop an understanding and attitude that will help them become informed, critical, and responsible members of a changing world (Wells, 1999). To better reflect developments in today's society, he advocated for explorative and collaborative learning in schools. In that approach, classes and schools become communities of inquiry, in which real understanding is achieved via a collaborative problem-solving process. Today, twenty-first century skills are in demand worldwide. Learning through inquiry is becoming an increasingly essential aspect of educational practices. Effective communication, curiosity, and critical thinking skills are essential competencies and habits of mind for life in today’s world (e.g., Wagner, 2014).

Teachers play a crucial role in developing students’ critical inquiry skills (Dobber & Van Oers, 2015). Creating a culture of inquiry in the classroom means creating an environment in which students are driven by curiosity, ask questions, make discoveries, and test their findings in a search for new understandings (Al-Sabbagh, 2009; Chin, 2002). Creating a culture of inquiry in the classroom requires changes in teachers’ knowledge, skills, and attitudes. Researchers have suggested that engaging teachers themselves in a culture of inquiry can bring about these changes (Dobber & Van Oers, 2015; Wells, 2011). In such a culture, teachers systematically and intentionally investigate their own teaching as a means of quality improvement. Then, teachers can use the results of such research to enhance their teaching and learning (Ellis & Castle, 2010; Gallimore, Ermeling, Saunders, Goldenberg, 2009; Van der Linden, Bakx, Ros, Beijaard, & Vermeulen 2012). The research base on promoting students’ inquiry-habit of mind is expanding. Previous meta-analyses have indicated a connection between inquiry-based teaching and improved student learning (Furtak, Seidel, Iverson, & Briggs, 2012). To add to the knowledge in this area, this study investigated the relationship between teachers’ inquiry-based work and students’ inquiry habit of mind.
Teachers’ role in stimulating students’ inquiry habit of mind in primary schools

**Theoretical framework**

All over the world, twenty-first century skills have become a key topic on the agendas of educational policymakers (e.g., Binkley et al., 2012; Niemi & Multisilta, 2016). Although the literature has defined the term “twenty-first century skills” in a variety of ways, some commonalities exist. Most definitions focus on complex thinking, learning, and communication skills (Saavedra & Opfer, 2012) and also emphasize students’ capacity to learn throughout their lives (Niemi & Multisilta, 2016). Inquiry and knowledge-creation skills are the most crucial, and these are linked to analytical skills, critical thinking skills, and creativity (Niemi & Multisilta, 2016). A growing body of research has indicated that providing students with opportunities to explore authentic problems can substantially enhance their understanding (Levy, Thomas, Drago, & Rex, 2013). In this approach, students’ inquiries focus on finding answers and creating artifacts that are significant in their own lives (Dobber & Van Oers, 2015).

**Students’ inquiry habit of mind**

The concept “inquiry habit of mind” is strongly related to concepts such as “researcherly disposition” (Tack & Vanderlinde, 2014), “inquiry as stance” (Cochran-Smith, 2003), and “scientific research dispositions” (Van der Rijst, 2009). In their study on teacher educators, Tack and Vanderlinde (2014) defined a researcherly disposition as a triad of an inclination towards research (affective aspect), an ability to conduct research (cognitive aspect), and a sensitivity to research opportunities (behavioral aspect). Cochran-Smith (2003) who also focused on teacher educators, described “inquiry as stance” as a critical habit of mind; an intellectual perspective; and a way of questioning, understanding, and connecting one’s day-to-day work to other’s activities and larger contexts. It is “a process of continual and systematic inquiry wherein participants question their own and others’ assumptions and construct local as well as public knowledge appropriate to the changing contexts in which they work” (Cochran-Smith, 2003, p. 25). In his study of scientific inquiry among university students, Van der Rijst (2009) found six different scientific research dispositions. These are the inclination to: (1) know, (2) understand, (3) be critical, (4) achieve, (5) share, and (6) be innovative. Earl and Katz (2006) have referred to school leaders’ inquiry habit of mind as an ongoing process of seeking out and using evidence to make decisions. In other words, it refers to a habit of using inquiry and reflection to think about one’s current position, as well as the destination and the means of reaching it. An inquiry habit of mind also means rethinking and evaluating this process, making
adjustments as necessary (Earl & Katz, 2006). Moreover, Wells (1999) explained that an inquiry habit of mind entails being open to wondering and puzzlement, trying to construct and test explanations, and mastering information.

There does not appear to be a consistent definition of students’ inquiry habit of mind. All studies agree, however, that an inquiry habit of mind involves being both curious and critical. Both of these aspects are important components of a student’s inquiry habit of mind, and this study investigates them.

**Students’ curiosity**

Curiosity can be defined as a desire to know, see, or experience that motivates exploratory behavior directed towards the acquisition of new information (Litman, 2005). Curiosity can be aroused by what Jirout and Klahr (2012) called “uncertainty in the environment” on the basis of their review of children’s scientific curiosity, such as a sense of uncertainty regarding the existence of an item in a particular location.

Zion and Sadeh (2007) found that curious high-school students seek challenges and enjoy modifying their inquiries as they move through the inquiry process. Students’ curiosity increased when they obtained unexpected results. Furthermore, unanticipated outcomes can fuel student’s inquisitive passion.

The notion of a logical structure, with the inquiry questions at the core and the inquiry plan surrounding it, emphasizes the importance of questioning, logical thinking, and appreciating curiosity as triggers for formulating questions (Zion & Sadeh, 2007). Scardamalia and Bereiter (2010) pointed out that curiosity alone is not sufficient to motivate sustained inquiry.

Students’ critical thinking habits

Research has indicated that even young children can engage in critical thinking and that school environments can promote the growth of these critical capacities through discursive interactions.
and formal interventions (Murphy, Rowe, Ramani, & Silverman, 2014). Critical thinking has a diversity of definitions (Mulnix, 2012; Petress, 2004). For example, according to Scriven and Paul (2008), critical thinking refers to an intellectually disciplined process of conceptualizing, applying, analyzing, synthesizing, and/or evaluating information to guide beliefs and actions. According to their definition, critical thinking is both a skill and a habit of mind. This means critical thinking is not only a set of processing skills but also a habit of using those skills to guide behavior. In other words, as Mulnix (2012) explained:

This highlights the contrast between merely constructing a logical argument, which can be done in a mechanical way, and thinking critically, which requires careful application of the skills of sound reasoning to patterns of belief and a commitment to accept the results of that reasoning. (p.465)

This study did not focus on critical thinking as a skill. Rather, it emphasizes its role as a habit of mind, which we call critical thinking habits. This means that we do not interpret being critical as the practice of processing several scientific skills. Instead, we understand it as the attitude necessary for performing these skills. This attitude is based on universal intellectual values that transcend subject matter divisions, such as: clarity, accuracy, precision, consistency and relevance (Scriven & Paul, 2008). This conceptualization is in line with Van der Rijst (2009), whose research has demonstrated that critical thinking habits include having a critical attitude towards others (e.g., articles or colleagues) but also towards experimental observations. A self-critical attitude, or being critical of one’s own ideas and work, also fits within this category. Generally speaking, a critical thinking habit boils down to harboring sophisticated doubts, consistently double-checking results, and considering issues of accuracy. These kinds of reservations can initiate critical questions on all manner of topics.

**Teachers creating a culture of inquiry in the classroom**

According to Lipman (2003), a culture of inquiry in the classroom (what he referred to as a “classroom community of inquiry”) means that students are investigating problems and engaged in inquiry. Students collaborate together, build on ideas of others, challenge one another to supply reasons for opinions and assumptions, and draw conclusions as a group (Lipman, 2003). The concept of learning through inquiry can be applied across a diverse range of school subjects (Dobber & Van Oers, 2015; Levy et al., 2013; Wells, 1999). The purpose of inquiry is to guide students in constructing their own knowledge by helping to develop their curiosity (Zion & Sadeh, 2007).
A culture of inquiry in the classroom implies inquiry-based learning. Many studies have focused on the teacher’s role in inquiry-based learning. These studies have revealed that student-centered approaches are limited in their ability to boost student achievement. In contrast, combined student-centered and teacher-centered approaches can provide structured support (Baeten, Dochy, & Struyven, 2012; Brown & Campione, 1994; Furtak et al., 2012).

Jones and Eick (2007) described three forms of inquiry-based science teaching. The first one is open-ended. With that approach, teachers put aside planned instruction to explore students’ questions. The second form of inquiry-based teaching is project-based inquiry, in which teachers design projects for students on the basis of the questions driving classroom discussions. The third form is guided inquiry. This teacher-centered approach utilizes a curriculum revolving around fixed scientific concepts and lessons (Jones & Eick, 2007). These three forms create a continuum from open-ended inquiry to guided inquiry, and learners’ responsibilities vary along this scale. According to Olson and Loucks-Horsley (2000), students should have opportunities to participate in all types of inquiries. They pointed out that guided inquiry is the best fit for developing science concepts, while more open-ended approaches afford more appropriate opportunities for cognitive development and scientific reasoning. Brown and Campione (1995) highlighted that it is not easy for teachers to know when to intervene and when to leave students alone. To be successful, teachers must be sensitive and continually diagnose student understanding (Brown and Campione, 1995). This is a difficult task for teachers, as it is nearly impossible to follow a single, standardized protocol for all students. This impediment constitutes one of the key reasons that teachers face difficulties worldwide in implementing inquiry-based learning (Abrahams & Reiss, 2012; Flick, 2000; Osborne & Dillon, 2008).

Lazonder and Harmsen’s (2016) meta-analysis of 72 studies found that teacher guidance has a significant positive effect on: (a) performance success, or the quality of the products students create during inquiry; (b) learning activities, or the embedded assessment of students’ actions during inquiry; and (c) learning outcomes, which are assessed after the task by means of domain knowledge posttests. Regarding performance success, their overall conclusion was “that learners perform better during an inquiry (i.e., create better products to exhibit their domain knowledge) when supported by more specific forms of guidance” (Lazonder & Harmsen, 2016, p. 704). Their results suggested that less specific forms of guidance (like process constraints or status overviews) are useful for young learners with lower inquiry skills, while older, more experienced learners benefit from specific types of guidance, like scaffolds.
or explanations. Regarding *learning activities* and *learning outcomes*, less specific forms of guidance lead to comparable results as more specific forms (Lazonder & Harmsen, 2016).

Davis, Janssen, and Van Driel’s (2016) study on elementary and secondary teachers and science curriculum materials demonstrated that the extent to which lessons are inquiry-oriented is heavily influenced by how inquiry-oriented the curriculum materials are. In line with Earl and Katz (2006), this study understood creating a culture of inquiry in the classroom to mean stimulating students’ inquiry habit of mind, as well as their data literacy. Teachers’ level of guidance in stimulating students’ inquiry habit and students’ data literacy can vary from student-centered to teacher-centered approaches.

**Inquiry-based working by teachers at the school level**

Creating a culture of inquiry in the classroom is one thing, but contributing to an inquiry-driven school culture is a different matter. Teachers’ inquiry-based working involves both aspects. In an inquiry-driven school, teachers collaboratively and systematically investigate their own teaching and use internal data and external research results to improve their teaching and learning (Ellis & Castle, 2010; Gallimore et al., 2009; Krüger, 2010b; Van der Linden et al., 2012). To truly build knowledge in this type of culture, deep inquiry questions (i.e., *how* and *why*) are necessary, while shallower questions (i.e., *what* and *when*) are less important (Scardamalia and Bereiter, 2006). According to Earl and Katz (2006), school leaders must have an inquiry habit of mind, be data-literate, and create a culture of inquiry. Translating this to teachers and considering that they work at both the classroom level and the school level means that teachers working in an inquiry-based manner must: (1) have an inquiry habit of mind, (2) be data-literate, (3) contribute to a culture of inquiry at the school level, and (4) create a culture of inquiry at the classroom level.

A teacher’s inquiry habit of mind has similarities with a student’s inquiry habit of mind. In their study on teachers’ inquiry habit of mind (or inquiry-based attitude, as they called it), Meijer, Geijsel, Kuijpers, Boei, and Vrielings (2016) found an internal reflective dimension and an external knowledge-sourcing dimension. This means teachers with an inquiry habit of mind critically reflect on their teaching and are curious about the evidence on which they base their decisions. In addition, Earl and Katz (2006) underscored that an inquiry habit of mind involves valuing deep understanding, reserving judgment, obtaining a range of perspectives, and systematically posing increasingly focused questions.
For teachers, data literacy refers to knowledge regarding measurement and statistical concepts. Data-literate teachers think about purposes, recognize different types and quality of data, prioritize the interpretation of data, and report to others (Earl & Katz, 2006). They can transform data into information, information into knowledge, and knowledge into action (Marsh & Farrell, 2014). Data is often narrowly defined as quantitative, standardized assessment data. Data literacy, however, also requires knowledge about other data, such as data about perceptions, motivations, processes, and behaviors (Mandinach & Gummer, 2013).

Contributing to a culture of inquiry at the school level means that teachers must collaborate in making sense of all sorts of data, engage in joint action planning, and share instructional strategies (Datnow, Park, & Kennedy-Lewis, 2013). Wanting to share is what Van der Rijst et al. (2008) called “an inclination to share.” This means being open to others, wanting to interact, and desiring to work cooperatively. While collaborating, teachers are influenced through their interactions and negotiations with others (Coburn & Turner, 2011). These others are not necessarily only colleagues, the term can also refer to external researchers (Van der Linden et al., 2012; Schenke, Van Driel, Geijsel, & Volman, 2016) or trained peer facilitators (Gallimore et al., 2009). This cooperative use of internal and external data is a type of professional learning that enhances new understandings. These new interpretations can stimulate improved practices, which can, in turn, influence student learning (Katz & Dack, 2014). In addition, they can change teachers’ attributions from external causes to their own teaching (Gallimore, 2009).

Psychological factors related to inquiry-based working

Earlier research has revealed that teachers’ inquiry-based working is strongly related to psychological factors, such as: (1) teachers’ attitude towards inquiry-based working, (2) teachers’ experienced social pressure to work in an inquiry-based manner, (3) teachers’ self-efficacy regarding inquiry-based working, and (4) teachers’ collective efficacy regarding inquiry-based working (Uiterwijk-Luijk, Krüger, Zijlstra, & Volman, 2017; Geijsel, Sleegers, Stoel, & Krüger, 2009). A teacher’s attitude towards inquiry-based working can be defined as his or her tendency to respond with some degree of (dis)favor towards inquiry-based working (based on Fishbein & Ajzen, 2010). Experienced social pressure to work in an inquiry-based manner refers to the belief that others want us to work in this specific manner and are already doing so themselves (based on Fishbein & Ajzen, 2010). Self-efficacy regarding inquiry-based working refers to believing that one is capable of successfully working in an inquiry-based
manner (based on Bandura, 1997). Finally, collective efficacy regarding inquiry-based working involves a teacher’s beliefs about the ability of his or her team to take an inquiry-based approach to working. Uiterwijk-Luijk et al. (2017) found that teachers’ sense of self-efficacy regarding inquiry-based working is related to all aspects of that approach, namely, working with an inquiry habit of mind, being data literate, creating a culture of inquiry in the classroom, and contributing to a culture of inquiry at the school level. In addition, teachers with a high sense of collective efficacy tend to engage in a culture of inquiry, at both the classroom level and the school level. Finally, a positive attitude towards inquiry-based working and a strong sense of social pressure to work in such a way appear to be valuable for teachers working with an inquiry habit of mind. Therefore, when studying teachers’ inquiry-based work, investigating these related psychological factors is also important.

The present study

Previous meta-analyses have indicated a connection between inquiry-based teaching and improved student learning (Furtak et al., 2012). However, little is known yet about whether teachers’ inquiry-based working also leads to an inquiry habit of mind in children. The present study is part of a larger study on school boards, school leaders, teachers, and students’ inquiry-based working (see also Uiterwijk-Luijk et al., 2017; Uiterwijk-Luijk, Krüger, Zijlstra, & Volman, accepted). In the present study, a survey investigated how teachers’ inquiry-based working is related to students’ inquiry habit of mind. In this study, students’ inquiry habit of mind includes curiosity (wanting to seek out new knowledge) and critical thinking habits (being critical of one’s self and others). Inquiry-based working by teachers includes: (1) working with an inquiry habit of mind, (2) being data literate, (3) contributing to a culture of inquiry at the school level, and (4) creating a culture of inquiry at the classroom level by stimulating students’ inquiry habit of mind and data literacy. As research has demonstrated that teachers’ attitude towards inquiry-based working, experienced social pressure to work in an inquiry-based manner, self-efficacy regarding inquiry-based working, and collective efficacy regarding inquiry-based working are all related to their actual inquiry-based work (Uiterwijk-Luijk et al., 2017), we also included these variables in the current study.

Since the role of the teacher appears to play a crucial role in helping students develop critical inquiry skills (Dobber & Van Oers, 2015), we hypothesized that the more teachers work in an inquiry-based manner, the stronger their students’ inquiry habit of mind would be. In addition, we hypothesized that a positive attitude towards inquiry-based working, a strong sense
of experienced social pressure regarding that approach, and a high degree of both self-efficacy and collective efficacy concerning inquiry-based working would correlate with high scores on students’ inquiry habit of mind. To provide a more in-depth understanding of teachers’ experiences with inquiry-based working and students’ perceptions of their inquiry habit of mind, a case study was conducted in two different schools.

The Dutch education system

The Dutch education system consists of 8 years of primary education, which is intended for children between the ages of 4 and 12 years old. In primary education, a large segment of schools are government-funded private institutions, most of which are based on religious principles (Scheerens, 2016). The Netherlands does not have a national curriculum. This means that curricula are shaped in a variety of ways, which can influence the extent to which teachers work in an inquiry-based manner. Nevertheless, at the central level, quality standards apply to all schools. These list the subjects to be studied, attainment targets, the number of teaching hours per year, teacher qualifications requirements, etc. However, these standards leave schools with a significant amount of freedom in terms of how to apply them. The national inspectorate is tasked with maintaining educational quality.

Method

Participants and procedures

An explanatory sequential mixed methods approach (Creswell, 2014) was used, involving a two phase project. The first phase, which utilized a survey, gathered and analyzed quantitative data. The survey’s purpose was to investigate the relationship between the different aspects of teachers’ inquiry-based working and students’ inquiry habit of mind. The case study’s objective was to help explain the survey responses, explore and understand teachers’ perceptions, and provide a more complete picture of students’ inquiry habit of mind.

We invited all 1,046 primary school boards in the Netherlands to participate with their schools in the first phase of the study. Invitations were sent by mail, social media was used to draw attention to this study, and we used our networks to extend more personal invitations to school boards. In total, 33 school boards (3.2%) responded positively. This low response rate was expected due to research fatigue in Dutch schools. After the school boards granted their permission, we sent a web-based survey to the school boards, school leaders, teachers, and
students. For this part of the study, we received responses from 1,104 students (at 31 schools) and 249 teachers from grade 5 through grade 8 (at 61 schools).

The 1,104 students were spread quite evenly across grade 5 (24%), grade 6 (25%), grade 7 (30%), and grade 8 (22%), with slightly more students in grade 7. Of student respondents, 50.5% were male, and 49.5% were female. The teachers often indicated that they worked with more than one grade. In particular, 29% reported teaching in grade 5, while 30% taught in grade 6, 35% taught in grade 7, and 35% taught in grade 8. Of the responding teachers, 70% were female, thus slightly diverging from national figures. In the Netherlands, 78% of teachers are female (Ministry of Education, 2013).

In phase two, the case study, we selected two schools: one with relatively high scores on inquiry-based working and one with average scores in that area. In order to gain a deeper understanding of teachers’ perceptions regarding inquiry-based working and students’ inquiry habit of mind, we collected data on different manifestations of inquiry-based working in everyday school practice. To select the schools for the case study, we examined teachers and school leaders’ scores on inquiry-based working and then contacted the selected schools by phone. If a school did not want to be involved in the study, we contacted another school with approximately equal scores. The case study was conducted in the following schools: Queen Beatrix Primary School and Mosaic Primary School. To maintain anonymity, all names used in this study are pseudonyms.

