Teachers' Inquiry-Based Attitude as an Objective in Teacher Education

Marie-Jeanne Meijer

About the cover

The cover of this book displays the Helix Bridge in Singapore which was inspired by the form of the DNA structure. This bridge represents the results of this study in two ways. The two helix structures embody the interwovenness of the two dimensions of the Inquiry-Based Attitude. The bridge also illustrates the connection between educational theory and educational practice by conducting this research in partnership with practitioners.

ISBN: 978 94 6159 679 6

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Printing: Datawyse | Universitaire Pers Maastricht

Teachers' Inquiry-Based Attitude as an Objective in Teacher Education

Proefschrift

ter verkrijging van de graad van doctor
aan de Open Universiteit
op gezag van de rector magnificus
prof. mr. A. Oskamp
ten overstaan van een door het
College voor promoties ingestelde commissie
in het openbaar te verdedigen

op vrijdag 21 april 2017 te Heerlen
om 13.30 uur precies

door

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geboren op 11 april 1962 te Zevenaar

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CHAPTER 1

Introduction

Introduction

The development of Inquiry-Based Attitude is internationally accepted as an essential new objective in educating and professionalising teachers. This emphasis on developing Inquiry-Based Attitude is important in a dynamic labour market that requires lifelong learning. Theoretical notions reflect the importance of Inquiry-Based Attitude as a facilitator of teachers' ability to continuously and sustainably renew their professional teaching performance and develop innovative practice (Cochran-Smith & Lytle, 2009; Cochran-Smith & Zeichner, 2010; Leeman & Wardekker, 2014; Mason, 2009; OCW/EZ, 2009; Onderwijsraad, 2014). This issue of continuation and sustainability from a lifelong learning perspective needs particular attention in teacher education (Hargreaves, 2003). After all, teacher educators play a key role in training teachers whose impact on learning outcomes has been convincingly proven (Hattie, 2003), and contribute to a nation's economic growth (Barber & Mourshed, 2007; Mourshed, Chijioke & Barber, 2010). Teacher educators therefore have a responsibility to train teachers who will improve and sustain the quality of their professional performance throughout their career (Barron & Darling-Hammond, 2008; Kuijpers, 2012). An Inquiry-Based Attitude as part of teachers' professional identity is necessary for the continuous professional development expected of them.

The attention paid to Inquiry-Based Attitude in teachers is not only connected to the perspective of lifelong learning, but also to a wider international tendency towards the development of a practice-based research culture in education in general (e.g. Cochran-Smith & Zeichner, 2010) and in higher vocational education in the Netherlands in particular (Griffioen, 2013). The guiding principle is to bridge the gap between theory and practice (retrieved from Vereniging van Lectoren website, 5 September 2016: https://www.lectoren.nl/vereniging). The ambition is to be more successful in contributing to innovation in education, the professionalisation of educational staff and the development and circulation of knowledge (Griffioen, 2013; OCW, 2004; Onderwijsraad, 2014; Ros et al., 2012; VHO, 2015). As a result of this international shared aim to bridge the gap between theory and practice in education, many publications have appeared which cover topics connected to a research culture in education, resulting in an increasing diversity in practice-based research approaches. In addition, methodological questions surrounding the tension between the quality and the practical relevance of research form a

key discussion topic (Cochran-Smith & Zeichner, 2010; Geerdink, 2010; Martens & Diepstraten, 2010; Martens, Kessels, De Laat, & Ros, 2012; Ros et al., 2012).

Despite the importance of Inquiry-Based Attitude as an objective in teacher education, which is emphasised in scientific, practical and policy resources and is characteristic of professionals in general, it is a scientifically under-explored concept. This makes it difficult to implement Inquiry-Based Attitude as an objective of teacher education with clear and achievable curriculum goals, let alone to understand educational didactics which contribute to its development or to understand which method of professionalisation will help educators in stimulating this attitude in their students. As such, this dissertation aims to contribute to a well-founded scientific understanding of Inquiry-Based Attitude as an objective in teacher education by means of practice-based research. To achieve this, four different teacher education practices at bachelor's and master's level at a large Dutch university for applied sciences contributed to this research.

Inquiry-Based Attitude

The literature shows that the Inquiry-Based Attitude concept is interpreted in different ways. For instance, the literature strongly suggests that Inquiry-Based Attitude is closely intertwined with the idea of a critically reflective practitioner who improves practice by using resources in their own context (e.g. Cochran-Smith & Lytle, 2009; Leeman & Wardekker, 2008, 2014). In this context, Inquiry-Based Attitude is considered to encourage the habit of critical thinking and constantly posing questions: 'Every site of professional practice becomes a potential site of inquiry' (Cochran-Smith & Lytle, p.121). From this inquiry perspective, having Inquiry-Based Attitude seems to correspond to a variety of academic learning qualities as for example being critical and having research skills (e.g. Bruggink & Harinck, 2012; Onderwijsraad, 2014). These qualities and skills bear a strong resemblance to professional development skills, such as the extension of professional knowledge through reflective practice and engagement in professional development and research skills (e.g. Maclellan, 2015; Scheerens, 2010). From this learning and development perspective, there are also theoretical suggestions that the personality traits of curiosity and openness can be seen as characteristics of Inquiry-Based Attitude (e.g. Bruggink & Harinck, 2012; Leeman & Wardekker, 2014), both because they are well-

known triggers for exploratory behaviour and the tendency to adopt new ideas (Berlyne, 1954a; Litman, 2008) and because they are positively associated with academic achievement (e.g. Chamorro-Premuzic & Furnham, 2009). This demonstrates that the theoretical notions of Inquiry-Based Attitude point to a broad set of characteristics related to the learning and development of professionals. Therefore, the concept of Inquiry-Based Attitude will be empirically explored from a range of theoretical perspectives concerning inquiry, learning and development.

Inquiry-Based Attitude inherent to professional identity

With the emergence of Inquiry-Based Attitude as a relatively new objective in teacher education (OCW/EZ, 2009; Onderwijsraad, 2014), teacher educators have been given a new task which brings a change in their work, and which consequently has implications for the whole concept of the role of teacher educators. Such a role change can be perceived as the development of a new professional identity (Trede, Macklin & Bridges, 2012). According to Geijsel and Meijers (2005), the core process in educational change is professional identity learning, in which collective meaning-giving and personal sense-making can be seen as supporting strategies for professional learning. A professional identity is often defined as 'me' in the context of work. This 'me' guides professional behaviour (Aangenendt, 2015; Beijaard, Meijer & Verloop, 2004; Canrinus et al., 2011) and has implications for taking up professional roles (Berry, 2009). In other words, the concept of professional identity points 'towards the notion that professional identity is a way of being and a lens to evaluate, learn and make sense of practice' (Trede et al., p. 374).

The complex structure of a professional's identity does not change easily under the influence of professional development programmes (Beijaard et al., 2004; Day, Kington, Stobart, & Sammons, 2006; Dinkelman, 2011). To gain deeper insight into professional identity learning in the field of psychology, Illeris (2014) has developed a model, based on recent prominent learning and development theories, which helps to interpret the complexity of identity and identity learning. In this model, values, attitudes, beliefs, manners and behavioural patterns are included in the so-called 'personality layer'. Although this layer is relatively stable, it can be influenced by professionalisation if transformative learning can be achieved (Mezirow, 1991, 1994). Transformative

learning is considered to be the highest level of deep learning and requires critical reflection (Illeris, 2014; Mezirow & Taylor, 2009). In this research, the transformative learning theory is used as a guideline when designing professional development interventions to support educators in learning how to stimulate Inquiry-Based Attitude in students.

Educators' professional development

Empirical insight into the effectiveness of educators' professional development is scarce (Cochran-Smith & Zeichner, 2010; Dengerink, Lunenberg & Kools, 2015). The available literature mainly concerns the transition from teacher to educator (e.g. Bates, Swennen & Jones, 2011; Loughran, 2014; Murray & Male, 2005). The specific need for a pedagogy of practising educators' professional development was illustrated in a recent study carried out by Goodwin et al. (2014) in which practising educators identified themselves as self-directed lifelong learners. They also rated the quality of their preparation for professional socialisation as significantly less adequate than the quality of their preparation for skills in teaching and research. To contribute to a better understanding of educators' specific roles, their related behaviour and their development into these roles, Lunenberg, Dengerink and Korthagen (2014) conducted a review study in which they identified six professional roles and determined the generic critical features of the development of these roles. These development features appear to demonstrate a strong correlation with the generic characteristics of effective teacher development (Borko, 2004; Desmione, 2009; Van Veen, Zwart, Meirink, & Verloop, 2010; Vermunt & Endedijk, 2011). The corresponding characteristics can be summarised as learning with and from peers, studying one's own daily practice, and employing learning support. This research builds on this knowledge to gain an empirical understanding of specific characteristics or active ingredients (Cochran-Smith & Zeichner, 2010) of educators' development interventions which enhance educators' performance in their role as a teacher of teachers with respect to stimulating students' Inquiry-Based Attitude.

Practice-based scientific research in partnership with practitioners

The importance of developing Inquiry-Based Attitude in students is emphasised at the same time as the ambition of higher vocational education to develop a practice-based research culture is reinforced. In fact, there is a noticeable 'promotion' of practice-based research in policy, and society is grounded in the idea that this approach is necessary to bridge the gap between educational theory and educational practice. To close this gap, collaboration between educational practitioners and researchers in practice-based scientific research is particularly important, as has been argued by authors such as Martens et al. (2012). This collaboration will lead to the creation of 'socially robust' knowledge and support the transfer of scientific knowledge into practice (See also Nowotny, Scott & Gibbons, 2001). The claim that knowledge production generated in the context of application will create 'socially robust knowledge' was introduced as 'mode-2' research by Gibbons et al. in 1994. 'Reliable knowledge can become socially robust only if society perceives the process of knowledge production to be participative' (Nowotny, Scott & Gibbons, 2006, p.51). This claim has broad support, as can be seen in Hessels and Van Lente's review study (2008) in which they systematically reflected on the Gibbons-Nowotny notion of 'mode-2' knowledge production. Moreover, from the perspective of learning and development, it is asserted that participation of practitioners in the knowledge creation process will not only contribute to the transfer of knowledge, but will also support the participants' professional development as well as contribute to innovation in practice (Bolhuis et al., 2012; Kessels, 2012; Martens et al., 2012). To generate knowledge in partnership with practitioners in this study, teacher educators are included as co-designers and as co-researchers, since they play a key role in stimulating the development of Inquiry-Based Attitude in their students.

Goals, research questions and chapter outlines

The central aim of this thesis is to increase a scientific and socially robust understanding of Inquiry-Based Attitude as an objective in teacher education by means of practice-based research. The literature suggests that Inquiry-Based

Attitude can be described as a broad concept based on a range of theoretical perspectives concerning inquiry, learning and development.

A set of six related empirical studies (described in Chapter 2, 3 and 4) is presented to explore the characteristics and predictors both of Inquiry-Based Attitude in teachers and of professional development interventions to stimulate the development of Inquiry-Based Attitude in students. A reflective conceptual study (Chapter 5) is presented to reflect on design principles of scientific knowledge creation and implementation in partnership with practitioners in mode-2 research.

Research questions to explore teachers' Inquiry-Based Attitude characteristics in Chapter 2 are:

1. What characteristics of the 'Inquiry-Based Attitude' of teachers can be distinguished?
2. To what extent are 'openness' and 'epistemic curiosity' related to the 'Inquiry-Based Attitude' of teachers?

Research questions to explore teachers' Inquiry-Based Attitude development predictors during education in Chapter 3 are:

3. To what extent do teachers develop Inquiry-Based Attitude during their first year of post-initial teacher education, and to what extent is this development related to the personality traits of openness and epistemic curiosity?
4. How and to what extent is Inquiry-Based Attitude development stimulated during the first year of post-initial teacher education, and what impact do the variables of time, educator and student-specific background have?

Research questions which explore the active ingredients of professional development interventions in Chapter 4 are:

5. To what extent and in what way do the designed professional development interventions support the transformative learning of educators?
6. How do these interventions influence changes in beliefs and/or behaviour of educators with regard to the stimulation of an Inquiry-Based Attitude in students?

To reflect on the design principles of knowledge creation and implementation in partnership with practitioners in mode-2 research, the question in Chapter 5 is:

7. How and why affected our research in partnership with practitioners educators' professional development and how did it bring innovation to teaching practice?

Chapter 2. Exploring Teachers' Inquiry-Based Attitude

In this chapter, the characteristics of Inquiry-Based Attitude as an objective in higher education are explored both conceptually and empirically in order to refine this objective from a poorly-defined global idea into a concept with reliable and valid characteristics. To achieve this, an exploratory procedure of questionnaire design, redesign and literature study was performed in collaboration with educators. Data were gathered on three different occasions among three different cohorts of teachers (N = 867) who started as students in a master's programme at a Dutch university for applied sciences. Data analyses were directed towards the determination of dimensions of Inquiry-Based Attitude and the construction of scales to measure those dimensions. The results of the studies reported in this chapter facilitate the answers to research questions 1 and 2.

Chapter 3. Developing Inquiry-Based Attitude during post-initial teacher education

This chapter reports a quantitative longitudinal survey study in which the development of Inquiry-Based Attitude is explored during post-initial teacher education. Survey data from 409 in-service teachers were collected during their first year as students in a master's programme. Variables in the study concerned the dimensions of Inquiry-Based Attitude which emerged from the studies described in Chapter 2, personality traits such as openness and curiosity and background variables such as gender and experience. The relationships between multiple variables at different levels and different time-points were analysed in order to predict the development of the dimensions of Inquiry-Based Attitude. The findings provided insight into positive and negative predictors of Inquiry-Based Attitude development. The results of the study reported in this chapter facilitate the answers to research questions 3 and 4.

Chapter 4. Professional Development of Teacher-Educators towards Transformative Learning

This chapter examines the active ingredients in professional development interventions intended to promote the role of educators' transformative learning in stimulating Inquiry-Based Attitude in their students. To achieve this, an educational design research method was followed. First, in partnership with five experienced educators, a professional development programme was designed, tested and redesigned. Second, a qualitative multiple case study examined the active ingredients of the interventions which had been designed, with regard to changes in educators' beliefs and behaviour. This multiple case study was conducted in four different authentic educational settings in which 20 educators participated over nine months. Data sources included videos, questionnaires, interviews and written personal theories of practice. The results offer new specific insights into designing professional development programmes towards transformative learning. The results of the studies reported in this chapter facilitate the answers to research questions 5 and 6.

Chapter 5. Bridging the Research-to-Practice Gap in Education: the Design Principles of Mode-2 Research Innovating Teacher Education

In this chapter, a conceptual contribution is made regarding the ways in which a partnership between educational researchers and practitioners in mode-2 research can bridge the gap between theory and practice. Through the theoretical lens of transfer of learning, we reflected on professional development, practitioners' knowledge creation and organisational innovation during a multi-year mode-2 research project. This reflection resulted in a working hypothesis concerning the design of research in partnership with practitioners in the context of application, with the aim of supporting scientific, socially robust knowledge creation as well as practitioners' development and innovative practice. The results of the study reported in this chapter enable answering research question 7.

Chapter 6. General discussion

Finally, the major findings of the chapters reported earlier are outlined and discussed. This chapter also reflects on the limitations of the research, makes

suggestions for future research and explores implications for practice. The chapter ends with an overall conclusion relating to the aim of this dissertation, to increase a scientific and socially robust understanding of Inquiry-Based Attitude as an objective in teacher education through practice-based research.

CHAPTER 2

Exploring Teachers' Inquiry-Based Attitude

This chapter was previously published: Meijer, M. J., Geijsel, F., Kuijpers, M., Boei, F., & Vrieling, E. (2016a). Exploring teachers' Inquiry-Based attitude. *Teaching in Higher Education*, *21*(1), 64-78. Small adjustments were made to the form in which this chapter was published.