To explore teachers’ perceptions and provide a more complete picture of students’ inquiry habit of mind, we conducted individual interviews with four teachers at each school (one teacher from each grade; four interviews per school; total N=8 teachers). We also held four group interviews at each school, each with four or five students (one group of students from each grade; four group interviews per school; total N=34 students). In addition, classroom observations were conducted. At Queen Beatrix Primary School students from grades 5 and 6 work together in one unit, and students from grade 7 and 8 work together in one unit. Two classroom observations were conducted at this school, one in each unit. At Mosaic Primary School, grade 5, 6, 7 and 8 were observed (total N=6 classroom observations). Teachers were asked to act as normally as possible so that we could view regular classroom activities. Individual interviews were approximately 45 to 60 minutes in length, while the group interviews with students were approximately 15 to 25 minutes long. Classroom observations took between 30 and 45 minutes and were videotaped.
Queen Beatrix Primary School is located in a small town in the Netherlands. Instead of working in grades, students and teachers work in units. Each unit has a large educational area with theme corners, quiet areas, and workplaces. Each unit contains a number of basic groups, composed of mixed grades and a classroom teacher. Teachers design the curriculum around certain themes, in which different subjects are explored. Students work with a development portfolio, in which they write down their targets, results, and reflections on each theme or subject. Mosaic Primary School is located in a large city in the Netherlands. It is situated in a so-called “impulse area,” which means it is in a zone with low incomes and a high unemployment rate. Therefore, Mosaic receives additional funds to reduce students’ educational disadvantages. The school uses regular year groupings from grade 1 through grade 8, and each class has its own teacher(s).

**Instruments**

**Phase 1 Survey**

**Student questionnaire**

We developed a questionnaire to investigate the degree to which students in grades 5 to 8 at Dutch primary schools (approximately 8 to 12 years old) have an inquiry habit of mind. Since there were no existing scales available for this measure, we designed all items specifically for this study.

The questionnaire contained 28 items divided across two instruments, one of which measured students’ curiosity and the other of which measured their critical nature. We interpreted curiosity and critical thinking habits both as positive twenty-first century skills, as the below examples underscore. Both instruments contained 8 propositions and 6 vignettes. The propositions utilized a 4-point response scale: completely disagree, somewhat disagree, somewhat agree, and completely agree. Table 4.1 depicts a sample proposition for each instrument. For the vignettes, students were asked to pick the answer that best matched their opinion. Each vignette had four answers, two of which represented an inquiry habit of mind and two of which did not. An example vignette from the instrument measuring curiosity is: “During math, you learned new complex sums. These sums can be calculated in a number of ways. What do you do?” Answers: “a. I would want to hear all the different ways, so I could choose the best one; b. I would be glad if I could figure out one method, and that would be enough for me; c. I would rather find out on my own whether there are other ways of calculating...”

**Teacher questionnaire**

The questionnaire for teachers consisted of 49 items rated on a 4-point Likert scale: completely disagree, somewhat disagree, somewhat agree, and completely agree. The instruments for measuring whether teachers worked with an inquiry habit of mind, were data-literate, and contributed to a culture of inquiry at the school level were based on Krüger’s (2010a) existing instruments. All scales were constructed by averaging the item scores (for the construction of the scales, see Uiterwijk-Luijk et al., 2017). As mentioned above, the present study used the mean scores per school. This means the study could draw conclusions about the schools but not about individual teachers. For this aggregate data, we deleted one item from the...
these complex sums; d. I would listen to other solutions but stick to my own method of calculating.” In this example, answers a and c represent curiosity, whereas answers b and d do not. An example vignette from the instrument measuring critical thinking habits is: “You have to do a presentation about sharks. You found someone else’s presentation about sharks on the Internet. What do you do?” Answers: “a. I would change a few words and use this presentation; b. I do not like that, and I would rather find things out by myself; c. I would look at other Internet sites to see if I come across something like it and then I would take the best things; d. I would copy this presentation and be glad that I finished it quickly.” In this example, answers b and c represent critical thinking habits, whereas answers a and d do not.

Table 4.1 provides the number of items and the Cronbach’s alpha for each scale. The reliability scores demonstrate that these scales could be trusted for use in further analyses.

Table 4.1. Reliability of the student questionnaire at the school level

<table>
<thead>
<tr>
<th>Scale</th>
<th>Number of items</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curiosity</td>
<td>14</td>
<td>.71</td>
</tr>
<tr>
<td>Critical thinking habits</td>
<td>14</td>
<td>.66</td>
</tr>
</tbody>
</table>

Notes: The text in italics is a sample proposition for each scale. “R” indicates that the item scores were reversed coded.

Teacher questionnaire

The questionnaire for teachers consisted of 49 items rated on a 4-point Likert scale: completely disagree, somewhat disagree, somewhat agree, and completely agree. The instruments for measuring whether teachers worked with an inquiry habit of mind, were data-literate, and contributed to a culture of inquiry at the school level were based on Krüger’s (2010a) existing instruments. All scales were constructed by averaging the item scores (for the construction of the scales, see Uiterwijk-Luijk et al., 2017). As mentioned above, the present study used the mean scores per school. This means the study could draw conclusions about the schools but not about individual teachers. For this aggregate data, we deleted one item from the
scale measuring teachers’ inquiry habit of mind (“I read literature to gain knowledge for my work”) and one item of the scale measuring whether teachers stimulated the students’ inquiry habit of mind (“I let students evaluate each other on the basis of assessment forms”), which resulted in higher Cronbach’s alphas for the scales. Table 4.2 provides the number of items, the Cronbach’s alpha, and a sample item for each scale. The preliminary analysis demonstrated that the reliability of the scales for working with an inquiry habit of mind and experienced social pressure were relatively low (Cronbach’s alpha = .62 and .61). In contrast, the reliability of all other scales was higher.

Table 4.2. Reliability of the teacher questionnaire at the school level

<table>
<thead>
<tr>
<th>Scale</th>
<th>Number of items</th>
<th>Cronbach’s alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with an inquiry habit of mind</td>
<td></td>
<td>.62</td>
</tr>
<tr>
<td><em>In my work as a teacher, I value deep understanding.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Being data-literate</td>
<td>6</td>
<td>.69</td>
</tr>
<tr>
<td><em>I am knowledgeable about statistical concepts.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contributing to a culture of inquiry at the school level</td>
<td>5</td>
<td>.88</td>
</tr>
<tr>
<td><em>My colleagues and I discuss new teaching methods based on the available research data.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creating a culture of inquiry at the classroom level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Stimulating students’ inquiry habit of mind</td>
<td>5</td>
<td>.73</td>
</tr>
<tr>
<td><em>I encourage students to share knowledge with each other.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Stimulating students’ data literacy</td>
<td>6</td>
<td>.74</td>
</tr>
<tr>
<td><em>In certain exercises, I let students keep a research log.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude towards inquiry-based working</td>
<td>5</td>
<td>.93</td>
</tr>
<tr>
<td><em>I enjoy inquiry-based working.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experienced social pressure regarding inquiry-based working</td>
<td>5</td>
<td>.61</td>
</tr>
<tr>
<td><em>Most people whose opinion I value think I should work in an inquiry-based manner.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy regarding inquiry-based working</td>
<td>5</td>
<td>.93</td>
</tr>
<tr>
<td><em>I am confident that I have the skills to work in an inquiry-based manner.</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collective efficacy regarding inquiry-based working</td>
<td>5</td>
<td>.93</td>
</tr>
<tr>
<td><em>I am confident that my team has the skills to work in an inquiry-based manner.</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. The text in italics is a sample item for each scale.
Phases Case study

Semi-structured interview schedules were used for the individual and group interviews, and these were based on the questionnaire items. When the mean questionnaire score from a particular school indicated either partial or complete agreement with a certain item on inquiry-based working, participants from that school were asked to give examples of that item. Students were observed in terms of their inquiry habit of mind, while the teacher observations focused on whether they created a culture of inquiry in the classroom.

Analysis

Theoretically, one would expect a mediation model with teachers’ psychological factors as the independent variables, teachers’ inquiry-based working as the mediator variable, and students’ inquiry habit of mind as the dependent variable. However, after using Baron and Kenny’s (1986) steps for mediation, it appeared that the statistical power was too low for this type of analysis.

We aggregated both the teacher data and the student data at the school level. As mentioned above, we used the mean scores. There was no straightforward link between teachers and students, because some teachers taught in more than one class, while some students had more than one teacher.

Next, we calculated the correlations between both the five aspects of teachers’ inquiry-based working and teachers’ psychological factors, and students’ inquiry habit of mind. Pearson product-moment correlation coefficients were also computed. We deemed results to be statistically significant when their p-values were at or beneath .05.

One-sample t-tests were conducted to determine whether a statistically significant difference existed between the questionnaires’ total mean scores and: (1) students’ curiosity and critical thinking habits at the case study schools, (2) teachers’ inquiry-based working and related psychological factors at the case study schools, and (3) school leaders’ inquiry-based working at the case study schools.

We transcribed and coded all of the interview data according to a coding scheme using MAXQDA. To analyze the data from the 8 teacher interviews, we began by utilizing deductive coding, with a coding scheme based on the theoretical framework. However, we permitted other codes to emerge from the data (inductive coding). To create the coding scheme, two researchers independently created categories and codes based on a random set of 4 teacher interview
transcripts. Disagreements were settled through discussion, and the meanings of codes were carefully adjusted. Once the categories and codes had been clearly defined, both researchers then labeled the remaining 4 transcripts on their basis. Random sampling was used to check for similarities and differences, and discussions settled any inconsistencies. Following coding, 6 categories emerged, and these were subdivided into 29 codes on teachers’ inquiry-based working. In the results section, Table 4.7 provides an overview of these categories and codes.

On the basis of the theory outlined above, the data gathered from the student interviews was coded into two categories: curiosity and critical thinking habits (both aspects of students’ inquiry habit of mind). To analyze the interview data, two researchers used the same strategy to analyze the data from the teacher interviews.

Once the coding scheme had identified trends in teachers’ creation of a culture of inquiry in the classroom and students’ inquiry habit of mind, these guided the analysis of the data from the observations. Specifically, we evaluated whether the observations reinforced or contradicted these trends. The data from the observations indicated whether classroom practices supported our interview results. We used the coding scheme to find examples of students working (or not working) with an inquiry habit of mind and teachers creating (or not creating) a culture of inquiry in the classroom. Relevant quotations were selected and interwoven with the findings.

**Results**

**Descriptive statistics**

The instruments measuring students’ curiosity and students’ critical thinking habits both contained two types of questions. Specifically, each had 8 propositions and 6 vignettes. Each type of question had two different answer categories. Whereas the propositions utilized a 4-point Likert scale (1, 2, 3, and 4), the vignettes had 4 answers, two of which represented an inquiry habit of mind and two of which did not (0 or 1). Therefore, we used the mean of the sum scores in our descriptive results (see Table 4.3). As Table 4.3 demonstrates, the mean sum score of all schools on curiosity was 27.24, while the mean sum score of all schools on critical thinking habits was 24.77.

Table 4.4 provides descriptive statistics for the scales used to measure teachers and school leaders’ opinions at the school level. Since the respondents filled out the questionnaire on their own, all scores reflect teachers and school leaders’ perceptions, aggregated at the school
All scales were constructed by first averaging the item scores and then averaging these scores at the school level. The mean scores for the scales fell between 2.70 and 3.39, as the “total scores” column in Table 4.4 makes clear. Bearing in mind that the midpoint of each scale was 2.5, the results indicated that at the school level, teachers and school leaders had (moderately) positive scores on the scales measuring inquiry-based working.

Table 4.3. Descriptive results of used scales of students at the school level

<table>
<thead>
<tr>
<th>Scale</th>
<th>n</th>
<th>total mean</th>
<th>sd</th>
<th>Min</th>
<th>Max</th>
<th>mean sum Mosaic</th>
<th>mean sum Beatrix</th>
</tr>
</thead>
<tbody>
<tr>
<td>Being curious</td>
<td>31</td>
<td>27.19</td>
<td>1.73</td>
<td>23.99</td>
<td>33.00</td>
<td>26.17</td>
<td>27.39</td>
</tr>
<tr>
<td>Being critical</td>
<td>31</td>
<td>24.76</td>
<td>1.73</td>
<td>20.00</td>
<td>28.33</td>
<td>25.06</td>
<td>23.74</td>
</tr>
</tbody>
</table>

Notes. n = sample size, sd = standard deviation, Min = minimum score, Max = maximum score.

Table 4.4. Descriptive statistics at the school level of used scales of teachers from all schools and from the two schools selected for the case study

<table>
<thead>
<tr>
<th>School leaders (n=58 schools)</th>
<th>Inquiry habit of mind</th>
<th>Data literacy</th>
<th>Creating a culture of inquiry by:</th>
<th>Total scores (all schools)</th>
<th>Scores case study schools</th>
<th>Beatrix</th>
<th>Mosaic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m (sd)</td>
<td>t (df)</td>
<td>m</td>
<td>p</td>
<td>t (df)</td>
<td>m</td>
<td>p</td>
</tr>
<tr>
<td>Teachers</td>
<td>3.36 (.39)</td>
<td>-.24 (54)</td>
<td>3.40</td>
<td>.81</td>
<td>4.15 (54)</td>
<td>3.20</td>
<td>.00</td>
</tr>
<tr>
<td></td>
<td>3.18 (.49)</td>
<td>-5.00 (57)</td>
<td>3.50</td>
<td>.00</td>
<td>-2.36 (57)</td>
<td>3.33</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>3.33 (.41)</td>
<td>-.05 (55)</td>
<td>3.33</td>
<td>.96</td>
<td>.87 (55)</td>
<td>3.28</td>
<td>.39</td>
</tr>
<tr>
<td></td>
<td>3.10 (.55)</td>
<td>-9.60 (56)</td>
<td>3.80</td>
<td>.00</td>
<td>-4.40 (56)</td>
<td>3.13</td>
<td>.66</td>
</tr>
<tr>
<td>Teachers</td>
<td>3.16 (.29)</td>
<td>-9.14 (60)</td>
<td>3.50</td>
<td>.00</td>
<td>1.16 (60)</td>
<td>3.12</td>
<td>.25</td>
</tr>
<tr>
<td></td>
<td>3.24 (.30)</td>
<td>-8.80 (60)</td>
<td>3.58</td>
<td>.00</td>
<td>-1.55 (60)</td>
<td>3.30</td>
<td>.13</td>
</tr>
</tbody>
</table>

Notes. Answer categories: 1 = completely disagree; 2 = partly disagree; 3 = partly agree; 4 = fully agree. n = sample size, m = mean item scores, sd = standard deviation. Significant p-values (≤ .05) are reported in bold type.
Correlations

Table 4.5 provides the correlations (r) at the school level between elements of teachers’ inquiry-based working and students’ inquiry habit of mind, and it also contains the p-values (p). As Table 4.5 demonstrates, there was a significant relationship at the school level between students’ curiosity and both teachers working with an inquiry habit of mind and teachers stimulating students’ data literacy. In terms of teachers’ psychological factors, in line with our hypothesis, there appeared to be a strong significant relationship between several of teachers’ psychological factors and students’ curiosity. Teachers’ attitude towards inquiry-based working, their self-efficacy regarding inquiry-based working, and their collective efficacy regarding inquiry-based working were all strongly related to students’ curiosity. However, none of these teacher variables were significantly related to students’ critical thinking habits.

Table 4.5. Correlations at the school level between teachers’ aspects regarding inquiry-based working and students’ inquiry habit of mind

<table>
<thead>
<tr>
<th>Teachers’ aspects regarding inquiry-based working</th>
<th>Students’ inquiry habit of mind</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Students’ curiosity</td>
<td></td>
<td>Students’ critical thinking habits</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>r</td>
<td>p</td>
<td>r</td>
<td>p</td>
<td></td>
</tr>
<tr>
<td>Working with an inquiry habit of mind</td>
<td>.38</td>
<td>.04</td>
<td>-.16</td>
<td>.41</td>
<td></td>
</tr>
<tr>
<td>Being data literate</td>
<td>.30</td>
<td>.10</td>
<td>-.03</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>Stimulating students’ inquiry-habit of mind</td>
<td>.34</td>
<td>.07</td>
<td>-.22</td>
<td>.25</td>
<td></td>
</tr>
<tr>
<td>Stimulating students’ data literacy</td>
<td>.61</td>
<td>.00</td>
<td>-.29</td>
<td>.13</td>
<td></td>
</tr>
<tr>
<td>Contributing to a culture of inquiry at the school level</td>
<td>.35</td>
<td>.06</td>
<td>.08</td>
<td>.68</td>
<td></td>
</tr>
<tr>
<td>Attitude towards inquiry-based working</td>
<td>.46</td>
<td>.01</td>
<td>-.15</td>
<td>.42</td>
<td></td>
</tr>
<tr>
<td>Experienced social pressure regarding inquiry-based working</td>
<td>.07</td>
<td>.72</td>
<td>.14</td>
<td>.45</td>
<td></td>
</tr>
<tr>
<td>Self-efficacy regarding inquiry-based working</td>
<td>.52</td>
<td>.00</td>
<td>-.20</td>
<td>.30</td>
<td></td>
</tr>
<tr>
<td>Collective efficacy regarding inquiry-based working</td>
<td>.42</td>
<td>.02</td>
<td>-.09</td>
<td>.63</td>
<td></td>
</tr>
</tbody>
</table>

Notes: n=30 schools. Significant p-values (≤ .05) are reported in bold type.
Correlations

Table 4.5 provides the correlations ($r$) at the school level between elements of teachers' inquiry-based working and students' inquiry habit of mind, and it also contains the $p$-values ($p$). As Table 4.5 demonstrates, there was a significant relationship at the school level between students' curiosity and both teachers working with an inquiry habit of mind and teachers stimulating students' data literacy. In terms of teachers' psychological factors, in line with our hypothesis, there appeared to be a strong significant relationship between several of teachers' psychological factors and students' curiosity. Teachers' attitude towards inquiry-based working, their self-efficacy regarding inquiry-based working, and their collective efficacy regarding inquiry-based working were all strongly related to students' curiosity. However, none of these teacher variables were significantly related to students' critical thinking habits.

Table 4.5. Correlations at the school level between teachers' aspects regarding inquiry-based working and students' inquiry habit of mind

<table>
<thead>
<tr>
<th>Students' inquiry habit of mind</th>
<th>Curiosity</th>
<th>Critical thinking habits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Working with an inquiry habit of mind</td>
<td>$.38</td>
<td>$.16</td>
</tr>
<tr>
<td>Being data literate</td>
<td>$.30</td>
<td>$.03</td>
</tr>
<tr>
<td>Stimulating students' inquiry habit of mind</td>
<td>$.34</td>
<td>$.22</td>
</tr>
<tr>
<td>Stimulating students' data literacy</td>
<td>$.61</td>
<td>$.29</td>
</tr>
<tr>
<td>Contributing to a culture of inquiry at the school level</td>
<td>$.35</td>
<td>$.08</td>
</tr>
<tr>
<td>Attitude towards inquiry-based working</td>
<td>$.46</td>
<td>$.15</td>
</tr>
<tr>
<td>Experienced social pressure regarding inquiry-based working</td>
<td>$.07</td>
<td>$.14</td>
</tr>
<tr>
<td>Self-efficacy regarding inquiry-based working</td>
<td>$.52</td>
<td>$.20</td>
</tr>
<tr>
<td>Collective efficacy regarding inquiry-based working</td>
<td>$.42</td>
<td>$.09</td>
</tr>
</tbody>
</table>

Notes: $n=30$ schools. Significant $p$-values ($\leq .05$) are reported in bold type.

Queen Beatrix Primary School and Mosaic Primary School

Students at Queen Beatrix Primary School and Mosaic Primary School

One-sample t-tests indicated that students at Queen Beatrix scored close to the mean sum score on curiosity ($t (30) = -.67, m = 27.39, p = .51$) and below the mean sum score on critical thinking habits ($t (30) = 3.42, m = 23.74, p = .00$). The scores for students at Mosaic demonstrated the opposite trend. Their scores on curiosity were below the mean sum score on that variable ($t (30) = 3.43, m = 26.17, p = .00$), while they were close to the mean sum score on critical thinking habits ($t (30) = -1.01, m = 25.06, p = .32$) (see Table 4.3).

In the case study, students were asked during the group interviews if they thought of themselves as curious and critical thinkers. When the students interpreted these traits as negative habits, we also utilized supplementary and more indirect questions. The answers indicated a difference between both schools regarding students' curiosity and critical thinking habits. Students at Queen Beatrix gave many examples of being curious and critical, while students at Mosaic provided few illustrations of either trait. Regarding curiosity, students from Queen Beatrix Primary School gave examples, such as the following:

*I am curious whenever I see, do, or hear something. I always just want to know things.* (Nick, student at Queen Beatrix Primary School)
*I always talk a lot with other people, because I am curious about their opinions.* (Ben, student at Queen Beatrix Primary School)
*I am always curious about other countries and other cultures and that kind of stuff.* (Indy, student at Queen Beatrix Primary School)

One student at Mosaic mentioned his curiosity during history lessons about events that happened in the past. Three others mentioned looking up unknown words on the Internet or in a dictionary as an example of being curious.

Students from Queen Beatrix also offered many examples illustrating their critical thinking skills. These especially involved facts about which they had heard or read:

*On Wikipedia, on the Internet, everybody can just write anything, so that's why I do not just believe anything that is on there.* (Stefanie, student at Queen Beatrix Primary School)
*Yes, I am critical, because we are all human, and humans make mistakes, so... for example, books are also made by humans, and so, yes, I am always critical.* (Bart, student at Queen Beatrix Primary School)
Usually, I go to more than one website. When something is mentioned on two or three sites, then it is probably true. (Willemijn, student at Queen Beatrix Primary School)

Although the survey scores of students at Mosaic Primary School were close to the total mean in terms of critical thinking habits, the case study data highlighted the same pattern for this variable as for curiosity. In contrast to students from Queen Beatrix, students at Mosaic gave very few examples of critical thinking habits.

Teachers at Queen Beatrix Primary School and Mosaic Primary School

As Table 4.4 demonstrates, the results of a one-sample t-test revealed that teachers from Queen Beatrix Primary School scored significantly higher on all aspects of inquiry-based working than the total mean scores of teachers at other schools. Teachers from Mosaic Primary School scored around the total mean in terms of working with an inquiry habit of mind, data literacy and stimulating students’ inquiry habit of mind. They scored above the mean on collaborating in a culture of inquiry. Finally, they scored below the mean on stimulating students’ data literacy.

Table 4.6 contains the results of one-sample t-tests assessing differences between the total mean scores for teachers and the mean scores for teachers at Queen Beatrix and Mosaic on psychological factors related to inquiry-based working. As can be seen, teachers at both schools scored above the mean in terms of their attitude, and their collective efficacy regarding inquiry-based working. In addition teachers at both schools scored around mean on self-efficacy regarding inquiry-based working. However they differ on their experienced social pressure: teachers at Queen Beatrix score below the mean and teachers at Mosaic score above the mean. This indicates that teachers at Mosaic Primary School experience more social pressure than teachers at Queen Beatrix Primary School.

In the case study, the results from the teacher interviews illustrated several ways in which teachers at both schools express their commitment to inquiry-based working. Teachers at both schools mentioned most of the same aspects related to working with an inquiry habit of mind, being data-literate, and contributing to a culture of inquiry at the school level. Table 4.7, which provides an overview of all elements mentioned by the teachers, demonstrates these similarities. For example, Irene from Queen Beatrix cited wanting to thoroughly understand an issue as an aspect of working with an inquiry habit of mind:

Well, there is an on-going discussion about teaching and assessing math. How can we teach math? We are not quite satisfied with our course books. So, we are looking around to see what else is out there. You hear a lot in the media at the moment about it, and my
Table 4.6. Comparison of total mean scores and scores of the case study schools on teachers’ psychological factors

<table>
<thead>
<tr>
<th></th>
<th>Total scores (all schools)</th>
<th>Scores case study schools</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers</td>
<td>m (sd)</td>
<td>m (df)</td>
<td>m</td>
<td>p</td>
</tr>
<tr>
<td>(n=61)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teachers</td>
<td>3.23 (.41)</td>
<td>-11.00 (60)</td>
<td>3.80</td>
<td>.00</td>
</tr>
<tr>
<td>Experienced social pressure</td>
<td>3.01 (.36)</td>
<td>5.61 (60)</td>
<td>2.75</td>
<td>.00</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>2.95 (.42)</td>
<td>-.99 (60)</td>
<td>3.00</td>
<td>.33</td>
</tr>
<tr>
<td>Collective efficacy</td>
<td>2.69 (.42)</td>
<td>-9.49 (60)</td>
<td>3.20</td>
<td>.00</td>
</tr>
</tbody>
</table>

Notes. Answer categories: 1 = completely disagree; 2 = partly disagree; 3 = partly agree; 4 = fully agree. n = sample size, m = mean item scores, sd = standard deviation. Significant p-values (≤ .05) are reported in bold type.

colleague and I often look for articles or literature to read about it, to see what is considered a good way of teaching math and how we can look at it from different angles.

(Irene, teacher at Queen Beatrix Primary School)

Angela from Mosaic Primary School gave the following example of wanting to thoroughly understand an issue:

When you look at the assessment data and see that the whole group had difficulties with one particular aspect, then you know either I have not done enough or I have done quite a lot, but it did not have the desired effect. Maybe I should do it in a different way to reach my goals. (Angela, teacher at Mosaic Primary School)

According to Table 4.7, the two schools differed in terms of how teachers create a culture of inquiry in the classroom. Teachers from Queen Beatrix mentioned a greater variety of aspects during the interviews than teachers from Mosaic. To stimulate students’ inquiry habit of mind, teachers from both schools mentioned that they encourage students to be critical, do not immediate answer students’ questions, and are open to students’ ideas. In addition, teachers at Queen Beatrix mentioned that they encourage students to be curious, have high expectations for students, and work with so-called learning questions. Each student formulates a question involving what he or she wants to learn about a specific theme or subject.

We always start with the children’s learning questions. What do you want to learn from this subject? Then, we look at how the student can formulate that question somewhat more broadly or more narrowly to make sure the core objectives are addressed. For example, a girl wanted to know about fashions during World War II. During interviews with elderly people, she found out that there was no fashion, and sometimes even no
CHAPTER 4

Table 4.7. Teachers approaches to working in an inquiry-based manner

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Mosaic</th>
<th>Beatrix</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Display an inquiry habit of mind</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Want to thoroughly understand issues</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Be critical</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Read literature</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Explore a range of perspectives</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Be ambitious</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Be data-literate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Collect data</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Analyze and interpret data</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Present research results to others</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Complete a course or a training that addresses research</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Create a culture of inquiry in the classroom by stimulating students’ inquiry habit of mind</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Work with learning questions</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Stimulate students’ curiosity</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Encourage students to be critical</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Avoid giving immediate answers to student questions</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Open to students’ ideas</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Have high expectations for students</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td><strong>Create a culture of inquiry in the classroom by stimulating students’ data literacy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Teach students how to write a research question</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Teach students how to collect data</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Teach students how to present research results</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Encourage students to share knowledge</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Teach students how to evaluate/reflect</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Create a culture of inquiry in the classroom by supporting inquiry</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Provide materials</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Have students working in learning corners</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Have students collaborate in groups</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Give students space and trust to conduct research</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Contribute to a culture of inquiry at the school level</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Conduct research with colleagues</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>• Discuss data together</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Share knowledge</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Be open</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>• Observe colleagues in other classrooms working with students</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>
To stimulate students’ data literacy, teachers from both schools show students how to collect data, present results, and evaluate the research process. Teachers from Mosaic mentioned that this happens once a year when students must gather information on a self-chosen subject and present their findings to the class. Teachers from Queen Beatrix claimed that this approach is part of their daily teaching practice. Therefore, they teach students how to formulate research questions and encourage them to share knowledge in various ways.

To support inquiry, teachers from both schools give students adequate space and trust. In addition, teachers at Queen Beatrix provide various research materials (e.g., a telescope, an old typewriter for students to take apart, and bulbs to investigate and plant), and every afternoon students work in so-called learning corners in which they collaborate in small groups.

The observational data also presented two different pictures, with teachers performing in more inquiry-focused, student-centered roles at Queen Beatrix and adopting more traditional, teacher-centered roles at Mosaic. The lessons observations at Queen Beatrix revealed a large educational area in which small groups of students moved from corner to corner. In each corner (which was not a literal corner but more of a small workspace), the student groups read the assignment for that station and followed the instructions. For example, during a project on Leonardo da Vinci, Shirley and Jessica had to write like he did, with their left hands and mirrored. The teacher had placed mirrors, colored felt-tip pens, instructions, and practice sheets in this corner in advance. Moreover, one of the teachers had created the instructions and practice sheets. Shirley and Jessica discussed the problem, tried to mirror their writing with their right hands, made mistakes, looked in each other’s mirrors, held the mirrors in different positions, asked the teacher for pointers, became frustrated, erased their mistakes in anger, started over, and were excited when they finally got it right. Meanwhile, Tom made a paper helicopter in the hallway and enthusiastically wanted to show his teacher how well it worked. After he let go of the helicopter at the top of the stairs, it dropped straight down and did not work properly. Tom was disappointed. After picking it up downstairs, Michael, a teacher, asked him what the problem was, following the question with, “What have you found out so far?” Tom started explaining what he had learned, tried again, and failed again. Michael mentioned the helicopter’s relationship with leaves from some specific trees. At the same time as they were gathering in a very loose setting and running up and down the stairs, the students were discussing issues like weight and the ability to fly. Michael moved to another group and the
students kept trying to make the best helicopter. Later, Monica, another teacher, asked them: “What have you found out, and what can you write about it in your research log?” After discussing the important issues, the group of five students wrote these down in their research logbooks. Some lay the floor, while others were writing and walking at the same time. This approach is in line with Zion and Sadeh (2007), who pointed out that the purpose of inquiry is to lead students to construct their own knowledge, which involves developing a sense of curiosity. Most assignments and teacher instructions at Queen Beatrix seemed designed to encourage student inquiries. The friendly atmosphere left students free to express their opinions, and the teacher emphasized coaching rather than lecturing. Or, as Melanie said:

> Children are curious by nature, and I think at school we really encourage that. We want children to have ownership, so that they receive education based on their needs. But, I also think it is very important that the children here at school can let their curiosity run free. That is why we sometimes have something like a demolition corner or a corner with microscopes. (Melanie, teacher at Queen Beatrix Primary School)

At Queen Beatrix, all of the types of teacher guidance mentioned by Jones and Eick (2007) were observed: open-ended, project-based inquiry, and guided inquiry. The evidence suggests that the teachers at Queen Beatrix focus on inquiry, with teachers’ guidance ranging from open-ended to guided inquiry and students’ responsibility levels varying accordingly. Teachers did not follow curriculum books. Rather, continual learning lines spanned subjects, and teachers concentrated on inquiry. This is in line with the previously mentioned theories of Dobber and Van Oers (2015), Levy et al. (2013), and Wells (1999), who pointed out that learning through inquiry can be applied in and across all sorts of subjects at school.

All the lessons observations at Mosaic indicated that both teachers and students predominantly adhered to traditional roles during whole-class instruction. Most class time was devoted to transferring knowledge, with a one-way interaction from teacher to students. For example, Janet, a sixth-grade teacher, read a chapter from a book while all students read along in their own copies. Next, Janet pronounced the difficult words, with the students repeating after her in a group. Sandra, an eighth-grade teacher, explained math problems to the whole class, asking questions and writing down the answers on the smart board in front of the classroom. She immediately corrected incorrect answers and further explained the problems. Correct answers were mostly praised. After the instruction, all students quietly worked to finish the course book’s math problems by themselves. In both cases, two or three students did not participate in the classroom instruction, because they had individual learning programs.
Teachers’ role in stimulating students’ inquiry habit of mind in primary schools

However, most observed class time at Mosaic was used for what Weimer (2002) identified as the most common teacher-centered methods: lecturing, explaining, demonstrating, questioning, and seat work. In all observed classes, students sat in rows facing the teacher in front. The teachers’ equipment consisted of course books, task sheets, a smart board, and a traffic light. They used the smart board to illustrate, present, and explain new topics. Each classroom at Mosaic also had a traffic light. When the teacher turned on the red light, students were supposed to work silently. Usually, silent work immediately followed instruction. When the teacher turned on the yellow light, students were allowed to work together and ask each other for help. When the green light was turned on, students could ask the teacher questions. When teachers were asked how they stimulated students’ inquiry habit of mind, they often mentioned the yellow traffic light, intended to encourage students to collaborate with each other:

*Yes, students often work together, but I am realistic – it quickly becomes chatting with each other rather than actually helping each other. I definitely encourage students to not just give any answer but to also explain how they got to the answer.* (Sandra, teacher at Mosaic Primary School)

In addition, Sandra highlighted that she tries to avoid immediately answering students’ questions. Instead, she encourages them to look up unknown words in a dictionary.

**Discussion and conclusions**

Since curiosity, critical thinking, and effective communication skills are essential competencies and habits of mind for life in the twenty-first century (Wagner, 2014), schools are increasingly implementing learning through inquiry. This study sought to investigate the relationship between teachers’ inquiry-based working and students’ inquiry habit of mind (curiosity and critical thinking habits). We hypothesized that the more teachers worked in an inquiry-based manner, the stronger the students’ inquiry habit of mind would be. In addition, we hypothesized that high scores on teachers’ attitude, experienced social pressure, self-efficacy, and collective efficacy regarding inquiry-based working would correlate with high scores on students’ inquiry habit of mind. We begin by discussing the results on students’ curiosity and then address students’ critical thinking habits.

Looking at students’ *curiosity*, the survey results partly supported our hypotheses. Indeed, the more teachers worked with an inquiry habit of mind, the more curious the students were. Moreover, in line with the results of Furtak et al.’s (2012) meta-analysis, the more teachers stimulated students’ data literacy, the more curious the students appeared. Although
earlier research has suggested that teachers could more effectively create a culture of inquiry in the classroom by working in such a culture themselves (Dobber & Van Oers, 2015; Wells, 2011), collaborations with others during inquiry, but also teachers’ data literacy, and efforts to stimulate students’ inquiry habit of mind did not seem to influence student curiosity. The finding that teachers’ data literacy or collaborative research efforts did not appear to enhance students’ curiosity could be due to the fact that these elements of inquiry-based working usually take place outside the classroom. Thus, they might affect students’ inquiry habit of mind to a lesser degree. However, an unexpected finding was that, when teachers see themselves as encouraging students’ inquiry habit of mind, this is not necessarily reflected in students’ curiosity scores.

In terms of teachers’ psychological factors regarding inquiry-based working, the study revealed that three factors are very important for students’ curiosity: (1) teachers’ positive attitude towards inquiry-based working, (2) a strong sense of self-efficacy regarding inquiry-based working, and (3) collective efficacy regarding inquiry-based working. All of these variables play a key role in stimulating students’ curiosity. Teachers at both case study schools had the same scores on these three factors. Their scores diverged on experienced social pressure regarding inquiry-based working (low at Queen Beatrix, high at Mosaic), but that variable did not influence student curiosity.

Regarding students’ critical thinking habits, the survey results quite unexpectedly indicated that none of the aspects of teachers’ inquiry-based working or related psychological factors appears to have any effect. Perhaps, stimulating students’ inquiry-habit of mind for teachers means encouraging curiosity, with less emphasis on promoting critical thinking.

The results of the case study illustrated that the classroom culture at Queen Beatrix Primary School is in line with what Lipman (2003) described as a classroom community of inquiry. At that school, teachers work in an inquiry-based manner, view inquiry as an important aspect of all lessons, and encourage various forms of inquiry, from guided to open-ended. In line with our hypothesis, students have plenty of space to investigate, be curious, and be critical. At Queen Beatrix, students think of themselves as both curious and critical, and they could offer many examples to support their opinion. At Mosaic, where teaching is teacher-centered, students feel less encouraged to be either curious or critical. Students at that school could think of very few examples either of curiosity or critical thinking.

One would expect that Queen Beatrix, with its high scores on teachers’ inquiry-based working within an inquiry-centered culture, would have also produced high scores on students’ curiosity and critical thinking habits. However, these scores were close to the mean and below
the mean scores, respectively. This suggests that an inquiry-based classroom culture does not automatically imply that students are curious and critical thinkers.

The survey findings and the case study results seemed to diverge. The survey suggested that when teachers indicate that they strongly stimulate students’ inquiry habit of mind, it does not affect students’ critical thinking abilities. However, the case study illustrated that in a school in which teachers continuously focus on stimulating students’ inquiry habit of mind students indeed were both more curious and more critical. The reason for this difference might be that the survey results measured the mean scores of all teachers at one school, while the case study revealed the actions of individual teachers.

Davis et al. (2016) found that the extent to which science lessons are inquiry-oriented is heavily influenced by how inquiry-oriented the curriculum materials are. In this study, the school at which teachers work in an inquiry-based manner does not rely on curriculum books, however. Rather, the teachers created their own materials and were led by learning lines and their focus on inquiry. This suggests that there are more ways of working in an inquiry-based manner than strictly following curriculum materials.

A limitation of the survey is that the teacher questionnaire relied on self-reports (see, for example, Schwarz, 1999). Thus, the results reflect teachers’ own perceptions. The case study provides more insight into teachers’ actual inquiry-based working, but a larger qualitative research study is necessary to overcome this limitation.

As mentioned above, we found a direct correlation between teachers’ psychological factors related to inquiry-based working and students’ inquiry habit of mind. It seems logical that the effect of these psychological traits would be indirect rather than direct. Unfortunately, mediation analysis was not possible with the available dataset, and it is up to future research to address this type of investigation.

The two case study schools were situated in quite dissimilar areas and served different populations. While Queen Beatrix is located in a smaller city in an area with mean incomes and an average unemployment rate, Mosaic primary is in a large city in an area with low incomes and a high unemployment rate. This dissimilarity could have affected teachers’ approaches and students’ inquiry habit of mind. It also means that the results on students’ inquiry habit of mind could have been influenced by variables other than the teachers and the school culture, such as the style of upbringing by their parents.
**Implications**

The findings of the present study contribute to our understanding of teachers’ inquiry-based working and students’ inquiry habit of mind. As the results demonstrate, teachers’ inquiry-based working and their related psychological factors influence students’ curiosity. This implies that teacher educators and school leaders who want to create an inquiry-based culture in schools, and (indirectly) enhance students’ curiosity, should encourage teachers’ inquiry-based working. They can do this by prompting teachers to discuss results together, sharing knowledge, and modeling behavior. Moreover, they could encourage teachers to take a positive attitude towards inquiry-based working by, for example, pointing out the educational benefits of such an approach and being enthusiastic about it. Finally, they could add to each teacher’s sense of self-efficacy and collective efficacy regarding inquiry-based working by enabling teachers to work in peer groups and creating a safe environment in which teachers feel free to investigate their own teaching practice.

To promote students’ curiosity, teachers can create a culture of inquiry in the classroom. This means, for example, teaching students how to work with learning questions and research questions, being open to students’ ideas and questions, and facilitating inquiry by providing research materials and having students work together in small groups.

This study has added to the literature on the relationship between teachers’ inquiry-based working and students’ curiosity. Future research could provide additional insights into how teachers can stimulate students to become critical thinkers.
CHAPTER 5

Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers

Abstract

Inquiry-based working contributes to teacher professionalization and educational improvements. This article presents the key findings of a qualitative case study carried out in three primary schools in the Netherlands. That study focused on the inquiry-based working of school boards, school leaders, and teachers, with the goal of better understanding how schools establish an inquiry-based culture. As a follow-up to a nationwide survey, this case study used semi-structured interviews, observations, and document analysis to gain insight into the interplay between school boards, school leaders, and teachers regarding inquiry-based working. It identified multiple ways in which educators can encourage others to work in an inquiry-based manner. These approaches are not only top-down (i.e., from school board to school leader, and from school leader to teacher) but also bottom-up (i.e., from teacher to school leader, and from school leader to school board).