Abstract

Having a well-founded insight into the characteristics of teachers Inquiry-Based Attitude supports operationalising this concept as a learning goal in teacher education. The aim of this study is to refine the notion of Inquiry-Based Attitude from an ill-defined global concept into something with reliable and valid characteristics. To do so, data were gathered on three different occasions amongst three different cohorts of teachers who participated in a master's programme at a Dutch university for applied sciences. This process of exploration and reconceptualisation was performed in collaboration with teacher educators. The results indicate that, statistically, Inquiry-Based Attitude has an internal reflective dimension and an external knowledge-sourcing dimension. Both dimensions can also statistically be differentiated from the personality traits openness to ideas, openness to change and epistemic curiosity. The implications of these findings for teacher education, plus recommendations for future research, are addressed.

Exploring Teachers' Inquiry-Based Attitude

Introduction

An Inquiry-Based Attitude (IA) as a development goal for teachers and as a characteristic of higher educated professionals emerges from the importance attributed to IA as a facilitator for lifelong learning in a rapidly changing knowledge society (OCW/EZ, 2009). Teacher quality has proven to be the main drive for successful learning outcomes (Hattie,2003) and the importance of teaching quality for economic growth has also been convincingly demonstrated (Mourshed, Chijioke & Barber, 2010). From this economic perspective, teachers play a key role in the development of society and are expected to improve their own performance throughout their entire career (Barron & Darling-Hammond, 2008; Kuijpers, 2012). Viewed from this angle, Scheerens (2010, 12) describes how lifelong learning applies to teacher professionalism: 'Teachers have a responsibility to extend the boundaries of professional knowledge through a commitment to reflective practice, through research and through systematic engagement in continuous professional development from the beginning to the end of their careers'. According to scientists like Hargreaves (2003), this lifelong learning perspective has particular consequences for teacher education (TE) and therefore scientists recommend the development of an IA as a basis for this continuous professional development in TE (e.g. Pollard, 2008). Having an IA seems so beneficial that it has become part of mainstream Dutch education and social policy (Onderwijsraad, 2014). Thus, the role of teacher educators is to develop IA in their student teachers who in turn apply this to their work with school students (Van Veen et al.,2010; Veerman et al., 2010). In fact, it seems that having a body of knowledge regarding IA is essential for professional development (Lamb et al., 2009). Although the importance of IA is widely emphasised, we were not able to find a clear and empirically grounded definition of IA in scientific literature (Meijer et al., 2014). IA can be considered as a broad, somewhat vague 'umbrella concept' with no power to give direction to the professional development of teachers.

This article describes a study that contributes to the empirical clarification of the concept of IA. The section below demonstrates that the theory of IA is unclear and ambiguous, and elaborates on two concepts that appear to be

relevant: (1) reflective behaviour as an instrument for professional development and (2) openness and curiosity as personality traits.

Theoretical exploration of the characteristics of an Inquiry-Based Attitude

Although there is no clear, empirically grounded definition of IA, theoretical notions point out the link between IA and deep-learning characteristics on the one hand and IA and personality traits such as curiosity and openness on the other. According to Cochran-Smith and Lytle (2009), for example, IA refers to a learning perspective and a critical habit of mind, which means that through 'working from an inquiry stance, every site of professional practice becomes a potential site of inquiry' (p. 121). They also argue that the development of curiosity will make a powerful contribution towards the evolvement of an inquiry stance (1999, 2001). This is in line with the research of Leeman and Wardekker (2008, 2014), which states that IA is characterised by the urge to constantly question (i.e. curiosity) whether what happens in school and one's actions as a teacher contribute to the development of the pupils. In their opinion, IA, or, as they call it, inquisitiveness, is closely related to critical reflection and becomes evident through the professional behaviour of the teachers. To identify the core elements of IA, Harinck, Kienhuis and De Wit (2009) interviewed 47 teacher trainers regarding IA and in addition, Harinck, and Goei (2010) and Bruggink and Harinck (2012), studied descriptions of IA in literature. They came up with a broad set of characteristics, including openness, curiosity, speculation, continuously asking questions, a critical and analytic attitude and a systematic use of knowledge, and suggested that IA is closely intertwined with the idea of the critical 'reflective practitioner' (see for instance Mason, 2002).

Based on literature, there seems to be a relationship between professional learner qualities and the supposed characteristics of IA. Learning professionals are required to: conduct critical reflection; explore, evaluate, acquire and share knowledge; be curious; be able to perform research (in the meaning of skills) and learn from others beyond their own professional limits (e.g. Day, 1999; Scheerens, 2010; Maclellan, 2015). To summarise, IA's theoretical characteristics reflect the ability to continuously and sustainably renew one's professional performance.

However, IA's characteristics are only theoretically described so far. Therefore, scientific clarity about IA is needed to operationalise IA as a learning

goal and to be able to develop a pedagogical approach. Since critical reflection is significant both as a facilitator of deep learning and as an assumed characteristic of IA, this concept will be elaborated in the next section. Curiosity and openness also need further attention in this section because they are frequently referred to alongside IA and critical reflection.

Critical reflection as a facilitator of deep professional learning

There is a broad consensus that critical reflection is an essential part of deep professional learning (Mezirow & Taylor, 2009; Avalos, 2011; Dyment & O'Connell, 2011). Researchers generally agree on the skills that deep professional learning requires: being able to experience situations in a clearheaded, unbiased manner; being able to observe and reflect from different perspectives; being able to construct theories or concepts and being able to use these theories to make decisions and solve problems (Kolb, 1984; Argyris & Schön, 1978; Jarvis, 2006; Bolhuis, 2009; Kegan, 2009). Within the context of deep learning, the difficulty of transferring what people learn in different situations has been an important theme in learning psychology for many years (Greeno, Collins, & Resnick 1996; Korthagen, 2010). Based on the complexity of learning in different contexts, Illeris (2004, 2007) developed a learning theory in which deep learning involves two essentially different types of processes, namely an external interaction process between the learner and his or her social, cultural and material environment, and an internal psychological process of acquisition and elaboration in which new impulses are connected to the results of prior learning. However, to achieve a permanent learning change or more extensive understanding, a type of learning is required in which the integration and anchoring of new knowledge has the effect of a permanent learning change (Mezirow, 1994; Kegan, 2009). This type of learning is referred to as critical reflection, and it is regarded as the highest level of reflection in reflective learning theories (Kember et al., 2008). When the results of this type of learning involve changes in the identity of the learner, Illeris (2014) describes it as transformative learning.

Openness and curiosity as a trigger for exploratory behavior

Openness and curiosity are theoretically considered to be characteristics of IA because they facilitate exploratory behaviour (Berlyne, 1954a; Litman, 2008) and are related to professional development (Hensel, 2010). However, they are

also known as stable personality traits that are quite consistent over a lifetime (Roberts & DelVecchio, 2000). This implicates that an educational environment has little impact on long-term development of those traits (Boekaerts, 1996; McCrae et al., 2000). Therefore, it is imperative to distinct IA as an educational development goal from these traits and to explore the relationship between IA and openness and curiosity.

Recent research from the perspective of developmental psychology offers a glimpse of the extent to which persons are able to develop themselves professionally (Arnold et al., 2005; Furnham, 2008). Hensel (2010) found that the need for personal growth is saliently and consistently related to the 'big five' personality trait 'openness to experiences' as measured in the well-known 'Five-Factor Model' (FFM) by McCrae and Costa (1989). Compared to people who are less open to experiences, people with a high level of 'openness to experiences' are more open to alternative points of view, information, external stimuli and social and political change (Jost et al., 2003; Sibley & Duckitt 2008). This tendency to adopt new ideas and changes also applies to intellectual curiosity (Roberts, Walton, & Viechtbauer, 2006; Hensel, 2010).