Keywords: inquiry-based working, inquiry-based leadership, culture of inquiry, school board, school leader, teacher

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4 This chapter is based on Uiterwijk-Luijk, L., Krüger, M., & Volman, M. (submitted). Promoting inquiry-based working: exploring the interplay between school board, school leaders and teachers.
CHAPTER 5

Introduction

Inquiry-based working has become increasingly important in education. In the span of a few decades, our society has shifted from an industrial model to a knowledge-based one, thanks to globalization, the internationalization of the economy, and new information and communication technologies (Voogt and Roblin, 2012). At the same time, increased autonomy for schools has emerged as an international trend. Schools have more policy space and freedom to make their own decisions, but this greater autonomy also means that they are increasingly held accountable for student achievements (Krüger and Geijsel, 2011). To provide direction in this new era, demand is growing for internal and external data providing insights into the effectiveness of teaching and school practices (Krüger, 2010; Schildkamp, Ehren and Lai, 2012; Vanhoof, Vanlommel, Thijs, and Vanderlocht, 2014). Using data as the basis for school improvement implies that school leaders and teachers engage in collaborative inquiry and that they base educational decisions on its results. In addition to using data to improve schools themselves, school leaders have another new role: guiding a culture of inquiry in which teachers utilize data to understand the effects of their actions, act on their learning, and share their findings with others (Earl and Katz, 2006). This also means that school boards are tasked with encouraging school leaders to create this type of culture in their organization.

Although evidence has demonstrated that data use on the part of school leaders and teachers leads to educational improvements that support student achievements (Campbell and Levin, 2009; Datnow, Park, and Kennedy-Lewis, 2013), little is known about how schools establish a culture of inquiry. In addition, literature is lacking on how educators at different levels of a school organization influence each other’s inquiry-based working (Schildkamp et al., 2012). Since collaboration is an important aspect of working in a culture of inquiry, it is important to take into account the two-way interaction between educators at different levels of a school organization. Existing research has focused on questions concerning how leaders and leadership practices affect the performance of teachers and students (e.g., Anderson, Leithwood and Strauss, 2010; Park and Datnow, 2009; Schildkamp et al., 2012). Other studies have investigated the influence of district leaders or school boards on educational quality (e.g., Hooge and Honingh, 2014; Wayman, Jimerson and Cho, 2012) or the effect of school boards on student learning (e.g., Lee, Seashore Louis, and Anderson, 2012). None of these studies, however, have emphasized the two-way interaction between school boards and school leaders, or between school leaders and teachers. Specifically, no research has evaluated the potential influence of teachers (school leaders) on the inquiry-based working of school leaders (school
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers boards. This study sought to better understand the interplay between school boards, school leaders, and teachers regarding inquiry-based working. A case study was conducted at three schools. At two of these institutions, school leaders and teachers gave themselves high scores on inquiry-based working, while at the final school, they assigned themselves average scores in that area.

Conceptual framework

A culture of inquiry

Schools with a culture of inquiry are more conscious of their educational quality, can better perceive weak spots in the instructional process, and make more focused adjustments for educational improvement (Krüger, 2010). This type of school is committed to challenging existing beliefs and practices, as well as to using data to improve education (Earl and Katz, 2006). According to Robinson and Lai (2006), education should be based on high-quality data and tested assumptions about what children need to learn effectively. In such schools, school boards, school leaders, and teachers invest a significant amount of time and energy into making data accessible and training teachers to become data literate (Schildkamp, et al., 2012).

Although the data-literacy skills are important for educators to possess (Daly, 2012; Earl and Katz, 2006; Wayman, 2013), this study focused on the broader concept of inquiry-based working, which goes beyond using data and being data literate. Based on Earl and Katz (2006), we define educators’ inquiry-based working as (1) having an inquiry habit of mind, (2) being data literate, and (3) creating a culture of inquiry in school. Having an inquiry habit of mind means valuing deep understandings, reserving judgment, considering a range of perspectives, and systematically posing increasingly focused questions (Earl and Katz, 2006). It includes having an inclination to achieve (being passionate and persistent), an inclination to know (being curious and excited), an inclination to understand (having overview and wanting to scrutinize), and an inclination to be critical (being honest and critical of one’s self and others; Van der Rijst, Kijne, Verloop, and Van Driel, 2008). While being critical sometimes has negative connotations (i.e., being judgmental), this paper uses the term to describe the positive and well-reasoned examination of ideas.

Data literacy refers to transforming data into information, and then into knowledge, and finally into action (Marsh and Farrell, 2014). This means that educators must be capable of effectively understanding and using data to inform their decisions. These tasks require them to
know how to develop hypotheses, identify problems, collect and interpret data, and implement courses of action. Data literacy should not be confused with assessment literacy. Assessment data constitute only one type of data, whereas data literacy also requires knowledge about other types of data, such as data on perceptions, motivations, processes, and behaviors (Mandinach and Gummer, 2013).

Finally, to create a culture of inquiry, school boards and school leaders need to involve others as they interpret and engage with data; promote an internal sense of urgency regarding the use of data; make time for data interpretation and for establishing collective meaning; and make use of critical friends. This means that school boards and school leaders should communicate a clear vision on working with data in the school (Earl and Katz, 2006; Jimerson, 2014; Krüger, 2010). Furthermore, in a culture of inquiry, boards (school leaders) enhance the inquiry habit of mind and data literacy of school leaders (teachers) (Earl and Katz, 2006; Krüger and Geijsel, 2011; Wayman and Stringfield, 2006). For teachers, this third aspect means contributing to a culture of inquiry by collaborating with other teachers in conducting research in the school and using data to improve their own teaching. In his review study on data use and social networks in educational improvement, Daly (2012) found that interpreting and using data in schools are the purview of educators who engage in social interactions to co-construct, understand, and utilize data.

The interplay between school boards and school leaders regarding inquiry-based leadership

School boards are expected to monitor and enhance the educational quality of their schools (Hooge and Honingh, 2014; Lee et al., 2012). School board members in the Netherlands hardly spend any time working directly with teachers. Instead, they exert their influence via school leaders. Research on how school boards encourage school leaders’ inquiry-based leadership, however, appears to be rare. Several studies have focused on how school boards influence this mutual effect, this study examined the interplay between both types of educators.

For teachers, this third aspect means contributing to a culture of inquiry by collaborating with other teachers in conducting research in the school and using data to improve their own teaching. In his review study on data use and social networks in educational improvement, Daly (2012) found that interpreting and using data in schools are the purview of educators who engage in social interactions to co-construct, understand, and utilize data.
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers

bottom-up flow of information, structured collaborations within and across schools) and decision-making autonomy (Wohlstetter et al., 2008).

So far, the literature has paid little attention to the fact that when school boards and school leaders work together, not only do school boards influence school leaders, but also do school leaders influence school boards. School leaders might also have an effect on school boards’ inquiry-based working. To investigate this mutual influence, this study examined the interplay between both types of educators.

The interplay between school leaders and teachers regarding inquiry-based working

Previous research has revealed that teacher collaborations are a key factor affecting data use (Wohlstetter et al., 2008; Lachat and Smith, 2005; Wayman and Stringfield, 2006). According to Jimerson (2014), school leaders should support teachers in collaboratively synthesizing and organizing data in different ways. This requires school leaders to lead internal research processes and organize dialogues within their schools to make sense of data as a team (Krüger, 2010). Although supportive school leaders apparently play an important role in enabling teachers to effectively use data (Schildkamp and Kuiper, 2010), according to Daly (2012), many studies have suggested that leaders may not have the skill sets to provide the leadership necessary to support data use. This could be because leaders are primarily driven by their necessary data skills, rather than by the desire to create a culture of collaborative inquiry (Daly, 2012).

Research on the social relations between school leaders and teachers regarding inquiry-based working appears to be rare. To date, researchers have paid little attention to the fact that when school leaders and teachers work together, they influence each other’s inquiry-based working via a parallel process. The direction of the effect potentially runs not only from school leaders to teachers, but also from teachers to school leaders. To investigate this mutual influence, this study focused on the interplay between both types of educators.

The present study

Based on a country-wide survey that we conducted in the Netherlands, we selected three primary schools to answer the following research question: “How can the interplay between school boards, school leaders, and teachers regarding inquiry-based working be characterized?” The study’s two sub-questions were as follows:
1. How can the interplay between school boards and school leaders regarding inquiry-based leadership be characterized?

2. How can the interplay between school leaders and teachers regarding inquiry-based working and inquiry-based leadership be characterized?

**Research context**

In the Netherlands, children aged 4- to 12-years-old attend primary schools. Dutch primary schools have eight grade levels. One of the essential characteristics of Dutch education is that schools are relatively autonomous. Schools are free to choose the religious, ideological, and pedagogical principles on which they base their education, and they can also decide how to organize their teaching activities. The government funds both public and private schools. Consequently, schools shape their curriculums in a variety of manners. This freedom could also influence the extent to which schools work in an inquiry-based manner.

The Ministry of Education, Culture, and Science has set quality standards that apply to all schools. These cover the subjects students must study, attainment targets, the number of teaching hours per year, the qualifications required for teachers, and other similar topics. There is no national curriculum, however. Schools select the course content, the textbooks they use, and the programs or extra subjects on offer. There is no standard required curriculum. Primary teacher education in the Netherlands is traditionally a form of higher vocational education, and it is highly application-oriented.

School boards in the Netherlands are expected to monitor and enhance the educational quality of their schools. Many boards can exist in a single city. For example, Amsterdam has 43 separate boards, each comprising from 1-16 schools (Ladd and Fiske, 2011). School board members are sometimes voluntary participants (e.g., parents of students). Nowadays, however, most school boards in the Netherlands are composed of professional members. The Education Inspectorate is responsible for maintaining educational quality and holds schools accountable for their outputs. Thus, schools must conduct self-evaluations and can be tasked with improving their quality levels when necessary. For the Ministry of Education, Culture, and Science, inquiry-based working is one key aspect of school improvement. In 2007, the Ministry introduced a so-called “quality agenda,” which encourages educators to make informed decisions in all aspects in education (Ministry of Education, Culture, and Science, 2007). Since that time, schools have been working towards becoming learning organizations where data guides educational improvement efforts. In an attempt to enhance the quality of primary
CHAPTER 5

1. How can the interplay between school boards and school leaders regarding inquiry-based leadership be characterized?

2. How can the interplay between school leaders and teachers regarding inquiry-based working and inquiry-based leadership be characterized?

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Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers education, academic routes to the profession were introduced in 2008 (Van der Wal-Maris, Schellings, Geldens, and Beijaard, 2015). In line with that initiative, academic primary schools, at which research plays an important role and at which student teachers can learn their profession, also were established.

Methodology

Design and respondents

We used an embedded multiple-case study design (Yin, 2012) to investigate three primary schools in the Netherlands. Each school was evaluated as a whole (holistic level), and three groups were studied within each school: (1) school board members, (2) school leaders (i.e., principal, deputy director, middle manager, internal advisor), and (3) teachers of grades 5 through 8.

We based the case selection on a survey on inquiry-based working that we conducted prior to this qualitative study (see Uiterwijk-Luijk, Krüger, Zijlstra, & Volman, 2017; Uiterwijk-Luijk, Krüger, Zijlstra, & Volman, accepted). For the purpose of the present study, we screened the inquiry-based working scores of school leaders and teachers from 71 participating schools. As we were interested in good practices regarding inquiry-based working, we selected schools at which leaders and teachers gave themselves average to high scores on inquiry-based working. We then randomly selected three schools from the set. Each selected school was contacted by phone. If it did not want to participate in the case study, we approached another school from the list of average- to high-scoring school leaders and teachers. The case studies took place in Bridge Primary School, Queen Beatrix Primary School, and Mosaic Primary School. To maintain anonymity, all names used in this study are pseudonyms. All three schools had school boards composed of professionals (rather than volunteers).

Bridge Primary School is located in a medium-sized city. Its student population is diverse in terms of the socio-economic status of students’ families, although its cultural diversity is limited. Most students are native Dutch. The school bases its educational offerings on the principles of the so-called Dalton Plan. Dalton education builds on the ideas of Helen Parkhurst (1886-1973), emphasizing three main principles: responsibility, freedom, and cooperation. Teachers seek to provide students with a structure encouraging them to take responsibility for their own learning process, act and think independently, and cooperate with
others (source: [www.daltoninternational.org](http://www.daltoninternational.org)). Bridge Primary School’s board also governs 14 other schools.

Queen Beatrix Primary School is an innovative primary school located in a relatively small city. Like Bridge, the families comprising its student population come from a variety of socio-economic backgrounds but are not very culturally diverse. Instead of employing a grade-based system, the teachers and students work in units. Each unit makes use of a large educational area with theme corners, quiet areas, and workplaces. Moreover, each unit contains a number of basic groups composed of mixed-grade students and a classroom teacher. Teachers design the curriculum around themes, and students explore different subjects within each theme. Students create a development portfolio, in which they write down their targets, results, and reflections on each theme or subject. Queen Beatrix’s board also governs 11 other schools.

Mosaic Primary School is situated in a large city in a so-called “impulse area,” a zone with low income levels and a high unemployment rate. Therefore, Mosaic receives additional funds to reduce students’ educational disadvantages. The school has a diverse student population in terms of both cultural and socio-economic diversity. The school uses the regular year groupings from grade 1 through grade 8, and each class has its own teacher(s). Mosaic Primary is governed by a board that is also responsible for 31 other schools.

Data collection

In order to answer the research questions, this study employed the following data collection strategies: (1) interviews with school boards, school leaders, and teachers (see Table 5.1 for respondents); (2) observations of meetings with school boards, school leaders, and teachers (3 per school, total N=9; see Table 5.2); and (3) document analysis. This triangulation, augmented with complementary methods and data sources, improved the reliability of the findings and enhanced their validity (Miles, Huberman, and Saldaña, 2014).

Semi-structured interview schedules were developed, with the interview questions based on questionnaire items from the survey conducted prior to this study. We asked school boards and leaders to give examples of items on which they had scored highly. For school boards (school leaders), these items concerned stimulating school leaders’ (teachers’) inquiry habit of mind and data literacy and communicating a vision for inquiry-based working. Next, we asked school boards, school leaders, and teachers whether and how other educators stimulated them to work in an inquiry-based manner. Finally, we asked respondents if they had any valuable suggestions for other schools seeking to work in a more inquiry-based manner.
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers

The initial question in all interviews was: “What do you think is the reason your school scored relatively highly on inquiry-based working in the survey?” The interviews took approximately 45-60 minutes.

Table 5.1. Respondents of the interviews per school.

<table>
<thead>
<tr>
<th></th>
<th>Chairman of the school board</th>
<th>School leaders</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Queen Beatrix</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Mosaic</td>
<td>1</td>
<td>6a</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: a The six school leaders at Mosaic Primary School that were interviewed consisted of one principal, one deputy, one middle manager and three internal advisors.

Table 5.2. Observations per school.

<table>
<thead>
<tr>
<th></th>
<th>Meeting of school board and school leaders</th>
<th>Meeting of school leaders</th>
<th>Team meeting (team and school leaders)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bridge</td>
<td>1a</td>
<td>N/A</td>
<td>2</td>
</tr>
<tr>
<td>Rainbow</td>
<td>1b</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Queen Beatrix</td>
<td>N/Ac</td>
<td>N/A</td>
<td>3d</td>
</tr>
</tbody>
</table>

Notes: a Meeting of the school board with school leaders from fourteen schools. b Meeting of the school board with three school leaders from Rainbow. c N/A = Not Available. d The three team meetings at Queen Beatrix consisted of one regular team meeting, one “end of the week evaluation” and one study day.

We observed and videotaped several meetings (see Table 5.2) and made field notes to document events outside of the camera’s range. Participants were observed with reference to them stimulating each other to work in an inquiry-based manner. Meeting observations lasted from 15-90 minutes. One observation took a whole day, following teachers and school leaders during a study day. Two interviews interrupted that observation. In addition, we analyzed documents to gain a complete picture of how each school’s board, leaders, and teachers encouraged each other’s inquiry-based working. In the Netherlands, all schools are obligated to have both an annual plan and a four-year policy plan. We studied both of these documents. In addition, we analyzed inspection reports and meeting agendas and minutes from the past two years. We randomly selected a maximum of 20 documents per type.
Data analysis

We transcribed and coded all interview data according to a coding scheme using MAXQDA coding software. To analyze the data, we first used deductive coding, with the coding scheme based on the theoretical framework. For example, we utilized a code such as: “school leader stimulates teachers’ inquiry habit of mind by discussing student results with teachers.” However, we permitted other codes to emerge from the data (inductive coding), such as “school leader stimulates teachers’ inquiry habit of mind by having high expectations.” To create the coding scheme, two researchers independently created codes and categories based on a random set of nine interview transcripts (two school board transcripts, three school leader transcripts, and four teacher transcripts). Disagreements were settled through discussion, and the meanings of the codes were carefully adjusted. Once the codes and categories had been clearly defined, both researchers then used them to label the remaining transcripts. Random sampling was used to check for similarities and differences in the remaining transcripts, and discussions settled any inconsistencies.

The coding scheme that emerged from the interviews guided the analysis of the data from the observations and documents. Specifically, we evaluated whether the observations and documents reinforced or contradicted these trends. We used the coding scheme to find examples of boards, leaders, and teachers encouraging each other to work in an inquiry-based manner. Relevant fragments were selected and interwoven into the description of the findings. Based on Miles et al. (2014), a cross-case analysis was used to develop sophisticated descriptions and deepen our understanding of the inquiry-based working of school boards, school leaders, and teachers. Next, a within-case analysis provided a well-grounded view of the good practices of each separate school as a whole.

Results

This section offers an overview of the school boards, school leaders, and teachers’ different approaches to inquiry-based working. Next, we compare the three schools and look for differences and similarities. We end this section with a portrait of each separate school as a whole.
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers

Overview of different approaches

Following coding, four categories emerged describing how school boards stimulated school leaders’ inquiry-based working: (1) stimulating school leaders’ inquiry habit of mind, (2) stimulating school leaders’ data literacy, (3) communicating a vision for inquiry-based working, and (4) supporting inquiry-based working. As Table 5.3 makes clear, the four categories were subdivided into 13 codes. Four codes were directly related to the interview questions (e.g., “The school board stimulates school leaders’ inquiry habit of mind by encouraging leaders to discuss student results with teachers”), and the other nine codes emerged from the respondents’ answers.

Table 5.3. School boards’ approaches to stimulating school leaders’ inquiry-based leadership

<table>
<thead>
<tr>
<th>Methods</th>
<th>Bridge</th>
<th>Beatrix</th>
<th>Mosaic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stimulate school leaders’ inquiry habit of mind by:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Discussing student results with school leaders</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. <em>Encouraging leaders to discuss student results with teachers</em></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Sharing knowledge</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>4. Modeling behavior</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Making demands</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>6. Having high expectations</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Encouraging leaders to cooperate and discuss research results with school leaders from other schools</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Stimulate school leaders’ data literacy by:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. <em>Involving external organizations to support school leaders in conducting research</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. <em>Developing internal expertise to support inquiry</em></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Communicate the vision for inquiry-based working by:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. <em>Communicating orally about the vision for inquiry-based working</em></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Support inquiry-based working by:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Providing money, time, and space</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>12. Trusting and believing</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>13. Being open to new ideas concerning research</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

Note: The text in italics represents codes that were directly related to the survey items.
Table 5.4 demonstrates the three categories that emerged regarding how school leaders stimulated school boards’ inquiry-based working, namely: (1) trusting and believing, (2) being critical, and (3) raising awareness of issues in need of investigation.

Table 5.4. School leaders’ approaches to stimulating school boards’ inquiry-based leadership

<table>
<thead>
<tr>
<th>Methods</th>
<th>Bridge</th>
<th>Beatrix</th>
<th>Mosaic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Trusting and believing</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2. Being critical</td>
<td></td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Raising awareness of issues in need of investigation</td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

Examining the interplay between school leaders and teachers, we found that the same four categories describing how boards stimulated leaders’ inquiry-based working also indicated how school leaders stimulated teachers’ inquiry-based working. In addition, we found a fifth category, namely, school leaders sharing leadership with teachers. We subdivided these 5 categories into 15 codes (see Table 5.5). It made logical sense that the codes again had a direct link to the interview questions. As Table 5.5 illustrates, 4 codes were directly related to the interview questions, while the other 11 codes emerged from the respondents’ answers. As Table 5.6 depicts, two categories indicated how teachers stimulated school leaders’ inquiry-based working: (1) being critical and (2) modeling behavior. In this study, the term “modeling behavior” referred to (un)conscious behavior encouraging others to work in an inquiry-based manner.

**Comparison of the three schools: differences and similarities**

Although the inquiry-based approaches of each school’s board, leaders, and teachers exhibited similarities, their reasons for doing so differed. At Bridge Primary, inquiry-based working served as a means of innovating (e.g., discovering new teaching strategies) to meet the demands of today’s changing society. At Queen Beatrix Primary, a focus on conducting research at all levels in the school (from the board to students), so as to strengthen students’ inquiry habit of mind, drove behavior. Mosaic Primary emphasized the analysis of assessment data and inquiry-based working as a means of improving students’ test results.
Table 5.4 demonstrates the three categories that emerged regarding how school leaders stimulated school boards' inquiry-based working, namely: (1) trusting and believing, (2) being critical, and (3) raising awareness of issues in need of investigation.

<table>
<thead>
<tr>
<th>Methods</th>
<th>Bridge</th>
<th>Beatrix</th>
<th>Mosaic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulate teachers’ inquiry habit of mind by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Discussing student results with teachers</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Encouraging teachers to discuss data with each other</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Sharing knowledge</td>
<td></td>
<td></td>
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<tr>
<td>4. Modeling behavior</td>
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<td>X</td>
<td>X</td>
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<td>5. Making demands</td>
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<tr>
<td>6. Having high expectations</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stimulate teachers’ data literacy by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Involving external organizations to support teachers in conducting research</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8. Training teachers in research skills (by school leaders)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Handing out step-by-step instructions regarding research skills</td>
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<tr>
<td>10. Shaping the school into an “academic primary school”</td>
<td></td>
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<tr>
<td>Communicate a vision for inquiry-based working by:</td>
<td></td>
<td></td>
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<tr>
<td>11. Communicating orally about the vision for inquiry-based working</td>
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<tr>
<td>Share leadership by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Sharing leadership responsibilities with teachers</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Support inquiry-based working by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13. Providing money, time, and space</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>14. Being open to new ideas concerning research</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>15. Creating a safe environment</td>
<td></td>
<td></td>
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</tbody>
</table>

Note: The text in italics represents codes that were directly related to the survey items.

Table 5.5. School leaders’ approaches to stimulating teachers’ inquiry-based working

<table>
<thead>
<tr>
<th>Methods</th>
<th>Bridge</th>
<th>Beatrix</th>
<th>Mosaic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stimulate teachers’ inquiry habit of mind by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Discussing student results with teachers</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2. Encouraging teachers to discuss data with each other</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>3. Sharing knowledge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Modeling behavior</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>5. Making demands</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Having high expectations</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Stimulate teachers’ data literacy by:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Involving external organizations to support teachers in conducting research</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>8. Training teachers in research skills (by school leaders)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Handing out step-by-step instructions regarding research skills</td>
<td></td>
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<tr>
<td>10. Shaping the school into an “academic primary school”</td>
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<td>Communicate a vision for inquiry-based working by:</td>
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<td>Share leadership by:</td>
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<tr>
<td>12. Sharing leadership responsibilities with teachers</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Support inquiry-based working by:</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>13. Providing money, time, and space</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>14. Being open to new ideas concerning research</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>15. Creating a safe environment</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Note: The text in italics represents codes that were directly related to the survey items.

Table 5.6. Teachers’ approaches to stimulating school leaders’ inquiry-based leadership

<table>
<thead>
<tr>
<th>Methods</th>
<th>Bridge</th>
<th>Beatrix</th>
<th>Mosaic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Being critical</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2. Modeling behavior</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 5

The interplay between the school board and school leaders

To create an inquiry-based culture, the school boards of all three schools stimulated school leaders’ inquiry habit of mind and data literacy and supported inquiry-based working in a variety of ways. To stimulate school leaders’ inquiry habit of mind, they discussed, for example, data on student results with school leaders. At Bridge and Mosaic, the school board specifically encouraged school leaders to also discuss data with teachers. All three school boards shared knowledge with their school leaders but did not explicitly encourage school leaders to share knowledge with teachers. However, school leaders still appeared to do this. In addition, all three school boards stimulated their school leaders’ inquiry habit of mind by modeling behavior, setting high expectations, and encouraging them to cooperate and share results with leaders from other schools. At Beatrix (where the focus was on students’ inquiry habit of mind) and Mosaic (where the focus was on students’ test results), boards also made demands regarding inquiry-based working. The three boards stimulated school leaders’ data literacy by either involving external organizations (Beatrix and Mosaic) or developing internal expertise (Bridge).

In all three organizations, inquiry-based working constituted an important aspect of their culture. However, none had a written vision for it. At Queen Beatrix, the school board did communicate orally on the topic. At all three schools, the school board provided money, time, and space for working in an inquiry-based manner. For example, boards organized in-company education. At Bridge and Beatrix, trusting school leaders and believing in them were important aspects of the school board’s approach. At Beatrix, these aspects were also mentioned in the opposite regard, with participants indicating that school leaders trusted their school board and had faith in it. The final way that school boards supported inquiry-based working was by being open to new ideas concerning research (Bridge and Beatrix). At both schools where this factor played a role, school leaders enjoyed an atmosphere in which they could critically question their school board. In addition, leaders at Queen Beatrix brought the board’s attention to issues in need of investigation.

The interplay between school leaders and teachers

School leaders at all three schools took the same approach to stimulating teachers’ inquiry habit of mind in order to create an inquiry-based culture (see Table 5.5): (a) discussing student results
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers with teachers, (b) encouraging teachers to discuss data with each other, (c) sharing knowledge, (d) modeling behavior, (e) making demands, and (f) having high expectations.

At Beatrix and Mosaic, leaders brought in external organizations to stimulate teachers’ data literacy. At Beatrix and Bridge, leaders handed out step-by-step instructions on how to conduct research. In addition, at Beatrix, school leaders stimulated teachers’ data literacy by training teachers in research skills and shaping the school into an academic primary school.

As mentioned above, none of the schools had a written vision for inquiry-based working. At Queen Beatrix, the school leaders communicated orally about it, however. At Mosaic, the principal pointed out that there was “somewhere a rule that all decisions must be based on data,” but that focus was more implicit than explicit and was not recognized in the interviews with teachers. School leaders from all three schools shared leadership responsibilities and supported inquiry-based working in several ways:

(a) by providing money, time, and space:

*I think our school leaders give us a lot of autonomy to explore, to find out for ourselves what works and what does not work. Not steering, but rather giving us the space to do so.* (Teacher at Queen Beatrix Primary School)

(b) by being open to new ideas concerning research:

*If you have a problem, you can always discuss it, and it will be investigated to find out what the cause is. For example, the reading comprehension of students appeared to be weak. After investigating our teaching methods, we added a new teaching method that filled in the gaps we had found. And, it is a great success.* (Teacher at Mosaic Primary School)

(c) by creating a safe environment:

*You see people who sort things out, who want to share experiences and results with each other. They want to talk about and discuss it together, without any kind of reproach or negative atmosphere; it is all very constructive.* (Principal at Queen Beatrix Primary School)

At Beatrix and Mosaic, teachers demonstrated the inquiry-based culture by being critical (e.g., asking critical questions about the bases for decisions) and modeling behavior (e.g., investigating and improving their own actions by comparing them with those of others and discussing the results). These actions prompted school leaders to work in an inquiry-based manner. This was not seen at Bridge.
**Bridge Primary School**

The school board at Bridge Primary School consisted of one professional administrator, Chairman Jan. The school’s leadership team was composed of one principal (Tanja), two middle managers, and one internal advisor. The school also employed 20 teachers. As mentioned above, at Bridge, working in an inquiry-based manner meant innovating, so as to meet the demands of today’s changing society.

**The interplay between the school board and school leaders at Bridge Primary School**

At Bridge, the interplay between Chairman Jan and school leaders regarding inquiry-based working was characterized by Jan standing back and appreciating the school leaders’ inquiry-based approaches. This approach is in line with Wohlstetter et al.’s (2008) suggestion that school boards should give school leaders decision-making autonomy.

*I can see that the principal supports teachers who do not show any progress, to ensure that they grow. She expects that of them. She expects them to work with an inquiry habit of mind. It is her intention to embed inquiry-based working in the school organization.*

(Jan, chairman of the school board at Bridge Primary School)

In return, Principal Tanja appreciated Jan’s inquiry habit of mind. She mentioned that he was well aware of educational research findings and that he regularly sent her interesting research papers. Indeed, during the observed meeting between Jan and the school leaders, Jan regularly referred to external research and national trends in education. Once a year, the school leaders met with Chairman Jan to discuss school results. At that meeting, he emphasized the importance of formulating hypotheses, analyzing data, thinking of different solutions, and avoiding hasty conclusions. Tanja was satisfied that her school could operate autonomously but believed that knowledge exchanges between schools should happen more often. In her view, Jan could play a more active role in realizing that. The chairman stimulated data literacy by appointing an internal expert to develop an instrument that school leaders could use to gather and analyze data on teachers’ capabilities. The internal expert trained school leaders from all of the schools in Jan’s district on how to use the instrument. The school’s multiyear plan indicated that the goal of this instrument was obtaining a better picture of teacher capacities to enhance educational quality. As Table 5.4 demonstrates, from their end, school leaders encouraged the board chairman to work in an inquiry-based manner by asking critical questions about new ideas that he had introduced to the school.
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers

I think that a lot of ideas are brought into our school as if they were the answer to everything, even if there was not even a question to start with. We should start with problems and questions from inside our school, not with a theory or study someone has read somewhere. (Tanja, principal at Bridge Primary School)

The interplay between school leaders and teachers at Bridge Primary School

Trust was the key element characterizing the interplay between school leaders and teachers at Bridge. The school leaders had high expectations for teachers, but they also believed that teachers would raise, investigate, discuss, and solve any issues in the school. In that inquiry-based culture, school leaders communicated a clear vision for education (the Dalton concept). Tanja pointed out that the Dalton concept’s vision anchored the team’s inquiry-based working. Indeed, all respondents pointed out that the team was open to innovation and research. Innovativeness, combined with a clear educational vision and inquiry-based working, ensured that leaders and teachers continuously evaluated all on-going work and new plans. Or, as both one of the teachers and the principal pointed out:

The success factor for inquiry-based working at this school is that new opportunities can be tried out and discussed collectively. When something can be done in a better way, actions will be undertaken. Or, at least the possibilities for our school will be looked at. (Tanja, principal at Bridge Primary School)

Our clear vision of what we want in our education is evident in our high expectations. This gives us something to evaluate and to reflect upon. (teacher at Bridge Primary School)

The school leader supported working in a culture of inquiry by arranging for teachers to collaborate in so-called workgroups. In these groups, teachers investigated and evaluated new ideas in an environment allowing them to critically reflect on their own teaching. The principal established clear research directions for the teachers to give them guidance and structure.

It is a good thing that we follow specific steps to give guidance (…) For example, during our research on making it easier for children to pass from grade 2 to grade 3, we formulated the hypotheses together. The next step was that all of these hypotheses needed to be investigated. (Tanja, principal at Bridge Primary School)

During the interviews, teachers indicated that they appreciated the culture that the school leaders had created in the school, which they described as providing them with autonomy to investigate anything of importance to them: “If you want to conduct research yourself, you are
guaranteed to get the cooperation and space you need” (teacher at Bridge Primary School). They mentioned the high expectations and the drive to innovate to improve educational quality. Teachers’ influence on school leaders was not emphasized.

**Queen Beatrix Primary School**

The school board at Queen Beatrix Primary School consisted of one professional administrator: Chairman Peter. The school’s leadership team was comprised of one principal (Karen), two middle managers, and one internal advisor. The school counted 9 teachers. As mentioned, Beatrix focused on conducting research at all levels in the school, from the board to students, so as to strengthen students’ inquiry habit of mind.

**The interplay between the school board and school leaders at Queen Beatrix Primary School**

The interplay between the board and school leaders was characterized by a focus on conducting research. Chairman Peter stressed the importance of investigating and using data when, for example, writing improvement plans: “I say to them, ‘Data should be made a priority–analyze it, discuss it with each other, make sure you draw your improvement plans from it.’” From their end, school leaders prompted Chairman Peter to work in an inquiry-based manner by trusting and believing in him, as well as by asking critical questions and bringing his attention to issues requiring examination. For example, Peter mentioned that, “Karen, the principal, often asks me, ‘Well, you asked this of us, but why? What is it based on?’” Both the governor and the school leaders emphasized that trusting and believing in one another was an important aspect of their inquiry-based culture.

> Just being able to talk to each other on an equal basis. It’s like, I face something difficult, how can we best deal with that? (Karen, principal at Queen Beatrix Primary School)

**The interplay between school leaders and teachers at Queen Beatrix Primary School**

Shared leadership, shared responsibilities, and shared knowledge are the key words characterizing the interplay between school leaders and teachers at Queen Beatrix. For example, the internal advisor shared knowledge that made teachers rethink their own teaching.
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers

*What I like is that our internal advisor has been to several workshops that made her really enthusiastic about a specific type of instruction. She shares this knowledge with us, which stimulates us to reevaluate our own instruction.* (teacher at Queen Beatrix Primary School)

During the observed study day, teachers brought their own data. One of the school leaders led a group session for teachers reviewing the research cycle, and instructions detailing how to analyze data were handed out. Next, the teachers analyzed their data in small groups and discussed the results. Afterwards, they presented their results in two subgroups. The interviews and meeting agendas made clear that the leaders and teachers took turns providing instruction and taking the lead during study days or meetings.

Although none of the documents described the school’s vision for inquiry-based working, in the interviews, school leaders and teachers indicated that this concept was communicated orally.

*We really want to acknowledge conducting research in everything we do. We always talk about ‘What have you achieved? How did you get these results? And, how do you analyze what still needs to be done?’ We think it is self-evident that we should always look for information and study data in depth.* (Karen, principal at Queen Beatrix Primary School)

*The vision of the school leaves quite a lot of room. I think that is a strong point. You are always welcome to contribute new ideas. It is not fixed.* (teacher at Queen Beatrix Primary School)

As Table 5.6 demonstrates, teachers in turn stimulated school leaders’ inquiry-based leadership by asking critical questions and modeling behavior. For example, one of the school leaders said in an interview that, “*I am very encouraged by teachers, not so much because of the things they say, but because I see how it motivates them to work in this inquiry-based manner.*”

*Mosaic Primary School*

The school board at Mosaic Primary School consisted of two professional administrators: Chairman Michael and Patrick, a member. The leadership team at the school consisted of one principal (Tom), one deputy, three middle managers, and three internal advisors. The school employed 27 teachers. Mosaic focused on assessment data, and inquiry-based working served as a way of improving student results.
The interplay between the school board and school leaders at Mosaic Primary School

The interplay between the school board and the school leaders at Mosaic was characterized by a focus on student assessment data.

_We use an instrument to analyze all our schools. If it is a good school, all scores are green, which means they are above the national average. When a score is red, we try to find out the reason. Are there, for example, difficulties with the applied teaching method? We will put down a range of recommendations for the school. Depending on the seriousness of the signal, we discuss the progress every few weeks, or just two times a year._ (Michael, chairman at the school board at Mosaic Primary School)

During the observed meeting between the school leaders and Michael, they discussed whether established attainment goals for student test results had been reached. The multiyear plan illustrated the school’s high goals. To achieve these objectives, the board made demands and set high expectations. Michael indicated that they modeled behavior by conducting research themselves and that they shared knowledge by distributing articles or pointing out where to find information on the Internet. The deputy recognized this:

_Patrick showed me a website which I found quite interesting. It shows the results of all primary schools in the Netherlands. He showed me a school that is similar to our school. That school’s scores were much higher than ours. That made me think, ‘How is that possible?’_ (deputy at Mosaic Primary School)

Mosaic was the only school in which we did not find evidence of school leaders encouraging the school board to work in an inquiry-based manner.

The interplay between school leaders and teachers at Mosaic Primary School

Openness characterized the interplay between school leaders and teachers regarding inquiry-based working at Mosaic. They demonstrated significant respect for one another, were willing to learn from one another, and left classroom doors open. School leader Tom stated in an interview that he modeled inquiry-based working by working with internal advisors to analyze the neighborhoods in students’ postcodes. They then compared their findings with government data about the different zones in his city. He made this effort, because parents in the Netherlands are free to choose their children’s school. By analyzing this data, they gathered information on the type of families attracted to their school and on the types of families that left the school early. Together with other leaders, they discussed whether the findings demonstrated a need to
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers adjust their policies, their classroom activities, or even their vision for the type of school they wanted to be.

Just as the school board did with the school leaders, the school leaders discussed student results with teachers twice a year. School leaders prompted teachers to observe each other in the classroom and discuss the strengths and weaknesses of each other’s teaching techniques. All teachers were asked to observe at least two colleagues each year and to be observed by a colleague at least once per year.

Beforehand, I had set myself a goal, and we all had to develop a personal action plan. Then I asked my colleague if I could observe her spelling instruction. I wanted to know how she did that so I might be able to improve my own spelling instruction. (teacher at Mosaic Primary School)

Until recently, the school leaders presented the entire school’s student achievements to teachers, so that they could discuss the results. However, as Tom stated “teachers were always quite anxious about that, because I would always ask them, ‘Can you explain these results?’” This school year, so as to share the responsibility of discussing student achievements, Tom asked the grade 5 teachers to present their results to the rest of the team. The teachers mentioned that they felt secure enough to show their weaknesses and that no one faced negative repercussions if, for example, results had not improved. Everyone felt welcome to speak up or ask questions. Several teachers mentioned that this safe environment was an essential element of the school in general and of inquiry-based working in particular.

In turn, as Table 5.6 depicts, teachers stimulated school leaders’ inquiry-based working by being critical and modeling behavior.

A few teachers had been reading and discussing the listening comprehension of young children. They found out that it is important to pay more attention to this in grades 1 and 2. That did not come from the school leaders but from the teachers themselves. (internal advisor at Mosaic Primary School)

When I run into something concerning student achievements, I automatically go to our deputy. She is our contact person about that. For example, with math I found the standards too strict. So, I asked her to examine these standards again. And, last week I heard one of the other teachers ask her about her reasons for the way she grouped some students. (teacher at Mosaic Primary School)

The evidence for these two aspects (teachers being critical and modeling behavior) was limited. They were mentioned during the interviews but were not evident during the observations or in the analyzed documents.
CHAPTER 5

Conclusion and discussion

The findings of the present study contribute to our understanding of the interplay between school boards, school leaders, and teachers regarding inquiry-based working. We studied three primary schools, each with unique reasons for working in an inquiry-based manner. These included innovating and connecting to the demands of today’s changing society, enhancing students’ inquiry habit of mind, and improving students’ test results. In addition, the three schools were situated in quite dissimilar areas and served different populations. Two schools were located in smaller cities in areas with average incomes and an average unemployment rate, while one school was situated in a large city in an area with low incomes and a high unemployment rate. These dissimilarities make this study’s outcomes useful for different types of schools, located in a range of areas and with a variety of goals.

Our first question was: How can the interplay between school boards and school leaders regarding inquiry-based leadership be characterized? In total, we found 13 ways in which school boards stimulated school leaders’ inquiry-based leadership. These were as follows: (1) discussing student results together with school leaders; (2) encouraging school leaders to discuss student results with teachers; (3) sharing knowledge; (4) modeling behavior; (5) making demands regarding inquiry-based working; (6) having high expectations; (7) encouraging leaders to discuss research results with school leaders from other schools; (8) involving external organizations, so as to help school leaders conduct research in a more professional manner; (9) developing internal expertise to support inquiry; (10) communicating about the vision for inquiry-based working; (11) providing money, time, and space; (12) trusting and believing; and (13) being open to new ideas concerning research. Anderson et al. (2010) also found evidence of some of these approaches, namely: modeling behavior; having high expectations; developing internal expertise to support inquiry; and providing money, time, and space.