Curiosity as a personality trait has been studied for over a century, and different characteristics are attributed to this concept: it is the base component for thinking (Dewey, 1910); it is the trigger for exploratory behaviour (Berlyne, 1954a, 1954b); it is a prerequisite for the construction of knowledge (Piaget, 1974) and a motivator for learning processes (Kolb, 1984). Empirical studies conducted over the last few decades show that curiosity consists of several separate constructs. Berlyne (1954a, 1954b) proved that there are two types of curiosity: 'perceptual curiosity' and 'epistemic curiosity'. Litman and Spielberger (2003) further elaborated on these findings in their empirical study pertaining to higher education. They concluded that curiosity is a relative homogeneous personality construct, in which perceptual curiosity and epistemic curiosity can be statistically distinguished. The study of Reio et al. (2006) pertaining to higher education concludes that curiosity consists of three factors: cognitive curiosity, seeking physical sensations and seeking social sensations. In their research, the cognitive curiosity factor proves to be powerful and independent, with a strong focus on the desire for new knowledge. Relevant for IA is the definition of curiosity based on the need for knowledge, which is referred to as 'epistemic curiosity' (Litman, 2008). This epistemic curiosity is seen as an important trigger for knowledge-sourcing behaviour, which means drawing on the expertise, experience, advice and opinions of others (Gray & Meister 2006).

Problem definition and research questions

Although there is some theorising concerning IA, empirically the concept is not very well developed. Meanwhile, in Dutch teacher training institutes both pre-service and in-service students are required to develop an IA. Students must 'prove' their IA in their portfolios and demonstrate it during teaching practice. Many teacher trainers are also asked to assess the IA of their students.

Based on the theoretical notions explained in the previous section, we presume that a teacher's IA is reflected in a broad set of elements that contribute also to deep learning within the context of professional performance. Within this broad set, reflection seems to stand out as an important element. Despite the common shared values attributed to openness and (epistemic) curiosity as characteristics of IA, developing these kinds of personality traits is not an educational goal in teacher training. To understand the relation between IA and those personality traits, scientific clarity is needed concerning the question to what extent those personality traits can be distinguished from IA.

The scope of the present exploratory study as a first step in a longitudinal research project is to increase the empirical understanding of the IA of teachers. The study aims to thoroughly explore the characteristics of IA in relation to the demands that new professionals have to meet with a particular focus on those aspects that may be developed through education. The main goal is to operationalise IA as a valid construct that can be differentiated from openness and epistemic curiosity as personality traits. The first two research questions of this dissertation are:

1. What characteristics of the 'Inquiry-Based Attitude' of teachers can be distinguished?
2. To what extent are 'openness' and 'epistemic curiosity' related to the 'Inquiry-Based Attitude' of teachers?

Table 1 Research Design

Phase	Step	Type of Research	Participants	Goal	Analysis	Results
Preparation	Step 1	Design-based	Focus group: 4 teacher educators + 3 scientists	Exploration characteristics of the concept of inquiry-based attitude → Development items for questionnaire (including think-aloud protocol)		This step resulted in a first version questionnaire: 64 behavioural statements
	Step 2	Quantitative	44 teachers	Refining first version questionnaire by thematic analyses of qualitative data	EFA (SPSS)	This step resulted in a second version questionnaire with 11 items and the likelihood of two dimensions: (1) internal, reflective dimension, α .79, variance 42.205% and (2) an external, knowledge sourcing dimension, α .79., variance 17.125%. R= .483/.001 Example dimension 1: I adjusted my own actions based on new knowledge Example dimension 2: I read books and/or articles to find additional information for my teaching
	Step 3	Quantitative	475 teachers	Fine-tuning the second version questionnaire	EFA (SPSS)	This step resulted in the main-study questionnaire with two dimensions: (1) IA-Internal reflective, α .71, variance 33.662% and (2) IA-External knowledge sourcing, α .56, variance 11.362% Critical assessment→ Confounded items → Redesign of questionnaire → 28 items

Phase	Step	Type of Research	Participants	Goal	Analysis	Results
Main Study	Question 1	Quantitative	348 teachers	Factor validation and further refinement of the main-study questionnaire IA	CFA (SPSS and Mplus)	This step resulted in a confirmation of the two IA-dimensions → 2 x 4 items (1) IA-Internal reflective, α .83, variance 42.110% and (2) IA-External knowledge sourcing, α .76, variance 21.110% (Chi^2 =22.869, df=19, p=0.2432; CFI=0.995; TLI= 0.992; RMSEA=0.0 - 0.056); SRMR=0.034) (R=.305/0.00)
	Question 2	Quantitative		Exploration of relatedness IA with openness and epistemic curiosity	Pearsons correlation analysis	R= between .135-.305

In the following, first the Method section is described including the participants and the different steps of the two-phase research design. Then, the results in answering the research questions are described. Finally, we elaborate on our findings in a Discussion section that also comprises implications of these findings for TE, plus recommendations for future research.

Method

To clarify the characteristics of IA and its relation to 'openness' and 'epistemic curiosity', the exploratory procedure of questionnaire design, redesign and literature study as described by Oppenheim (2005) was followed. As a result, a research design with two phases (See Table 1) was used to answer both research questions: the preparation phase, intended to derive a valid and reliable operationalisation of the concept of IA which resulted in a questionnaire (See Table 2), and the main study phase, which targeted the research questions. To answer the research questions, the results of the preparation phase (i.e. the operationalisation of IA into the main study questionnaire) were applied. To explore the relatedness of IA with openness and epistemic curiosity, additional instruments were applied as described below.

To explore to what extent IA is related to openness, two facet scales – 'openness to ideas' and 'openness to actions' – of the Dutch version of the 'Revised Neo Personality Inventory Questionnaire' (NEO-PI-R) were used because the NEO-PI-R has a clear conceptual basis and documented validity, and shows strong long-term stability (McCrae et al., 2011). It organises personality into five broad heterogeneous personality dimensions: neuroticism, extroversion, openness, altruism and conscientiousness. Every dimension consists of six homogeneous facet scales, which are scored using a five-point Likert scale. People with high scores for the used openness facet scales seem to thrive in situations that require flexibility; they are highly adaptable to change and their openness facilitates seeking information and feedback (Roberts, Walton, & Viechtbauer 2006). A low score means the opposite. Using facet scales instead of the whole questionnaire is supported by the empirical research of de Vries (2012), which shows that the homogeneous facet scales have a higher predictive value than the broad heterogeneous dimensions.

To explore to what extent IA is related to epistemic curiosity, the 'Interest and Deprivation Curiosity Questionnaire' of Litman (2008) was translated into

Dutch by a qualified translator. The translation was presented to a focus group (described in the Preparation Phase section) and minor textual aspects were modified. Interest and deprivation are facet scales of 'Epistemic Curiosity', which means 'the desire to obtain new knowledge expected to stimulate positive feelings of intellectual interest or reduce undesirable states of informational deprivation' (Litman, Crowson, & Kolinski 2010, 531). A four-point Likert scale was used to score the questionnaire. A low score means that a trait is present to a lesser extent, and a high score means that it is present to a higher extent.

Participants

This section describes the participants of the studies: first, in general and second for the different steps of the two-phase study. All participants are qualified teachers who entered the study or were studying for 'Master Special Educational Needs' (MSEN) or 'Master Learning and Innovation' (MLI) at a Dutch university for applied sciences that offered these courses at three different geographic locations: in the middle of the country and in the north and the west. These participants were chosen because we assumed IA could be found among qualified teachers who were motivated to follow an intellectually challenging master's course to boost their professional development. Each either worked as a teacher or as a teacher trainee for at least 2 days a week. The distribution by gender and age represents the current situation in the Dutch educational system and is in line with most European countries (EACEA 2012).

Starting their study, the participants received digital questionnaires that could be completed in 15–20 minutes. The participants were promised that their responses would be processed anonymously and they were offered a research workshop as an incentive. After 2 weeks, a reminder was sent to non-respondents to encourage participation. The participants per phase:

Preparation step 1. No participants

Preparation step 2. All 44 participants (2 males and 42 females, aged 21–28, mean age 22.2) were primary education teachers who entered the full-time MSEN course shortly after graduating from their initial teacher training.

Preparation step 3. All 475 participants (78 males and 397 females, aged 20–56, mean age 33.5) were teachers who entered year 1 or year 2 of the MSEN (n = 399) and the MLI course (n = 76). They worked in primary education (60.4%), secondary education (11.2%), vocational education (16.6%), special education (8%) and other (3.8%).

Main study. All 348 participants were teachers (response rate 58.9%, 60 males and 288 females, aged 20–62, mean age 35) who entered year 1 of the MSEN (n = 304) or MLI course (n = 44). They worked in primary education (61.2%), secondary education (14.7%), vocational education (14.9%), special education (7.2%) and other (2%).

Preparation phase: questionnaire development

The development of a valid and reliable questionnaire, which was required to answer the research questions, involved the following three steps.

Preparation step 1

To increase the conceptual understanding of IA and help improve future practical implementation (McKenney & Reeves, 2013), four experienced teacher educators and three scientists operationalised IA in behavioural statements by following the focus group method (Bryman, 2012) and conceptualised and re-conceptualised the broad set of characteristics as derived from the theoretical exploration. Choosing to operationalise IA through behavioural statements is in line with the idea that attitudes are expressed through behaviour or speech and that a particular attitude includes a tendency to respond in a certain manner and with a certain intensity when confronted with certain stimuli (Oppenheim, 2005). As a result, a first version of a questionnaire regarding teachers' IA was put together, consisting of 64 behavioural statements with a high face validity regarding teachers' IA in their individual professional context over the past 6 months (examples: 'I adjusted my own actions based on new knowledge' or 'I read books and/or articles to find additional information for my teaching'). A four-point Likert scale was used, which included the option 'not applicable'. A low score means the intended behaviour is less present, while a high score

means it is more present. To improve the quality, this first version questionnaire was presented to four teachers and assessed in accordance with a think-aloud protocol (Jaaskelainen, 2010). This resulted in a few minor textual adjustments.

Preparation step 2

To refine the item pool and divide it into a smaller set of more valid statements by thematic analyses of qualitative data, 44 participants completed the first questionnaire. The nature of a possible underlying dimensional structure was explored through an exploratory principal component analysis (PCA). Oblique rotations were chosen because we assumed related components. To interpret the factors, statements with an item loading of 0.500 or more were taken into account. Eleven statements met these requirements: five statements included a factor that could be interpreted as 'internal, reflective behaviour' and six statements could be interpreted as 'external, knowledge-sourcing behaviour'. The internal reliability of both scales was $\alpha = 0.79$. This resulted in a second version questionnaire with 11 statements (See Table 1, results row 2).

The interpretation of the reflective statements concerns reflective behaviour regarding personal opinions and beliefs as described by, for example, Kember et al. (2000). An example of such a statement: I adjusted my own actions based on new knowledge. External knowledge-sourcing behaviour is interpreted as the need for written knowledge and information sources or human capital, such as experts or colleagues. An example of such a statement is: I read books and/or articles to find additional information for my teaching.

The correlation between the factors was significant and positive ($r = 0.483/p = 0.001$), and can be explained by the focus of both factors on professional growth.

Preparation step 3

For further fine-tuning, the second version questionnaire was completed by 475 participants. Again, a PCA was followed but this time only statements with item loadings higher than 0.65 were taken into account (Preacher & MacCallum 2003). The statistical exploration (See Table 1, row 3) again indicated a two-factor model with a substantive similarity to the previous conceptual interpretation, in which IA seemed to have an internal reflective dimension (IA-I) and an external, knowledge-sourcing dimension (IA-E).

Despite this outcome, the item loadings of three statements indicated a shift from one factor to the other. For example, 'I reconsidered my opinion as a result of new information' shifted from internal to external. Besides, the reliability was weak (IA-I = α 0.71 and IA-E = α 0.56). The question was raised to what extent these three statements were confounded, that is, influenced the results to an unknown extent. Critical examination of the content of these statements provided reasons to assume confoundedness: 'reconsidering my opinion' might be interpreted as belonging to IA-I whilst 'new information' might be seen as part of IA-E. As a result of this critical examination, the questionnaire was improved by adding new statements. The new statements regarding IA-I were inspired by the 'reflection questionnaire' of Kember et al. (2000) with psychometric properties validated by Lethbridge et al. (2013). The new statements concerning IA-E were inspired by the Knowledge Sourcing Behaviour Questionnaire of Gray and Meister (2006).

These adjustments led to the third version, that is, the main study questionnaire IA which contained 28 statements in which IA-I was measured based on 13 statements, each with two or three of the following characteristics: (1) reflection level; (2) reflection goal and (3) reflection trigger. An example: 'I thought about the approach to my work and considered alternative ways of doing it.' The IA-E was measured based on 15 statements that each included two or three of the following characteristics: (1) How is the individual drawn to knowledge?, (2) What kind of knowledge is the individual drawn to? And (3) What is the knowledge source. An example: 'I consulted experts outside my school organisation when I needed knowledge or information.'

Main study: answering the research questions

To collect data for answering the research questions, 348 participants completed the developed questionnaire IA and the questionnaires concerning openness and curiosity. The analysis of this data set included two steps: at first our theory of IA as a two-factor model was tested by performing a confirmatory factor analysis (CFA) using SPSS and the Mplus statistical package (Muthén & Muthén 2012). To achieve a good fit in Mplus, the reliabilities of the scales, the factor loadings and factor correlations were also checked. Secondly, to measure the degree of relatedness between teachers IA and the traits openness and epistemic curiosity, a Pearson's correlation analysis was conducted.

Results for research question 1

As mentioned above, to test our theory that IA is a construct with two dimensions that can be interpreted as (1) an internal reflective dimension and (2) an external knowledge-sourcing dimension, two CFAs were conducted and factor loadings, variance and reliability were checked. First, a CFA in SPSS was performed under the condition of two factors. As a result, the main-study questionnaire was reduced to 10 statements with a factor loading above 0.650. Six statements represented our theory concerning IA-I and four statements represented our theory concerning IA-E. In the IA-I factor, one statement was just at the critical threshold with a factor loading of 0.651; the other statements and both factors had a loading between 0.691 and 0.810. The IA-I factor had an explained variance of 39.621%; the IA-E factor had an explained variance of 18.993%.

The second step of the analysis involved performing a CFA in Mplus with the 10 statements. A good fit was initially hampered by the statement with factor loading 0.651 and by a statement that shifted towards the other factor. Looking at the formula once more, we saw that these two statements refer more to the reflection process and do not refer specifically to professional development, which was the case for the other statements. Removing these two statements clarified the theoretical interpretation of the first factor.

After removing these two statements, the CFA confirmed IA as a model that can statistically distinguish the IA-I and the IA-E factor ($\chi^2 = 22.869$, df = 19, p = 0.2432; CFI = 0.995; TLI = 0.992; RMSEA = 0.00–0.056; SRMR = 0.034). The weak correlation (R = 0.305) between the two factors is significant and positive (See Table 1, results row 4).

The third step of the analysis involved checking the factor loadings, variance and reliability in SPSS. This resulted in a two-factor model with an improved explained variance of 42.110% and 21.110% and a good internal consistency (IA-I = α 0.832 and IA-E = α 0.762), factor loadings between 0.682 and 0.838 (See Table 2) and a confirmation of our conceptual interpretation, in which IA has an internal reflective dimension, which has the improvement of professional behaviour as a goal, and an external, knowledge-sourcing dimension (IA-E), which has increasing theoretical knowledge as a goal.

Results for research question 2

The analysis concerning the second research question was conducted in order to explore to what extent openness and epistemic curiosity are related to IA. For this purpose, correlations were calculated between the Openness to Ideas (OPIDEA) and Openness to Action (OPACT) facet scales from the Neo-Pi-R and the Curiosity Interest (CURINT) and Curiosity Deprivation (CURDEP) scales from Litman (2008). The results show that all significant correlations are weak (between 0.135 and 0.305, or to state it otherwise: common variance lies between 2% and 9%) and positive in nature (See Table 3). This can be explained by the fact that it is likely that these personality traits facilitate IA. The correlations found between OPACT and OPIDEA and CURINT and CURDEP are between 0.135 and 0.528 (common variance between 2% and 28%). The relatively high correlation between OPACT and CURINT (0.528) can be explained by the fact that both cases are about broad interests.