Wohlstetter et al. (2008) suggested that school boards should provide systemic support and decision-making autonomy. This study saw evidence of this in two of the schools, but because this aspect was not specifically linked to inquiry-based working, it was not coded as such. We were impressed with the school leaders’ powerful role in encouraging school board members’ inquiry-based leadership by trusting and believing in them, prompting critical questions, and raising awareness regarding issues in need of investigation.

Our second question was: How can the interplay between school leaders and teachers regarding inquiry-based working and inquiry-based leadership be characterized? We found 15 ways in which school leaders stimulated teachers’ inquiry-based working. The first six
Promoting inquiry-based working: exploring the interplay between school boards, school leaders, and teachers approaches involve school leaders stimulating teachers’ inquiry habit of mind by: (1) discussing student results with them; (2) encouraging teachers to discuss data with each other; (3) sharing knowledge; (4) modeling behavior; (5) making demands; and (6) having high expectations. In line with Jimerson (2014), who pointed out that school leaders should support teachers’ effective use of data, we found four ways in which school leaders accomplished that task: (7) involving external organizations, so as to support teachers in conducting research; (8) training teachers in research skills; (9) handing out step-by-step instructions regarding research skills; and (10) shaping the school into an “academic primary school.” Finally, we found the following 5 ways in which school leaders stimulated teachers’ inquiry-based working: (11) communicating the vision for inquiry-based working; (12) sharing leadership with teachers; (13) providing money, time, and space; (14) being open to new ideas concerning research; and (15) creating a safe environment. When examining teachers’ effect on school leaders’ inquiry-based leadership, we found evidence of 2 approaches. Teachers asked critical questions and modeled behavior.

In short, the potential for inquiry-based working in schools often depends on top-down initiatives: from the board to leaders, and from leaders to teachers. Nevertheless, this study found powerful approaches that also helped teachers to influence leaders and leaders to influence the board. This means that we no longer can dismiss the influence of the interplay between educators with different roles in schools.

**Limitations of the study and implications for educational practice and policy**

To enrich our understanding of inquiry-based working, our initial intent was to study schools in which all educators were extremely effective at working in an inquiry-based manner. Unfortunately, we were not able to find schools that had scored so highly and also wanted to participate in this study. However, this study still provides clear insight into how school board, school leaders, and teachers can encourage each other’s inquiry-based working.

If we want to encourage educators to work in a more inquiry-based manner, there is the challenge of prompting boards and leaders to clearly formulate their vision for inquiry-based working. Several studies (e.g., Earl and Katz, 2006; Jimerson, 2014; Krüger, 2010) have established the importance of having a clear vision for inquiry-based working. The three studied schools all had their own views on why working in an inquiry-based manner is important. However, none of them had recorded this vision in writing. Writing down such a vision can help schools explicating their reasons for adopting that approach, and making them more aware
of their actions (Geijsel, Sleegers, Stoel, & Krüger, 2009). In addition, we saw that boards (leaders) did not explicit the data they based their decisions on. This means a challenge exists for boards (leaders) to involve leaders (teachers) in their data-based decision making. This is the case not only when it comes to student assessment data but also when it comes to other decisions regarding, for example, policy development and planning.

Our study has made clear there are several ways to shape accountability and data-based decision-making in schools. National policy-makers and the inspectorate can use these results as an example to emphasize not only the use of assessment data in schools but also the broader phenomenon of inquiry-based working, including a culture of inquiry in schools. Educators of leaders and teachers could focus on the top-down and bottom-up interventions that each of them can undertake to stimulate this type of working in school organizations. Teacher (school leader) educators can concretize teachers’ (leaders’) potential influence on school leaders (school boards) regarding inquiry-based working. This paper gives many examples of approaches that school boards, school leaders, and teachers can use to stimulate inquiry-based working at all levels in schools.
CHAPTER 6

Summary and general discussion

Inquiry-based leading and learning

Inquiry-based working by school boards, school leaders and teachers and students’ inquiry habit of mind

Introduction

Inquiry-based working is assumed to contribute to improving educational quality (Krüger 2010a) and to stimulate professional learning (Katz & Dack, 2014). It involves having an inquiry habit of mind, being data literate and creating a culture of inquiry in schools (based on Earl & Katz, 2006). The general aim of this study was to provide insight in the way school boards, school leaders and teachers work in an inquiry-based manner, how an inquiry-based culture is established in schools and what this means for the inquiry habit of mind of students. A students’ inquiry habit of mind includes being curious and having critical thinking skills.

To find out what encourages educators to work in an inquiry-based manner, we used a quantitative survey to investigate the relationship between the psychological factors attitude, experienced social pressure, self-efficacy and collective efficacy, and school leaders’ and teachers’ inquiry-based working (described in chapter 2 and 3). In addition, we performed a case study at 3 schools to investigate the mutual influence between school boards, school leaders, and teachers regarding inquiry-based working (chapter 5). To examine the relationship between teachers’ inquiry-based work and students’ inquiry habit of mind we combined the results from our survey and our case study (chapter 4). In this final chapter, the main findings and conclusions are presented and discussed.
Summary of the main findings and conclusions

In chapter 2, a study on inquiry-based leadership was presented. The central question was formulated as follows: How are attitude, experienced social pressure and self-efficacy related to inquiry-based leadership in primary schools? To answer this question 79 school leaders completed a questionnaire about their attitude towards inquiry-based leadership, the experienced social pressure they feel to lead their school this way and their self-efficacy regarding inquiry-based leadership. In addition, the questionnaire asked about three aspects of inquiry-based leadership: working with an inquiry habit of mind, being data literate and creating a culture of inquiry in the school.

The predictor that stood out to the greatest degree was self-efficacy regarding inquiry-based leadership. Self-efficacy regarding inquiry-based leadership appeared to be related to all three aspects of inquiry-based leadership. The sole sub-aspect for which self-efficacy regarding inquiry-based leadership did not show a specific contribution was stimulating the inquiry habit of mind of teachers. Attitude towards inquiry-based leadership appeared to be related to two sub-aspects of creating a culture of inquiry: communicating a vision on inquiry-based working and stimulating the inquiry habit of mind of teachers. There was no relationship found between experienced social pressure and inquiry-based leadership. However, a strong positive correlation among the three predictors and between a) each psychological factor (self-efficacy, attitude and experienced social pressure) and b) all aspects of inquiry-based leadership was found. This means that although some predictors do not make a unique contribution to inquiry-based leadership, self-efficacy, attitude and experienced social pressure with regard to inquiry-based leadership are all strongly related to inquiry-based leadership.

This study also investigated the role of several background characteristics. Taking into account the psychological factors, only age appeared to be related to two aspects of inquiry-based leadership: school leaders in the age group 51-60 score higher than others on stimulating teachers’ inquiry habit of mind and on stimulating teachers’ data literacy. This means that participants in the age group 51-60 lead their schools in a more inquiry-based manner than younger leaders, perhaps due to experience.

Chapter 3 reports on the relationship between psychological factors and inquiry-based working by teachers. The central question of this study was: How are attitude, experienced social pressure, self-efficacy regarding inquiry-based working, and collective efficacy regarding inquiry-based working related to inquiry-based working by primary school teachers
in the Netherlands? To answer this question data from questionnaires completed by 249 teachers were used.

Again, as in chapter 2, the predictor that stood out to the greatest degree was self-efficacy regarding inquiry-based working. Self-efficacy regarding inquiry-based working is a factor that appeared to be related to all aspects of teachers’ inquiry-based working. Teachers with a strong sense of self-efficacy towards inquiry-based working also had a strong inquiry habit of mind, possessed high skills related to data literacy, strongly contributed to a culture of inquiry at the school level and strongly created a culture of inquiry in their classrooms. It seems that in order to work in an inquiry-based manner it is necessary for teachers to believe that they are able to successfully perform behaviour related to the different aspects of inquiry-based working. Collective efficacy regarding inquiry-based working appeared to be related to three sub-aspects of working in a culture of inquiry: at the school level through collaboration with colleagues and at the classroom level through stimulating students’ inquiry habit of mind and students’ data literacy. Apparently, teachers’ beliefs about the ability of his or her team to work in an inquiry-based manner are relevant for contributing to a culture of inquiry on the school level and for creating a culture of inquiry in the classroom. As opposed to self-efficacy regarding inquiry-based working, there was no relationship between collective efficacy regarding inquiry-based working and working with an inquiry habit of mind or being data literate.

In addition, this study showed that primary school teachers with a strong positive attitude towards inquiry-based working also scored high on working with an inquiry habit of mind. However, no direct relationship between attitude and other aspects of inquiry-based working was found. This study also showed that teachers who strongly felt that others expected them to work in an inquiry-based manner (experienced social pressure) also had a stronger inquiry habit of mind. However, experienced social pressure was not found to have a relationship with other aspects of teachers’ inquiry-based working.

We explored how a number of background characteristics were related to inquiry-based working by primary school teachers in the Netherlands. What stood out is that teachers in grade 5 seemed to stimulate students’ data literacy more than teachers who teach in other grades. Perhaps the teaching methods used by teachers differ per grade on this matter, or teachers working in grades 6, 7 and 8 might think students already possess research skills.

In the following study, described in chapter 4, a mixed-method study was used to answer the question: What is the relationship between teachers’ inquiry-based working and
students’ inquiry habit of mind? A students’ inquiry habit of mind includes being curious and having critical thinking habits. For this part of the study, we used the same responses from the 249 teachers as described in chapter 3 and the responses from 1,104 students from grade 5 through grade 8. At the school level the survey data revealed a relationship between teachers’ inquiry-based work and students’ curiosity. The more teachers worked with an inquiry habit of mind and the more teachers stimulated students’ data literacy, the more curious the students in that school appeared. Teachers’ collaborative inquiry with colleagues, teachers’ data literacy, and efforts to stimulate students’ inquiry habit of mind did not seem to influence student curiosity. Three of teachers’ psychological factors regarding inquiry-based working appeared to be important for students’ curiosity: (1) teachers’ positive attitude towards inquiry-based working, (2) a strong sense of self-efficacy regarding inquiry-based working, and (3) collective efficacy regarding inquiry-based working.

However, no relationship was found between any aspect of the teachers’ inquiry-based approach and students’ critical thinking habits. The case study results on the other hand, illustrated several approaches of teachers to work in an inquiry-based manner that could stimulate not only students’ curiosity, but also students’ critical thinking habits.

Chapter 5 presented the key findings from a qualitative case study in three primary schools, focused on the interplay between school boards, school leaders, and teachers regarding inquiry-based working. Each of the three schools had their own reasons for working in an inquiry-based manner. These included innovating and connecting to the demands of today’s changing society, enhancing students’ inquiry habit of mind, and improving students’ test results. In addition, the three schools were situated in quite dissimilar areas and served different populations. Two schools were located in smaller cities in areas with average incomes and an average unemployment rate, while one school was situated in a large city in an area with low incomes and a high unemployment rate. These dissimilarities make this study’s outcomes useful for different types of schools, located in a range of areas and with a variety of reasons to work in an inquiry-based manner. In total we found thirteen ways in which school boards stimulate school leaders’ inquiry-based leadership. For example, we found approaches like: discussing student results together, stimulating to cooperate and discuss research results with school leaders from other schools, trusting and believing, and being open to new ideas concerning research. The other way around school leaders stimulated school board members’ inquiry-based leadership by also trusting and believing in them, by prompting critical questions, and by raising awareness about issues that need to be investigated.
We also found fifteen ways in which school leaders stimulate teachers’ inquiry-based working, including approaches like: modeling behavior, involving external organizations to support teachers in conducting research, sharing leadership with teachers, and creating a safe environment. Teachers stimulated their school leaders’ inquiry-based leadership by asking critical questions and by modeling behavior.

We can conclude that the potential for inquiry-based working in schools is highly stimulated by top-down initiatives: from board to leaders and from leaders to teachers. Nevertheless, this study found powerful approaches that helped teachers to influence leaders and leaders to influence board members to work in an inquiry-based manner.

**General discussion**

**Contributions of this dissertation**

This dissertation contributes to the existing research on data-based working in schools. Firstly by focusing on inquiry-based working instead of data use. Many international studies emphasize the importance of data use in schools (e.g. Anderson et al., 2010; Ikemoto & Marsh, 2007; Jimerson, 2014; Katz & Dack, 2014; Mandinach, 2012; Schildkamp et al., 2012; Schildkamp et al., 2014). However, inquiry-based working differs from the more standard 'data use' in the sense that it does not focus on the use of data but, instead, encourages an approach within schools where inquiry together with the use of data is at the centre. This requires professionals in the school to work with an inquiry habit of mind, to be data literate, and to create a culture of inquiry (Earl & Katz, 2006; Krüger & Geijsel, 2011). Secondly, this dissertation contributes to the existing research on data-based working in schools, by focussing on psychological factors instead of knowledge and skills that are related to this type of work. While the knowledge and skills of school leaders and teachers using data have been studied, little is known about the psychological factors that may influence the extent to which inquiry-based working is carried out (e.g. Vanhoof et al., 2014). Moreover, there is a third gap in the existing research which is narrowed by this dissertation. No research so far has evaluated the potential influence of teachers on the inquiry-based working of school leaders, or the potential influence of school leaders on the inquiry-based working of school boards. The results of this study increases our understanding of the interplay between school boards, school leaders, and teachers regarding inquiry-based working. Indeed, we found that the potential for inquiry-based
working in schools is highly stimulated top-down: from board to leaders and from leaders to teachers. However, we also found several approaches in the influence the other way around: from teachers to leaders and from leaders to boards. This means we no longer can dismiss the influence of the interplay between educators with different roles in schools.

Our findings described in Chapter 2 and 3 offer new insights in how psychological factors are related to whether and how school leaders and teachers work in an inquiry-based manner. In our study self-efficacy regarding inquiry-based working appeared to be important for both school leaders’ as well as teachers’ inquiry-based working. This is in line with earlier research (Krüger & Geijsel, 2011). In addition, our study shows that for teachers also collective efficacy is important. Apparently a high sense of self-efficacy towards inquiry-based working is needed for school leaders and teachers to work in an inquiry-based manner. For teachers also a high sense of collective efficacy is needed. Research of Vanhoof et al. (2014) showed that for school leaders in Flanders a positive attitude towards data use is important. The results of our study show that although related through a strong correlation with other psychological factors, for school leaders and teachers in the Netherlands there is no direct relationship between attitude and inquiry-based working. Perhaps the relationship between psychological factors and inquiry-based working is related to the culture of each country, or psychological factors play different role in either data use and in inquiry-based working.

Our research sought for ways in which educators could be encouraged to work in an inquiry-based manner. There is not a lot of research on the way in which educators at different levels in the school organization influence each other in their inquiry-based working (Schildkamp et al., 2012). Anderson et al. (2010) found four approaches that school boards can use to stimulate school leaders in their inquiry-based working: modeling behavior, having high expectations, developing internal expertise to support inquiry; and providing money, time, and space. Our study, as described in Chapter 5, added to this knowledge and showed a wide variety of 13 ways in which boards can stimulate school leaders to work in an inquiry-based manner. In addition to Andersons’ four approaches we found: discussing student results together with school leaders, encouraging school leaders to discuss student results with teachers, sharing knowledge, making demands regarding inquiry-based working, encouraging leaders to discuss research results with school leaders from other schools, involving external organizations, so as to help school leaders conduct research in a more professional manner, communicating about the vision for inquiry-based working, trusting and believing; and being open to new ideas concerning research.
In addition, we found 15 ways in which school leaders stimulated teachers’ inquiry-based working. Six of these approaches involve school leaders stimulating teachers’ inquiry habit of mind: discuss student results with them, encourage teachers to discuss data with each other, share knowledge, model behavior, make demands, and have high expectations. Jimerson (2014) pointed out that school leaders should support teachers’ effective use of data. We found four ways in which school leaders accomplish that task: involve external organizations, so as to support teachers in conducting research, train teachers in research skills, hand out step-by-step instructions regarding research skills, and shape the school into an “academic primary school.” Finally, we found 5 more ways in which school leaders stimulated teachers’ inquiry-based working: communicate a vision for inquiry-based working, share leadership with teachers, provide money, time, and space, be open to new ideas concerning research, and create a safe environment.

In Chapter 2 and 3 we described that it is important for school leaders to pay attention to psychological factors that might influence teachers’ inquiry-based working. Several of the mentioned approaches might indeed stimulate teachers’ attitude, experienced social pressure, self-efficacy or collective efficacy regarding inquiry-based working. For example, leaders who encourage teachers to discuss data with each other might stimulate with this approach their teachers’ collective efficacy. Leaders (or boards) who communicate a vision for inquiry-based working might stimulate teachers’ (or leaders’) positive attitude towards it. And leaders (boards) making demands might increase teachers’ (leaders’) experienced social pressure.

No research so far studied the potential influence of teachers on school leaders’ inquiry-based working, or the potential influence of school leaders on school boards’ inquiry-based working. The contribution of this dissertation to the existing literature is that this research increases the insight in the interplay between school boards, school leaders, and teachers regarding inquiry-based working. We found that inquiry-based working is highly stimulated top-down: from board to leaders and from leaders to teachers. However, we also found several examples of influence the other way around: from teachers to leaders, and from leaders to boards. For example school leaders and teachers asked critical questions to respectively school boards and school leaders. Teachers modelled behavior and school leaders made their board more aware of issues that needed to be investigated. Knowing that the interplay between boards, leaders, and teachers influences their inquiry-based working is an important insight in stimulating inquiry-based working in schools.
We were also interested in the influence of teachers’ inquiry-based working on students’ curiosity and critical thinking habits. Previous meta-analyses of Furtak et al. (2012) indicated a connection between inquiry-based teaching and improved student learning. However, there is no research on whether teachers’ inquiry-based working also stimulates students’ inquiry habit of mind (curiosity and critical thinking habits). We found that at the school level, teachers can influence the curiosity of students in several ways, for example by working with an inquiry habit of mind, or by stimulating students’ data literacy. However, none of the aspects of teachers’ inquiry-based working in schools or related psychological factors appeared to have any effect on students’ critical thinking habits. Perhaps, stimulating students’ inquiry-habit of mind for teachers means encouraging curiosity, with less emphasis on promoting critical thinking. On the other hand, the case study illustrated that in a school in which teachers continuously focus on stimulating students’ inquiry habit of mind, students were both more curious and more critical. The reason for this difference might be caused by the research method: quantitative by using a questionnaire or qualitative by using interviews and observations. The qualitative study made it possible to ask supplementary questions which made clear that when teachers strongly stimulate students’ inquiry habit of mind their students are curious and possess critical thinking habits.

Methodological considerations

In this study, we used both quantitative and qualitative approaches. We started this research with a quantitative survey amongst school boards, school leaders, teachers and students. Subsequently, we used an embedded multiple-case study design (Yin, 2012) to investigate three schools that scored average to high on inquiry-based working in the survey. In this way, information regarding inquiry-based working was obtained in different ways. The case study results helped explain the survey responses, and provided a more complete picture of school boards’, school leaders’, and teachers’ inquiry-based working and students’ inquiry habit of mind. For instance, the survey results indicated that school leaders encouraged teachers to discuss data with each other. The case study results showed that one way of doing this was by prompting teachers to observe each other in the classroom and discuss the strengths and weaknesses of each other’s teaching techniques. We therefore recommend to perform not only quantitative, but also qualitative measurements while conducting research, as the qualitative results can deepen the quantitative results.
In Chapter 4 we described the mixed-method study on the relationship between teachers’ inquiry-based working and students’ inquiry habit of mind. The questionnaire for teachers was based on existing instruments. The questionnaire to investigate the degree to which students have an inquiry habit of mind, was developed specifically for this study. There was no straightforward way of linking teachers and students, because some teachers taught in more than one class, while some students had more than one teacher. To solve this issue, we aggregated both the teacher and the student data at the school level.

Limitations and directions for further research

A limitation of this study is that only a small number of the invited school boards participated with their schools. In future research in might be a better option to invite school leaders to participate with their boards, instead of inviting school boards to participate with their schools.

Secondly, a limitation of the survey concerns the fact that self-reports were used (see e.g. Schwartz, 1999). Self-reports reflect participants’ own perceptions. The disadvantage of this is that people tend to respond socially desirable (see e.g. Batista-Foguet, Revilla, Saris, Boyatzis and Serlavós, 2014). The use of complementary qualitative research contributed to more insight into school boards’, school leaders’ and teachers’ actual inquiry-based working. A larger qualitative research in more schools would could gain even more insight in this matter.

The study presented in chapter 4 focussed on students’ curiosity and critical thinking habits. The third limitation concerns the fact that we had to aggregate both the teacher data and the student data at the school level. The reason for this was that some teachers taught in more than one class, while some students had more than one teacher. This means that no straightforward link between teachers and students can be made. Since many teachers in the Netherlands have part-time jobs in which two or more teachers share a class together, it is difficult to prevent this.

Based on the results of this study, several other suggestions for future research can be made. Future research could make clear whether there is a mutual influence on inquiry-based working between teachers and students. Perhaps not only teachers have an effect on their students’ inquiry habit of mind, but students also have an effect on their teachers’ inquiry-based working.
In Chapter 5 we described 3 schools at which we conducted our case study research. Each of these three schools had their own reasons and their own vision for inquiry-based working. The question is whether their reasons are representative of other schools, or that there exist other reasons why schools work this way. To gain insight in such underlying visions and describe these, might encourage other schools to follow these examples because they recognize themselves in the outlined stories.

A final suggestion for further research is to use action research as a method to experiment with new approaches to stimulate inquiry-based working in schools. In this way the strategies to encourage inquiry-based working, as described in Chapter 5, could be supplemented and deepened.

Implications for practice and policy

From a practical perspective, our findings are directly relevant not only for school boards and school leaders who want to stimulate inquiry-based working in their schools, but also for educators of school leaders and teachers and for the design of professional development initiatives on this matter. Our findings confirm the conclusions of Vanhoof et al. (2014) that if we want to increase inquiry-based working by teachers, it is not enough to provide knowledge and skills regarding data use. Our study showed that we also need to enhance educators’ self-efficacy and collective efficacy, as well as their attitude. In addition, social pressure also helps. Self-efficacy and collective efficacy can be enhanced by collaborating in peer groups, talking about each other’s capabilities, discovering each person’s strengths, and giving positive feedback. In order to promote a positive attitude and enact social pressure the benefits of inquiry-based working for educational quality should be emphasized by school boards, school leaders and educators of school leaders and teachers.

To promote students’ curiosity, teachers can create a culture of inquiry in the classroom. This means, for example, teaching students how to work with learning questions and research questions, being open to students’ ideas and questions, and facilitating inquiry by providing research materials and having students work together in small groups. Chapter 4 provided several approaches of teachers that could stimulate both students’ curiosity and critical thinking habits. Teacher educators can use these approaches in their teaching to model these type of skills to student teachers.
The study presented in chapter 5 indicated that if we want to encourage educators to work in a more inquiry-based manner, there is the challenge of prompting boards and leaders to clearly formulate their vision for inquiry-based working. In addition, school boards (leaders) should involve school leaders (teachers) in their own data-based decision making. Not only when student assessment data is involved, but also when it comes to decisions at the school level regarding, for example, policy development and planning.

When national policy-makers want to stimulate the broader inquiry-based working in primary schools, they should not only focus on using assessment data in schools, but on the broad spectrum of inquiry-based working, including creating a culture of inquiry in schools. Educators of leaders and teachers could focus on the interventions each of them can undertake to stimulate this type of working in the school organization, not only top-down, but also bottom-up.
Nederlandse samenvatting (summary in Dutch)

Onderzoeksmatig leiden en leren

Onderzoeksmatig werken door bestuurders, schoolleiders en leraren en de onderzoekende houding van leerlingen

Inleiding

Onderzoeksmatig werken draagt bij aan de kwaliteit van het onderwijs (Krüger 2010a) en het leren van leraren (Katz & Dack, 2014). Onderzoeksmatig werken houdt in dat onderwijsprofessionals werken met een onderzoekende houding, onderzoeksvaardigheden beheersen en een onderzoekende cultuur in de school vormgeven (Earl & Katz, 2006). Het doel van het onderzoek dat wordt gepresenteerd in dit proefschrift is inzicht te verkrijgen in het onderzoeksmatig werken van bestuurders, schoolleiders en leraren, in hoe een onderzoekende cultuur in scholen gerealiseerd kan worden en in de invloed van de leraar op de onderzoekende houding van leerlingen. Onder een onderzoekende houding van leerlingen verstaan we dat zij nieuwsgierig en kritisch zijn.

Om na te gaan wat schoolleiders en leraren stimuleert om onderzoeksmatig te werken, is een survey verricht naar de relatie tussen enerzijds de psychologische factoren attitude, ervaren sociale druk, self-efficacy en collective efficacy en anderzijds het onderzoeksmatig werken van schoolleiders en leraren (beschreven in de hoofdstukken 2 en 3). Daarnaast is op drie scholen een casestudie uitgevoerd om de wederzijdse beïnvloeding tussen bestuurders, schoolleiders en leraren ten aanzien van onderzoeksmatig werken te onderzoeken (hoofdstuk 5). Om de relatie tussen het onderzoeksmatig werken van leraren en de onderzoekende houding van leerlingen te onderzoeken, combineerden we de resultaten van de enquête en de casestudie (hoofdstuk 4). In deze samenvatting worden de belangrijkste bevindingen en conclusies van dit proefschrift gepresenteerd, gevolgd door een discussie waarin de bijdrage van dit proefschrift aan theorievorming wordt besproken. Vervolgens worden beperkingen van het onderzoek bediscussieerd en worden aanbevelingen gedaan voor toekomstig onderzoek. Tot slot worden implicaties voor de praktijk en het beleid besproken.
Nederlandse samenvatting (summary in Dutch)

Onderzoeksmatig leiden en leren

Onderzoeksmatig werken door bestuurders, schoolleiders en leraren en de onderzoekende houding van leerlingen

Inleiding

Onderzoeksmatig werken draagt bij aan de kwaliteit van het onderwijs (Krüger 2010a) en het leren van leraren (Katz & Dack, 2014). Onderzoeksmatig werken houdt in dat onderwijsprofessionals werken met een onderzoekende houding, onderzoeksvaardigheden beheersen en een onderzoekende cultuur in de school vormgeven (Earl & Katz, 2006). Het doel van het onderzoek dat wordt gepresenteerd in dit proefschrift is inzicht te verkrijgen in het onderzoeksmatig werken van bestuurders, schoolleiders en leraren, in hoe een onderzoekende cultuur in scholen gerealiseerd kan worden en in de invloed van de leraar op de onderzoekende houding van leerlingen. Onder een onderzoekende houding van leerlingen verstaan we dat zij nieuwsgierig en kritisch zijn.

Om na te gaan wat schoolleiders en leraren stimuleert om onderzoeksmatig te werken, is een survey verricht naar de relatie tussen enerzijds de psychologische factoren attitude, ervaren sociale druk, self-efficacy en collective efficacy en anderzijds het onderzoeksmatig werken van schoolleiders en leraren (beschreven in de hoofdstukken 2 en 3). Daarnaast is op drie scholen een casestudie uitgevoerd om de wederzijdse beïnvloeding tussen bestuurders, schoolleiders en leraren ten aanzien van onderzoeksmatig werken te onderzoeken (hoofdstuk 5). Om de relatie tussen het onderzoeksmatig werken van leraren en de onderzoekende houding van leerlingen te onderzoeken, combineerden we de resultaten van de enquête en de casestudie (hoofdstuk 4). In deze samenvatting worden de belangrijkste bevindingen en conclusies van dit proefschrift gepresenteerd, gevolgd door een discussie waarin de bijdrage van dit proefschrift aan theorievorming wordt besproken. Vervolgens worden beperkingen van het onderzoek bediscussieerd en worden aanbevelingen gedaan voor toekomstig onderzoek. Tot slot worden implicaties voor de praktijk en het beleid besproken.
Samenvatting van de belangrijkste resultaten

In hoofdstuk 2 wordt een studie gepresenteerd naar onderzoeksmatig leiderschap. De centrale vraag is als volgt geformuleerd: *Wat is de relatie tussen attitude, ervaren sociale druk en self-efficacy en onderzoeksmatig leiderschap van schoolleiders in het basisonderwijs?* Negenenzeventig schoolleiders vulden een vragenlijst in over hun attitude ten aanzien van onderzoeksmatig leiderschap, de sociale druk die ze ervaren om onderzoeksmatig leiding te geven en hun self-efficacy met betrekking tot onderzoeksmatig leiderschap. Ook werd in de vragenlijst gevraagd naar drie aspecten van onderzoeksmatig leiderschap: het hebben van een onderzoekende cultuur. *Self-efficacy met betrekking tot onderzoeksmatig leiderschap* blijkt samen te hangen met alle drie de aspecten van onderzoeksmatig leiderschap. Het enige sub-aspect waarmee self-efficacy geen specifieke samenhang liet zien was het stimuleren van de onderzoekende houding van leraren. *Attitude ten opzichte van onderzoeksmatig leiderschap* bleek gerelateerd aan twee sub-aspecten van het vormgeven van een onderzoekende cultuur: het communiceren van een visie op onderzoeksmatig werken en het stimuleren van de onderzoekende houding van leraren. Tussen *ervaren sociale druk* en onderzoeksmatig leiderschap werd geen relatie gevonden. Tussen de drie psychologische factoren (attitude, ervaren sociale druk en self-efficacy) zelf, en tussen elke psychologische factor afzonderlijk en alle aspecten van onderzoeksmatig leiderschap werd echter wel een sterke positieve correlatie gevonden. Dit betekent dat de psychologische factoren self-efficacy, attitude en ervaren sociale druk met betrekking tot onderzoeksmatig leiderschap soms geen unieke bijdrage leveren, maar desondanks wel een sterke relatie hebben met onderzoeksmatig leiderschap.

Met deze studie werd ook de rol van verschillende achtergrondkenmerken onderzocht. Rekening houdend met de psychologische factoren, blijkt leeftijd gerelateerd te zijn aan twee aspecten van onderzoeksmatig leiderschap: schoolleiders in de leeftijdsgroep 51-60 scoorden hoger dan anderen op zowel het stimuleren van de onderzoekende houding van leraren, als het stimuleren van onderzoeksvaardigheden van leraren. Dit betekent dat de deelnemende schoolleiders in de leeftijdsgroep 51-60 hun scholen op een meer onderzoekende manier leiden dan jongere leiders, wellicht doordat zij meer ervaring hebben.

**Hoofdstuk 3** beschrijft de relatie tussen psychologische factoren en het onderzoeksmatig werken van leraren. De centrale vraag van dit onderzoek is: *Wat is de relatie tussen attitude, ervaren sociale druk, self-efficacy en collective efficacy en het onderzoeksmatig
werken van leraren in het basisonderwijs in Nederland? De vragenlijst werd ingevuld door 249 leraren.

Evenals in hoofdstuk 2, viel *self-efficacy met betrekking tot onderzoeksmatig werken* het meest op. Deze factor bleek gerelateerd aan alle aspecten van onderzoeksmatig werken door leraren. Leraren met een sterk gevoel van self-efficacy op het gebied van onderzoeksmatig werken hadden een sterk onderzoekende houding, beheersten in hoge mate onderzoeksvaardigheden en droegen sterk bij aan het vormgeven van een onderzoekende cultuur op zowel school- als klasniveau. Het lijkt erop dat leraren vooral onderzoeksmatig werken als ze echt van zichzelf geloven dat zij dat kunnen. *Collective efficacy met betrekking tot onderzoeksmatig werken* bleek samen te hangen met drie deelaspecten van het vormgeven van een onderzoekende cultuur: op schoolniveau samenwerken met collega’s en op klasniveau het stimuleren van zowel de onderzoekende houding, als de onderzoeksvaardigheden van leerlingen. Kennelijk is het geloof en vertrouwen dat leraren hebben in het eigen team op het gebied van onderzoeksmatig werken relevant voor het vormgeven van een onderzoekende cultuur op zowel school- als klasniveau. In tegenstelling tot self-efficacy met betrekking tot onderzoeksmatig werken was er geen relatie tussen collective efficacy en het hebben van een onderzoekende houding en het beheersen van onderzoeksvaardigheden. Daarnaast liet deze studie zien dat leraren in het basisonderwijs met een sterk positieve *attitude ten opzichte van onderzoeksmatig werken* hoog scoorden op het hebben van een onderzoekende houding. Tussen attitude en de andere aspecten van onderzoeksmatig werken werd echter geen directe relatie gevonden. Leraren die sterk het gevoel hadden dat anderen van hen verwachten dat zij onderzoeksmatig werken (*ervaren sociale druk*), hadden ook een sterke onderzoekende houding. Ervaren sociale druk had echter geen relatie met andere aspecten van het onderzoekmatig werken van leraren.

We onderzochten tevens de rol van verschillende achtergrondkenmerken in relatie tot het onderzoeksmatig werken van leraren. Wat opviel was dat leraren in groep 5 de onderzoekende houding van leerlingen meer stimuleren dan leraren in andere groepen. Wellicht verschillen de lesmethodes per groep op dit gebied, of denken leraren in de groepen 6, 7 en 8 dat leerlingen onderzoeksvaardigheden al beheersen.

In de volgende studie, beschreven in *hoofdstuk 4*, is een mixed-method studie gebruikt om de volgende vraag te beantwoorden: *Wat is de relatie tussen het onderzoeksmatig werken van leraren en de onderzoekende houding van leerlingen?* Een onderzoekende houding bij leerlingen houdt in dat ze nieuwsgierig en kritisch zijn. Voor dit deel van de studie gebruikten
we data van dezelfde 249 leraren als in hoofdstuk 3 en die van 1.104 leerlingen uit de groepen 5 tot en met 8. Op schoolniveau lieten de resultaten een relatie zien tussen het onderzoeksmatig werken van leraren en de nieuwsgerigheid van leerlingen. Hoe hoger leraren scoorden op het werken met een onderzoekende houding en het stimuleren van onderzoeksvaardigheden van leerlingen, hoe hoger leerlingen op die school scoorden op nieuwsgerigheid. Samenwerken aan onderzoek met collega’s, zelf onderzoeksvaardigheden beheersen en een onderzoekende houding stimuleren bij leerlingen leken geen effect te hebben op de nieuwsgerigheid van leerlingen. Drie psychologische factoren van leraren op het gebied van onderzoeksmatig werken bleken belangrijk voor de nieuwsgerigheid van leerlingen: (1) een positieve attitude ten opzichte van onderzoeksmatig werken, (2) een sterk gevoel van self-efficacy ten opzichte van onderzoeksmatig werken en (3) een sterk gevoel van collective efficacy ten opzichte van onderzoeksmatig werken.

Er bleek echter geen enkele relatie tussen de verschillende aspecten van onderzoeksmatig werken van leraren en de kritische houding van leerlingen. De casestudie daarentegen, liet verschillende manieren zien waarop leraren niet alleen de nieuwsgerigheid, maar ook de kritische houding van leerlingen kunnen stimuleren.

**Hoofdstuk 5** beschrijft de belangrijkste uitkomsten van een kwalitatieve casestudie op drie basisscholen, gericht op de wisselwerking tussen het onderzoeksmatig werken van bestuurders, schoolleiders en leraren. Elk van de drie scholen had zijn eigen redenen om op een onderzoeksmatige manier te werken: respectievelijk blijvend willen innoveren om zo tegemoet te komen aan de eisen van de veranderende samenleving, de onderzoekende houding van leerlingen willen stimuleren en toetsresultaten willen verbeteren. De drie scholen waren gesitueerd in verschillende regio’s en verschilden wat betreft hun leerlingpopulatie. Twee scholen stonden in kleinere steden in wijken met een gemiddeld inkomen en een gemiddelde werkloosheid, terwijl één school in een grote stad stond in een wijk met lage inkomen en een hoge werkeloosheid. Deze verschillen maken de uitkomsten van dit onderzoek relevant voor verschillende soorten scholen, uit verschillende regio’s en met verschillende redenen om onderzoeksmatig te werken. In totaal hebben we dertien verschillende manieren gevonden waarop bestuurders het onderzoeksmatig leiderschap van schoolleiders stimuleerden. Zo vonden we strategieën als: leerlingresultaten samen bespreken, stimuleren dat schoolleiders samenwerken met andere scholen en samen onderzoeksresultaten bespreken, vertrouwen en geloven in de ander en openstaan voor nieuwe ideeën met betrekking tot onderzoek. Andersom stimuleerden schoolleiders hun bestuurders eveneens tot onderzoeksmatig leiderschap door
vertrouwen en geloof in hen te hebben, door kritische vragen te stellen, en door hen bewust te maken van zaken die moeten worden onderzocht.

Ook vonden we vijftien manieren waarop schoolleiders het onderzoeksmatig werken van leraren stimuleerden, zoals: modellen van gedrag, betrekken van externe organisaties om leraren te ondersteunen bij het uitvoeren van onderzoek, delen van leiderschap met leraren en creëren van een veilige omgeving. Leraren stimuleerden het onderzoeksmatig leiderschap van hun schoolleiders door kritische vragen te stellen en ook door het modellen van gedrag.

We kunnen concluderen dat het potentieel voor onderzoeksmatig werken in scholen sterk gestimuleerd wordt door top-down initiatieven: van bestuurders naar schoolleiders en van schoolleiders naar leraren. Deze studie heeft echter ook laten zien dat er krachtige benaderingen zijn waarmee leraren hun schoolleiders en schoolleiders hun bestuurders kunnen stimuleren om onderzoeksmatig te werken.

**Discussie**

Dit proefschrift levert een aanvulling op de bestaande literatuur over onderzoeksmatig werken. Ten eerste doordat het zich niet alleen richt op het gebruik van data in scholen, dat in internationale studies wordt benadrukt (e.g. Anderson et al., 2010; Ikemoto & Marsh, 2007; Jimerson, 2014; Katz & Dack, 2014; Mandinach, 2012; Schildkamp et al., 2012; Schildkamp et al., 2014), maar ook op het belang van een onderzoekende houding, onderzoeksvaardigheden en een onderzoekende cultuur in de school (Earl & Katz, 2006; Krüger & Geijsel, 2011). Ten tweede levert dit proefschrift een aanvulling op de bestaande literatuur door te focussen op psychologische factoren in plaats van op de kennis en vaardigheden die nodig zijn voor deze manier van werken. Terwijl kennis en vaardigheden van schoolleiders en leraren met betrekking tot onderzoeksmatig werken in diverse studies zijn onderzocht, is er nog maar weinig bekend over de relatie hiervan met psychologische factoren (Vanhoof et al., 2014). Ten derde onderzochten we niet alleen de mogelijke invloed van bestuurders op schoolleiders en van schoolleiders op leraren, maar bestudeerden we ook de invloed van schoolleiders op het onderzoeksmatig werken van bestuurders en van leraren op het onderzoeksmatig werken van schoolleiders.

De resultaten van hoofdstuk 2 en 3 bieden nieuwe inzichten in de manier waarop psychologische factoren zijn gerelateerd aan de mate waarin en de manier waarop schoolleiders
en leraren onderzoeksmatig werken. In ons onderzoek bleek self-efficacy met betrekking tot onderzoeksmatig werken een belangrijke rol te spelen bij de mate waarin schoolleiders en leraren onderzoeksmatig werken. Dit sluit aan bij resultaten uit eerder onderzoek (Krüger & Geijsel, 2011). In aanvulling daarop blijkt uit ons onderzoek dat voor leraren ook collective efficacy belangrijk is bij het onderzoeksmatig werken. Blijkbaar hebben schoolleiders en leraren een hoge mate van self-efficacy met betrekking tot onderzoeksmatig werken nodig om op een onderzoeksmatige manier te werken. Leraren hebben daarnaast ook een sterk gevoel van collective efficacy nodig. Uit onderzoek van Vanhoof et al. (2014) kwam naar voren dat voor schoolleiders in Vlaanderen met name een positieve attitude ten opzichte van het gebruiken van data belangrijk is. Uit de resultaten van ons onderzoek kwam dit minder sterk naar voren. Wellicht is de relatie tussen psychologische factoren en onderzoeksmatig werken cultuurgebonden, of spelen psychologische factoren een andere rol bij het gebruiken van data, dan bij onderzoeksmatig werken. Op basis van eerder onderzoek (Earl & Katz 2006; Schildkamp et al., 2013) vermoedden we dat ervaren sociale druk een belangrijke factor zou zijn bij het al dan niet onderzoeksmatig werken van schoolleiders en leraren. Ook ervaren sociale druk met betrekking tot onderzoeksmatig werken blijkt echter alleen een indirecte relatie te hebben met onderzoeksmatig werken.