Table 2. Two-dimensional structure matrix.

	Dimension	
	IA internal	IA external
	α = 0.83	α = 0.76
I adjusted my own actions based on new knowledge	0.838	
I reflected on my actions to check whether I could have done things better	0.827	
By thinking about my actions I have changed my usual approach in a number of ways	0.816	
I kept reassessing my experiences to learn from them and improve my performance at work	0.793	
I read publications or other sources to increase my knowledge about a specific educational topic		0.801
I kept up with professional publications to keep up to date with what is happening in my field		0.794
I read books and/or articles to find additional information for my teaching		0.792
I surfed the Internet to find interesting sources to use in my work		0.682

Note: Extraction method: principal component analysis; rotation method: Oblimin with Kaiser normalisation.

Conclusion and discussion

As a result of this exploratory study, we can now characterise an IA as a professional attitude that contributes to teachers' development in higher education. We were able to split IA into two reliable and validly measurable components. First, IA has an internal reflective dimension (IA-I), which relates to the ability to acquire new professional modes of understanding and behaviour. Secondly, an external knowledge-sourcing dimension (IA-E) is distinguished, which relates to behaviour that is triggered by the need for increasing one's professional knowledge. Both dimensions can statistically be distinguished from the personality traits 'openness to ideas', 'openness to changes' and 'epistemic curiosity'. This distinction is relevant, because higher education focuses on goals that can be developed instead of personality traits that are quite consistent over lifetime.

Our two dimensions seem to correspond with Illeris's (2009) learning processes theory. Where IA-I resembles the internal interaction process in which critical reflection is denoted as the highest level of reflective learning, with transformative learning as a learning outcome (Illeris, 2014), IA-E seems to correspond to Illeris's external interaction process. This is because it concerns the interaction between learners and their environment and can be compared to sourcing knowledge in literature and/or consulting experts. In this way, the learning processes theory and our findings support each other. Moreover, the added value of our research concerns the operationalisation of IA.

Because of this operationalisation, our study also contributes to scientific clarity in how we can understand IA in education. This clarity is needed as a first step in developing a pedagogy in educating IA. Within the context of TE, educators and students can use the two dimensions to diagnose to what extend and in what way the dimensions of IA play a role in improving their performance or practice. For this goal, our questionnaire IA can be of support. Further research should point out if this self-assessment questionnaire can be used as a first step in the development of a valid instrument for assessors to examine the development of students IA and give insight into its value in monitoring the development of IA during education.

Because developing an IA is not exclusive for Dutch teachers, we assume that a clear concept of IA is relevant for other professionals in other countries as well. Although our research population is comparable with the regular teacher population in the Netherlands and Europe, from the perspective of generalisability we have to take in account that our specific population was

motivated to professionalise as a teacher. Therefore, further exploration is needed to gain insight into the extent in which the motivation for professional growth as a teacher is responsible for our results. Since our study is, by our knowledge, a first empirical exploration of IA, we advise to validate our theory in other professional and international fields of higher education to gain a deeper understanding of the possibility of IA as a universal construct. To understand to what extent IA can be developed during education and how educators can boost this development, we advise to follow students for a longer period of time. Finally, we recommend investigating the role of openness and epistemic curiosity as predictors of the development possibilities of IA. Such an investigation should also look further into the role of reflection levels as referred to by Kember et al. (2008) and the variety of knowledge sources characterised by Gray and Meister (2006).

In conclusion, this study is a first step in the understanding of IA as a two-dimensional construct and can support the development of a pedagogy to stimulate IA in higher education. For this aim, our questionnaire IA can be used.

CHAPTER

3

Developing an Inquiry-Based Attitude during Post-Initial Teacher Education

This chapter is in submission: Meijer, M., Kuijpers, M., Boei, F., Vrieling, E.,& Geijsel, F. (in submission). Developing an Inquiry-Based Attitude during post-initial teacher education.

Abstract

This study explores the development of Inquiry-Based Attitude (IA) during post-initial teacher education. Survey-data from 409 in-service teachers were collected during their first year as master of education student. An analysis of the relationships between multiple variables at different levels and different time-points showed a positive IA-development, which cannot be predicted by the traits openness or epistemic curiosity, or explained by student-specific background-variables. The variables teacher-educator and time turned out to be positive predictors, while experience and work-setting outside education are reflected as negative predictors on IA-engagement during education. The findings have resulted in practical implications for teacher education.

Developing an Inquiry-Based Attitude during Post-Initial Teacher Education

Introduction

Research that contributes to a better understanding of the impact of pedagogical approaches of educators, working with post-initial 'in-service' teachers, is limited or non-existent. This in spite of the firmly grounded notion that teachers have a significant influence on students' learning (Cochran-Smith & Zeichner, 2010; Hattie, 2003; OECD, 2005), and the high expectations of educators' qualities in educating these teachers whose qualities, in return, contribute convincingly to the economic success of a nation (Barber & Mourshed, 2007; Mourshed, Chijioke, & Barber, 2010). These high expectations lead to a growing ambition that teachers achieve a master's level qualification (Bailey & Sorensen, 2013; CPB, 2014; Howe, 2013; Onderwijsraad, 2011). The Dutch ambition is to even double the amount of master's level teachers between 2014 and 2020, which is why in-service (bachelor's level) teachers are facilitated with scholarships (CPB, 2014). Not only more teachers with a master's degree are preferred, the Dutch Educational Council (2014) also promotes developing an Inquiry-Based Attitude (hereinafter: IA) during teacher education. IA is internationally accepted as an important new goal in educating and professionalising teachers. Theoretical notions reflect IA as a facilitator to continuously and sustainably renew one's teaching performance and the ability to innovate practice (Cochran-Smith & Lytle, 2009; Cochran-Smith & Zeichner, 2010; Leeman & Wardekker, 2014; Mason, 2009). Moreover IA is expected to enhance continuous professional development (for exemple, OCW/EZ, 2009; Onderwijsraad, 2014).

However, educational research literature offers no insights into the characteristics of an appropriate pedagogy for educators with regard to developing students' IA, moreover, there is a knowledge gap with respect to the IA development as a result of education. Therefore, the goal of the present study is to contribute to the theory of developing IA during the post-initial education of in-service teachers (hereinafter: students) studying for a professional master's degree. We are particularly interested in the extent in which IA develops during

education; in ways to encourage this development and in factors that have educational impact.

The link between the offered education and students' learning is difficult to estimate because there are many intervening and cofounding variables that influence educational results (Cochran-Smith & Zeichner, 2010; OECD, 2005). Therefore, to illuminate the impact of teacher education on students' IA, it is important to link our research to relevant characteristics that students bring to education. For this reason, specific insight is required into the relationship between IA-development and students' personality traits such as 'openness' and 'curiosity', whereas they are often linked to personal growth and professional development (Chamorro-Premuzic & Furnham, 2009; Reio & Wiswell, 2000). Studying this relationship is also relevant because the assumption, in literature, is that IA, openness and curiosity are strongly related (Bruggink & Harinck, 2012; Cochran-Smith & Lytle, 2009; Leeman & Wardekker, 2008).

Before presenting our study, we first describe a theoretical background in which IA is presented as a construct with two dimensions. Stimulating the development of IA during post-initial education is conceptualised as professional identity learning; and the role of traits such as 'openness' and 'curiosity' in professional development is elaborated.