Er is niet veel onderzoek naar de manier waarop professionals op verschillende lagen in de schoolorganisatie elkaar beïnvloeden als het gaat om onderzoeksmatig werken (Schildkamp et al., 2012). Anderson et al. (2010) vonden een viertal strategieën die bestuurders kunnen toepassen om schoolleiders te stimuleren in hun onderzoeksmatig leiderschap: voorbeeldgedrag vertonen, hoge verwachtingen hebben, interne expertise van professionals in de school benutten en faciliteren in tijd, geld en ruimte. Onze studie die is beschreven in hoofdstuk 5 vulde aan tot 13 verschillende strategieën waarop bestuurders onderzoeksmatig leiderschap stimuleerden. Zij doen dit bijvoorbeeld door leerlingresultaten met schoolleiders te bespreken, schoolleiders te stimuleren om onderzoeksresultaten met andere schoolleiders te bespreken en open te staan voor nieuwe onderzoeksideeën. Daarnaast vonden we 15 strategieën waarop schoolleiders het onderzoeksmatig werken van leraren stimuleren. Jimerson (2014) geeft aan dat schoolleiders onderzoeksvaardigheden van leraren moeten stimuleren. We vonden vier manieren waarop schoolleiders dat doen, bijvoorbeeld door externen te betrekken en door stapsgewijze instructies over onderzoek doen aan te reiken. Omdat we breder keken dan alleen beheersen van onderzoeksvaardigheden vonden we daarnaast zes strategieën die gericht waren op het stimuleren van de onderzoekende houding van leraren (zoals leraren stimuleren om
leerlingresultaten met elkaar te bespreken en voorbeeldgedrag te tonen). Tot slot vonden we nog vijf strategieën waarmee schoolleiders leraren ondersteunden in het onderzoeksmatig werken (zoals leiderschap spreiden en een veilige omgeving creëren).

In hoofdstuk 2 en 3 kwam naar voren dat het belangrijk is om als leidinggevende ook aandacht te hebben voor psychologische factoren. Diverse van de genoemde strategieën sluiten daar op aan. Schoolleiders die leraren stimuleren om data met elkaar te bespreken bijvoorbeeld, kunnen met deze aanpak de collective efficacy van hun leraren stimuleren. Bestuurders (respectievelijk schoolleiders) die een visie op onderzoeksmatig werken communiceren, zouden daarmee een positieve attitude van schoolleiders (respectievelijk leraren) ten opzichte van onderzoeksmatig werken kunnen stimuleren. En bestuurders (schoolleiders) die eisen stellen op dit gebied, zouden daarmee de sociale druk die door schoolleiders (leraren) wordt ervaren kunnen verhogen.

Geen enkel onderzoek tot nu toe bestudeerde de mogelijke invloed van leraren op het onderzoeksmatig werken van schoolleiders, of van schoolleiders op het onderzoeksmatig werken van bestuurders. De bijdrage van dit proefschrift aan de bestaande onderzoeks literatuur is dat dit onderzoek het inzicht vergroot in de wisselwerking tussen bestuurders, schoolleiders en leraren ten aanzien van onderzoeksmatig werken. We vonden dat het potentieel voor onderzoeksmatig werken in scholen sterk top-down gestimuleerd wordt: van bestuur naar schoolleiders en van schoolleiders naar leraren. We vonden echter ook verschillende voorbeelden van invloed de andere kant op: van leraren naar schoolleiders en van schoolleiders naar bestuurders. Schoolleiders en leraren stelden bijvoorbeeld kritische vragen aan respectievelijk bestuurders en schoolleiders. Leraren toonden voorbeeldgedrag en schoolleiders maakten bestuurders bewust van zaken die onderzocht dienen te worden. Het gegeven dat de wisselwerking tussen professionals op verschillende lagen in de school van invloed is op het onderzoeksmatig werken is een belangrijk inzicht voor het stimuleren van onderzoeksmatig werken in scholen.

We waren ook geïnteresseerd in de invloed van het onderzoeksmatig werken van leraren op de nieuwsgierigheid en kritische houding van leerlingen. Een meta-analyse van Furtak et al. (2012) wees op een verband tussen onderzoeksmatig werken in de klas en verbeterde leerresultaten van leerlingen. Er is echter niet eerder onderzoek gedaan naar de vraag of het onderzoeksmatig werken van leraren ook invloed heeft op de onderzoekende houding van leerlingen (nieuwsgierig en kritisch zijn). Dit onderzoek liet zien dat leraren de nieuwsgierigheid van leerlingen op verschillende manieren beïnvloeden, bijvoorbeeld door zelf
te werken met een onderzoekende houding, of door het stimuleren van onderzoeksvaardigheden van leerlingen. Geen enkel aspect van het onderzoeksmatig werken van leraren in de school of van de psychologische factoren die daarmee samenhangen, bleek echter een effect te hebben op de kritische houding van leerlingen in de school. Leraren die de onderzoekende houding van leerlingen stimuleren, bevorderen hiermee kennelijk vooral de nieuwsgierigheid van leerlingen en minder het kritisch denken. Aan de andere kant liet de casestudie zien dat in een school waar leraren sterk gericht waren op het stimuleren van de onderzoekende houding van leerlingen, de leerlingen zowel nieuwsgieriger als kritischer waren. De reden voor het verschil kan te maken hebben met de wijze waarop de informatie verzameld is: kwantitatief met een vragenlijst dan wel kwalitatief door middel van observaties en interviews. In het kwalitatieve onderzoek kon meer doorgevraagd en uitgediept worden.

**Beperkingen en aanbevelingen voor toekomstige studies**

Een eerste beperking van dit onderzoek is dat slechts een klein aantal van de uitgenodigde schoolbesturen met hun scholen aan het onderzoek heeft deelgenomen. In toekomstig onderzoek is het wellicht een betere optie om schoolleiders uit te nodigen om deel te nemen met hun bestuurders, in plaats van schoolbesturen uit te nodigen om deel te nemen met hun scholen.


De studie die is beschreven in hoofdstuk 4 is gericht op het stimuleren van de nieuwsgierigheid en de kritische houding van leerlingen. De derde beperking heeft betrekking op het feit dat we zowel de data van de leraren als die van de leerlingen moesten aggregeren op schoolniveau. De reden hiervoor was dat sommige leraren in meer dan een klas lesgaven en sommige leerlingen meer dan een leraar hadden en er geen duidelijke relatie gelegd kon worden tussen leraren en leerlingen individueel. Dit betekent dat er geen directe link gelegd kan worden
tussen leraren en leerlingen. Aangezien in het Nederlandse onderwijs veel gewerkt wordt in duobanen waarbij meerdere leraren samen een groep hebben is het lastig om dit te voorkomen.

Op basis van de resultaten van deze studie kunnen diverse andere suggesties voor toekomstig onderzoek gedaan worden. Toekomstig onderzoek zou duidelijk kunnen maken of leraren en leerlingen elkaar wederzijds beïnvloeden op het gebied van onderzoeksmatig werken. Wellicht hebben niet alleen leraren invloed op de onderzoekende houding van leerlingen, maar hebben leerlingen ook invloed op het onderzoeksmatig werken van leraren.

De drie scholen die in hoofdstuk 5 werden beschreven hadden verschillende redenen om onderzoeksmatig te werken. Het is de vraag of hun redenen representatief zijn voor andere scholen, of dat er nog andere redenen bestaan waarom scholen op deze manier werken. Meer te weten komen over dergelijke redenen en achterliggende visies en deze beschrijven kan ervoor zorgen dat meer scholen zich herkennen in de geschetste verhalen waardoor zij gestimuleerd worden om deze voorbeelden te volgen.

Een laatste suggestie voor toekomstig onderzoek is om actieonderzoek in te zetten waarin geëxperimenteerd wordt met nieuwe aanpakken om het onderzoeksmatig werken op scholen te stimuleren. Op deze wijze kunnen de strategieën voor het stimuleren van onderzoeksmatig werken die in hoofdstuk 5 zijn beschreven, aangevuld en verder uitgediept worden.

**Implicaties voor praktijk en beleid**

Vanuit praktisch oogpunt zijn onze bevindingen niet alleen direct relevant voor bestuurders en schoolleiders die onderzoeksmatig werken willen stimuleren in hun scholen, maar ook voor de opleiders van schoolleiders en leraren en voor ontwikkelaars van initiatieven voor professionele ontwikkeling op dit terrein. Onze bevindingen bevestigen de conclusies van Vanhoof et al. (2014), dat als we het onderzoeksmatig werken van leraren willen verhogen, het niet genoeg is om alleen te werken aan kennis en vaardigheden met betrekking tot het gebruiken van data. We moeten ook de self-efficacy en collective efficacy van professionals versterken, evenals hun positieve attitude ten aanzien van onderzoeksmatig werken. Bovendien blijkt dat externe sociale druk ook helpt. Self-efficacy en collective efficacy kan worden versterkt door samen te werken in peer groups, door te praten over de eigen en elkaars capaciteiten en ieders sterke punten, en het geven van positieve feedback. Om een positieve attitude te bevorderen en leraren en
schoolleiders sociale druk met betrekking tot onderzoeksmatig werken te laten ervaren, kunnen de voordelen van onderzoeksmatig werken voor de kwaliteit van het onderwijs benadrukken door bestuurders, schoolleiders en opleiders van schoolleiders en leraren.

Om de nieuwsgierigheid van leerlingen te bevorderen, kunnen leraren een onderzoekende cultuur in de klas creëren. Hoofdstuk 4 laat verschillende manieren zien waarop leraren de nieuwsgierigheid en het kritisch denken van leerlingen kunnen stimuleren. Leraren kunnen leerlingen bijvoorbeeld leren werken met leer- en onderzoeksvragen, openstaan voor ideeën en onderzoeksvragen van leerlingen en onderzoek faciliteren door middel van het verstrekken van onderzoeksmaterialen en het inzetten van werkvormen waarbij leerlingen kunnen samenwerken in kleine groepen. Lerarenopleiders kunnen deze benaderingen gebruiken in hun eigen didactische aanpak om zo model te staan voor aankomende leraren.

De studie die is beschreven in hoofdstuk 5 laat zien dat, als we onderwijsprofessionals willen stimuleren om meer onderzoeksmatig te werken, er een uitdaging ligt voor bestuurders en schoolleiders om hun visie op onderzoeksmatig werken helder te formuleren. Daarnaast kunnen bestuurders hun schoolleiders en schoolleiders hun leraren meer betrekken bij hun eigen op data gebaseerde besluitvorming. Niet alleen als het gaat om leerlingresultaten, maar ook als het gaat om beslissingen op schoolniveau en bijvoorbeeld het ontwikkelen en vormgeven van beleid.

Wanneer nationale beleidsmakers het onderzoeksmatig werken in basisscholen willen stimuleren, moeten zij zich niet alleen richten op het gebruiken van toetsresultaten in scholen, maar op het bredere spectrum van onderzoeksmatig werken, inclusief het hebben van een onderzoekende houing en het vormgeven van een onderzoeksmatige cultuur in de school. Opleiders van schoolleiders en leraren kunnen aandacht besteden aan interventies om onderzoeksmatig werken in de schoolorganisatie, niet alleen top-down, maar ook bottom-up te stimuleren.
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Lisette Uiterwijk-Luijk was born on July 16th, 1970, in Maassluis, the Netherlands. After receiving her secondary school diploma from the Griftland College in Soest in 1988, she moved to London for a year to work as an au pair. In 1989, she started her study at the Marnix Academy, a university of applied sciences to become a primary school teacher. After graduating in 1993 she worked as a teacher in several primary schools. At the same time she studied Educational Sciences at the University of Utrecht and graduated in 1998. Next, she worked as an educationalist at Innovam, an expert center for training, certification and consultancy in the mobility sector. After that, in 2001, she started working at the Marnix Onderwijscentrum, an institute for further training and educational advice for primary schools, which is part of the Marnix Academy. At the same time she started working at Octaaf, which later on became Penta Nova, Academy for leadership in Education. In 2012, the board of the Marnix Academy enabled her to start a PhD study at the University of Amsterdam. She did her study alongside her work as a consultant, curriculum developer and coordinator of the Master Educational Leadership. In 2017, she also started working at the Netherlands Initiative for education research (Dutch acronym: NRO), which has been established to reduce the gap between scientific research and educational practice.
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Publications

**Articles in peer-reviewed journals**


**Articles submitted for publication**


**Professional publications**


**Conference contributions (selection)**

Publications

Articles in peer-reviewed journals


Articles submitted for publication


Professional publications


Conference contributions (selection)

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Contributions of the author and co-authors to the papers in this dissertation

Chapter 2 is based on:


**Contributions**

Lisette Uiterwijk-Luijk is the first author of this paper. She reviewed the literature, developed the instruments, collected and analysed the data, and drafted the initial manuscript. The research team further consisted of Monique Volman, Meta Krüger, and Bonne Zijlstra, who were the supervisors of Lisette Uiterwijk-Luijk. The research team collaboratively conceptualized and designed the study. Lisette Uiterwijk-Luijk and Bonne Zijlstra discussed all the steps in the process of analysis and its outcomes, and where necessary the primary data were rechecked. The supervisors contributed to the analysis and interpretation of the data, and reviewed the manuscript.

Chapter 3 is based on:


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Lisette Uiterwijk-Luijk is the first author of this paper. She reviewed the literature, developed the instruments, collected and analysed the data, and drafted the initial manuscript. The research team further consisted of Monique Volman, Meta Krüger, and Bonne Zijlstra, who were the supervisors of Lisette Uiterwijk-Luijk. The research team collaboratively conceptualized and designed the study. Lisette Uiterwijk-Luijk and Bonne Zijlstra discussed all the steps in the process of analysis and its outcomes, and where necessary the primary data were rechecked.
The supervisors contributed to the analysis and interpretation of the data, and reviewed the manuscript.

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Lisette Uiterwijk-Luijk is the first author of this paper. She reviewed the literature, developed the instruments, collected and analysed the data, and drafted the initial manuscript. The research team further consisted of Monique Volman, Meta Krüger, and Bonne Zijlstra, who were the supervisors of Lisette Uiterwijk-Luijk. The research team collaboratively conceptualized and designed the study. The research team discussed all the steps in the process of analysis and its outcomes. The supervisors contributed to the analysis and interpretation of the data, and reviewed the manuscript.

**Participating investigators**

Judith Amels participated in coding the interview transcripts.

Lucy Gooskens contributed in data collection

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Lisette Uiterwijk-Luijk is the first author of this paper. She reviewed the literature, developed the instruments, collected and analysed the data, and drafted the initial manuscript. The research team further consisted of Monique Volman and Meta Krüger, who were the supervisors of Lisette Uiterwijk-Luijk. The research team collaboratively conceptualized and designed the study. The research team discussed all the steps in the process of analysis and its outcomes. The
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De eerste die mij op het idee zette om überhaupt aan promotieonderzoek te beginnen was Ron de Bakker, opleidingsmanager van het Marnix Onderwijscentrum. "Maar denk eraan: het is wel monnikenwerk!" waarschuwde jij me nog. En dat was het af en toe zeker! Dan jij wel Ron, dat jij dit in mij zag, nog voordat ik dat zelf deed, mij op dit spoor hebt gezet en me altijd hebt ondersteund om door te gaan. Ik waardeer het enorm dat de Marnix Academie mij de mogelijkheid heeft geboden om twee dagen per week te besteden aan dit onderzoek.

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Dankwoord

De eerste die mij op het idee zette om überhaupt aan promotieonderzoek te beginnen was Ron de Bakker, opleidingsmanager van het Marnix Onderwijscentrum. “Maar denk eraan: het is wel monnikenwerk!” waarschuwde jij me nog. En dat was het af en toe zeker! Dank je wel Ron, dat jij dit in mij zag, nog voordat ik dat zelf deed, mij op dit spoor hebt gezet en me altijd hebt ondersteund om door te gaan. Ik waardeer het enorm dat de Marnix Academie mij de mogelijkheid heeft geboden om twee dagen per week te besteden aan dit onderzoek.

In de kenniskring Leiderschap in het onderwijs van Penta Nova, met Meta Krüger als lector, kreeg het eerste idee van promotieonderzoek doen verder vorm. Meta, dank je wel dat je mijn copromotor hebt willen zijn. Dank voor je vertrouwen, je stimulans en je ondersteuning. Ik kon bij je terecht met grote en kleine vragen. We hebben heel wat keren om de tafel gezeten in Utrecht en Amsterdam en zaken doorgesproken. Je kon me pittige feedback geven, maar was ook enorm positief en enthousiast wanneer ik dan weer zaken had aangepast en verder was gekomen in mijn onderzoek.

Met mijn promotor Monique Volman ben ik van begin tot eind heel erg blij geweest. Monique, je hebt me het vertrouw gegeven om dit als buitenpromovendus te kunnen doen. We hebben, samen met de andere begeleiders, vele gesprekken gevoerd op jouw kamer op de UvA. Je zorgde ervoor dat ik sterker in mijn onderzoek kwam te staan, mijn stukken sterker onderbouwde en steeds weer verder aanscherpte. Dank je wel voor jouw betrokkenheid.

Bonne Zijlstra, sloot zich als copromotor aan bij mijn onderzoek. Bonne, jouw methodologische ondersteuning heeft me grote stappen vooruit geholpen. Jij hielp me met ingewikkelde analyses, maar liet het me ook gewoon zelf uitvogelen wanneer je dacht dat ik dat wel kon.

De leden van de kenniskring waren als een klankbord waar ik terecht kon met mijn vragen, mijn frustraties en mijn successen. De congressen die we samen mochten bezoeken in Istanbul, IJsland en Canada waren hoogtepunten waarin we elkaar goed hebben leren kennen. In het bijzonder wil ik twee leden van de kenniskring noemen. Allereerst Judith Amels, die onvermoeibaar vele uren met mij achter de computer in een kleine ruimte op de Marnix zat om samen interviews te labelen, een codeboom te maken en begrippen nader te definiëren. Ten tweede Gerlo Teunis, bij wie ik op zijn scholen en bij zijn bestuur een pilot uit mocht voeren om mijn vragenlijsten aan te scherpen.
Uiteraard wil ik ook al die bestuurders, schoolleiders, leraren en leerlingen bedanken die mee hebben gedaan aan mijn onderzoek. Wat heb ik vaak gehoord dat we in het onderwijs onderzoeksmoe raken, dat er zo veel enquêtes binnenkomen en verzoeken om deel te nemen aan weer een onderzoek. Dat het tijd en energie kost die jullie liever in andere zaken steken. Wat geweldig dat jullie de waarde van mijn onderzoek hebben ingezien en hier een bijdrage aan hebben willen leveren!

In de eerste jaren van mijn onderzoek was het mijn vader die als critical friend met me meelas. Als leek in het onderwijs zette hij vraagtekens bij zaken die voor mij zo vanzelfsprekend waren. Hij haalde toch nog een laatste taal- of spelfout uit teksten die ik al honderd keer had doorgenomen. Wat is het ongelooftelijk jammer dat hij niet bij mijn promotie kan zijn. Wat zou hij trots geweest zijn… Lieve mam, dank je wel dat jij en papa mij altijd hebben gestimuleerd om door te leren en verder te komen en dat jullie me het doorzettingsvermogen hebben meegegeven waardoor hier nu mijn proefschrift ligt.

Tot slot wil ik mijn gezin bedanken. Lieve Niels, Jesse en Cherelle, jullie hebben mij regelmatig moeten missen als ik weer eens achter de computer kroop. Toch heb ik van jullie steeds alle ruimte gekregen om dit onderzoek te doen en af te ronden. Zonder jullie steun had ik dit nooit kunnen doen. Dank je wel, jullie zijn geweldig!
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