The two dimensions of Inquiry-Based Attitude

The scarce recent literature concerning the notion of IA in the teaching practice describes it as a concept with a broad range of characteristics with respect to personality traits and or learning- or research skills, or forms of research-mindedness (e.g. Bruggink & Harinck, 2012; Cochran-Smith & Lytle, 2009; Leeman & Wardekker, 2008; 2014). Because of this lack of clarity, IA and IA-related concepts such as 'research dispositions' (Rijst, 2009; Tack & Vanderlinde, 2014) and 'Inquiry as a stance'(Cochran-Smith & Lytle, 2009) are sometimes used as interchangeable concepts (see for example Onderwijsraad, 2014). To clarify IA as a construct with valid and reliable characteristics, Meijer, Geijsel, Kuijpers, Boei and Vrieling (2016a) conducted a multiannual empirical study, amongst students who participated in a post-initial master's programme at a Dutch university for applied sciences. In this study, we explored the developable IA features in order to support operationalizing IA as a learning goal in post- initial teacher education. As a result, IA was operationalized as a

concept with two dimensions: an internal reflective dimension (hereinafter: IA-Intern) and an external knowledge-sourcing dimension (hereinafter: IA-Extern).

The IA-Intern dimension concerns the ability for students to gain new modes to understand themselves, new knowledge and expertise, and the working context with the purpose of professional development. The IA-Extern dimension focuses on the intentional actions to gain new information and knowledge from relevant knowledge-sources such as literature and experts, to answer specific professional questions. IA-extern can be observed as behaviour that is triggered by the need for increasing one's professional knowledge with the purpose of professional development (Meijer, et al.,2016a).

With reflection being a key aspect of IA-Intern, the reflection levels in practice-based education as distinguished by Kember et al. (2004; 2000) and validated by Lethbridge et al. (2013) are relevant in the present study. Four levels were distinguished, of which the latter three levels are related to a deep approach to learning (Illeris, 2014; Leung & Kember, 2003). These three levels are: 'understanding': comprehending the theoretical concepts; 'reflection': intellectual and affective activities to facilitate thinking about personal professional practice experiences and 'critical reflection': de- and reconstruction of personal beliefs, which can lead to new beliefs (Kember et al., 2000).

Educators role in stimulating students' IA

The significance of teachers' impact on the learning of students is convincingly proven, but understanding the link between teaching and learning outcomes, is still an important research theme in education (Cochran-Smith & Zeichner, 2010; Hattie, 2003; Loughran, 2014; Timperley, 2014). In our previous research (Meijer, Kuijpers, Boei, Vrieling, & Geijsel, 2016b) we assumed that engaging the development of students' IA during education is related to promoting learning on the level of professional identity. A professional identity is often defined as 'me' in the context of work. This 'me' guides professional behaviour (Aangenendt, 2015; Beijaard, Meijer & Verloop, 2004; Canrinus et al., 2011. This kind of learning focuses on professional beliefs and behaviour, (Geijsel & Meijers, 2005; Illeris, 2014; Kelchtermans, 2009) and is a knotty challenge for educators, while a professional identity has a complicated structure (Beijaard, Meijer, & Verloop, 2004; Dinkelman, 2011).

Developmental psychology shows that a professional identity consists of a part that is stable and therefore insensitive to change, and a part that is relatively unstable and therefore sensitive to change (e.g. Day, Kington, Stobart, & Sammons, 2006; McCrae et al., 2000). The aimed professional identity learning in the present study is related to the so-called relatively unstable 'personality layer' (Illeris, 2014). This layer includes values, beliefs, behavioural patterns, manners and attitudes which can be influenced by education with a particular focus on deep-learning. Hence the assumption that this deep learning is the kind of learning that needs to be evoked and stimulated by educators in order to stimulate the development of students' IA.

Research literature supports the fact that the so-called 'deep learning' (c.f. Fullan & Langworthy, 2014; Van Veen, Zwart, Meirink, & Verloop, 2010) or more specific: 'transformative learning' (Illeris, 2014; Mezirow, 1991) is the type of learning one could or should aim for in stimulating IA. This way of learning involves 'in essence, the (trans)formation of the teacher identity' (Flores & Day, 2006, p. 220) and is considered to be the deepest level of learning. It requires critical reflection that demands a high degree of cognitive skills (Illeris, 2014; Mezirow & Taylor, 2009; Taylor, 2007). Although the impact of critical reflection on deep learning is generally recognized (for example, Avalos, 2011; Dyment & O'Connell, 2011), there is still a lack of knowledge in the relation of this learning with teachers' behaviour.

Based on the above, we assume that when an educator is focussed on evoking students' knowledge-sourcing, understanding, reflection and critical reflection, deep learning for the purpose of professional identity learning concerning IA, is stimulated.

Linking Openness and Curiosity to IA development

From literature the assumption arises that IA, openness and curiosity are intertwined (Bruggink & Harinck, 2012; Cochran-Smith & Lytle, 2009; Leeman & Wardekker, 2008). Based on current research in the fields of education and developmental psychology, it is plausible to assume that the development of IA is facilitated by the personality trait 'openness' of which the stability over life-time is proved convincingly (Cobb-Clark & Schurer, 2012; McCrae et al., 2000; Roberts, Walton, & Viechtbauer, 2006). The meta-analysis of Jost, Glaser, Kruglanski and Sulloway (2003) and Sibley and Duckitt (2008) showed strong

evidence that people with a high level of openness are more open to alternative points of view, information, external stimuli and social as well as political change. Moreover, openness as measured in the well-known 'Five Factor Model' (FFM) by McCrea and Costa (1989), is reported as saliently and consistently related to the need for personal growth (Hensel, 2010). The positive relation between 'openness' and deep learning has been demonstrated convincingly by Chamorro-Premuzik and Furnham (2009) who examined the relationship between broad personality traits and learning approaches among 852 university students.

Besides the assumption that openness facilitates the development of IA, there is evidence that the tendency to adopt new ideas and changes also applies to curiosity, (Litman & Spielberger, 2003; Reio, Petrosko, Wiswell, & Thongsukmag, 2006) and more specific to 'epistemic curiosity' or 'intellectual exploratory behaviour' (Hensel, 2010; Roberts et al., 2006). The personality trait of curiosity has been studied over a century and is described as a motivator of: thinking (Dewey, 1910); exploratory behaviour (Berlyne, 1954a, 1954b); knowledge construction (Piaget, 1974) and learning processes (Kolb, 1984).The empirical study of Reio and Wiswell built further on these previous theories and elaborated how curiosity-induced behaviour, such as information seeking, plays a meaningful role in workplace learning as well as in job performance' (2000, p. 5). For a better understanding in epistemic curiosity as a facilitator of learning and development, Litman and Spielberger (2003) and Litman (2008) conducted large-scaled empirical research to explore epistemic curiosity and its underlying constructs. They defined epistemic curiosity as a construct with two underlying dimensions: (1) a desire to obtain new knowledge to stimulate positive feelings of intellectual interest, characterised as 'curiosity interest'; (2) a desire to obtain new knowledge to reduce undesirable states of information, characterised as 'curiosity deprivation'. In the recent meta-analysis concerning predictors of academic performance, (Von Stumm, Hell, & Chamorro-Premuzic, 2011) epistemic curiosity was found as one of the predictors, next to intelligence and conscientiousness. In addition, there is also evidence that epistemic curiosity enhances academic performance when it is combined with reflective learning approaches (Komarraju, Karau, Schmeck, & Avdic, 2011). In our opinion, it is relevant to explore if and to what extent epistemic curiosity is also a predictor for the development of our IA-dimensions. In this matter, we have to take into account that empirical results concerning the specific stability of epistemic curiosity, as defined by Litman (2008), are lacking.

Research questions

To gain insight into the development of the Inquiry-Based Attitude during post-initial teacher training and how this development can be linked to students' characteristics, plus to understand how the development of IA is stimulated during education, we posed research question 3 and 4 of this dissertation.

3. To what extent do teachers develop Inquiry-Based Attitude during their first year of post-initial teacher education, and to what extent is this development related to the personality traits of openness and epistemic curiosity?
4. How and to what extent is Inquiry-Based Attitude development stimulated during the first year of post-initial teacher education, and what impact do the variables of time, educator and student-specific background have?

In the following, the method section of this longitudinal exploratory quantitative study is described first, including the participants and instrumentation, followed by the presentation of the analysis and results. Finally, we elaborate on our findings in a discussion section which includes the implications of these findings on teacher education, plus recommendations for future research.

Method and study design

This study is a quantitative longitudinal survey study in which we explored the IA-development and the stimulation of this development, by following a cohort of in-service teachers during their first year as master's students. For each question, a questionnaire was composed based on existing validated questionnaires, and was sent out at different time-points (See Instrumentation and procedure). The collected data were explored by using regular statistical techniques in SPSS 20 (i.e. paired t-test, One-way Anova, correlation analysis and multiple regression analysis) and explored by using the generalized estimating equations (GEE) package in R 3. 2. 3. by following the GEE procedure as described by Twisk (2013). GEE was chosen because it provides the possibility to simultaneously analyse the relationships between multiple variables at different levels and different time-points by using all available longitudinal data. A GEE analysis basically consists of three (alternating) steps: linear regression analysis;

calculating the parameters of the working correlation structure; and re-estimate the regression coefficients, adjusting for the dependency of the observations. Additionally, we controlled the possible influence of student-specific background-variables such as gender, experience, work setting or type of master.

Participants and setting

The participating students (N = 409) were all qualified bachelor's degree teachers who entered year one of the 'Master Special Educational Needs' (MSEN) (n = 363) or the 'Master Learning and Innovation' (MLI) (n = 46) at a Dutch university for applied sciences. This university offered these courses at five different geographic locations (A = 16.9%, B = 13.4%, C = 4.6%, D = 19.3% and E = 45.7%). On every sub-location, education was offered within the same structure: three courses during a period of eight weeks with five practice-based working colleges' of four hours. All education was designed by the same pedagogical design principles and executing education principles concerning: pedagogical approach, practical relevance, literature, research and reflective skills, including assignments. Education was executed by different educators in different groups of approximately 15 random students (i.e. there is no systematic group participation by the same students).

All participants worked as in-service teachers or trainees for at least two days per week (experience in education from 1 to 36 years, on average 10,3 years) in a work setting of primary education (58.9%), secondary education (15.5 %), vocational education (14.2%), special education (6.8%), and other (4.6 %). Their jobs can be described as teacher (80.9%), coach, coordinator or other (19.1%). The distribution by gender and age (15.2% males and 84.4% females, aged 20-63, mean age 35) represents the current situation in the Dutch educational system and is in line with most European countries (EACEA, 2012). Besides, the diversity among the participants represents the general influx of students in professional educational masters.

Instrumentation and procedure

The next two sections describe how we composed and sent out two questionnaires based on existing instruments. The 'IA-Development Questionnaire'

addresses research question 3, and the 'Engaging IA in Education-Questionnaire' addresses research question 4.

IA-Development Questionnaire

To measure the development of IA during education and its relation with the traits openness and curiosity, a questionnaire was composed using the following three reliable and valid instruments:

(1)The 'Inquiry-Based Attitude Questionnaire' (Meijer et al., 2016a) organises IA into an internal reflective dimension (IA-Intern), which relates to the ability to acquire new professional modes of understanding and behaviour, and an external knowledge-sourcing dimension (IA-Extern) which relates to behaviour that is triggered by the need for increasing one's professional knowledge. Question Examples are: 'I kept reassessing my experiences to learn from them and improve my performance at work' (IA-intern) or 'I kept up with professional publications to keep on being updated on what is happening in my field' (IA-Extern). A four-point Likert scale was used to score the questionnaire with two scales of each four questions. A low score means that IA is present to a lesser extent. If none of the possible answers applied, this could be scored as not applicable.

(2) For the two facet scales: 'openness to ideas' and 'openness to actions', the Dutch version of the 'Revised Neo Personality Inventory Questionnaire'(Hoekstra, Ormel, & De Fruyt, 1996) was used. A five-point Likert scale scores the scales of each eight questions; a low score means that a trace has a low presence. Question examples are: 'I think it's interesting starting new hobbies' (openness to actions) or 'I love solving problems or puzzles'(openness to ideas).

(3) The 'Interest and Deprivation Curiosity Questionnaire' (Litman, 2008) was used in the Dutch version (Meijer et al., 2016a). Each scale includes 5 items and is scored by a four-point Likert scale, whereas low score means a 'lesser presence'. Question examples: 'I enjoy learning about subjects that are unfamiliar to me' (curiosity interest) or 'I spend hours on a problem because I cannot rest without answer'(curiosity deprivation).

To be able to control the IA-development for other potential student-specific variables, participants were asked to provide information about: gender, age,

experience, work-setting, job description, type of master and geographic location of the master's course. This questionnaire was digitally sent out twice to all students that entered the master's courses. The first time was at the beginning of year one (pre-test), and the second time was at the beginning of year two (post-test).

'Engaging IA in Education Questionnaire'

To measure how students IA is engaged during education, the 'Questionnaire to Measure the Level of Reflective Thinking' (Kember et al., 2000; Lethbridge et al., 2013) and the 'Inquiry-Based Attitude Questionnaire' (Meijer,Geijsel, Kuijpers, Boei, & Vrieling, 2016a) were used to compose a questionnaire that included four scales, which assess the extent to which students are engaged in: knowledge-sourcing, understanding, reflection and critical reflection. Each scale consisted of 4 questions that could be scored by a five-point Likert scale, in which a higher score meant a higher presence of the stimulation of the IA-development. Question examples include: 'During this course, I interviewed experts to expand my knowledge on education'(knowledge-sourcing);'I needed to understand the theories taught by the educator in order to perform tasks in practice'(understanding); 'This course made me think over what I have been doing in practice, and I had to consider alternative ways of doing it'(reflection) and 'During this course, I discovered faults in my professional opinions that I previously believed to be right'(critical reflection). Before sending out the questionnaire, the reliability was tested (N = 350) and the results were comparable with the original instruments (see, Table 1. Reliability 'Stimulating IA in Education Questionnaire').

To be able to control other potential student-specific variables, participants were asked to provide information about: gender, age, experience, work-setting, job description, type of master and geographic location of the master's course. This questionnaire was digitally sent out three times to all first year students, at the end of three successive educational periods of eight weeks. Students had a free choice to participate.

Table 1. Reliability 'Engaging IA in Education Questionnaire' based on existing instruments (Kember et al., 2000; Meijer et al., 2016a).

Cronbach's Alpha	Understanding	Reflection	Critical reflection	Knowledge-sourcing
Original instruments	.76	.63	.68	.76
Translated instruments	.76	.72	.76	.74

Analysis and Results

In this section, we present the analysis and results per research question.

Research question 3: Analysis

Addressing our third research question, we asked to what extent in-service teachers' IA develop during their first year, and to what extent this development is related to the personality traits openness and epistemic curiosity, we analysed the gathered data using the 'IA-development Questionnaire'. We conducted a paired-sample t-test to analyse the difference of IA-Intern and IA-Extern between the beginning of year one (T1, n = 350) and the beginning of year 2 (T2, n = 197). In order to perform the analysis, both datasets of T1 and T2 were merged and checked for outliers, missing values and recoded if necessary. Because we needed paired measures, we only used data from respondents that participated both times (n = 125). We created two new variables representing the progression-score of IA-Intern and IA-Extern (i.e. difference between T1 and T2) (Nijdam, 2004). Next, we determined to what extent IA-progression-scores could be explained by student-specific variables: gender (paired-sample t-test), age in categories (One-way Anova), experience in years (Pearsons correlation analysis), work-setting in categories (One-way Anova), job description in categories (One-way Anova), type of master (paired-sample t-test) and geographic location of the master's course (One-way Anova).We then calculated whether there was a causal relation between IA-progression scores and the scores on the traits openness and epistemic curiosity. We first examined, with a correlation analysis, whether there is a predictive linear relationship (Baarda, van Dijkum, & de Goede, 2014) between the progress scores on IA and the traits. We then explored with a stepwise multiple regression analysis (Huizingh, 2012) which combination of variables together formed the best unique predictor of progression-scores on IA.

Results for research question 3

Both IA-Intern and IA-Extern develop during the first year of the course. There is a positive, significant difference (t = -5.113; df = 124; p = .000) with regard to IA Intern on T1 (namely = 3.520) and T2 (namely = 3.774). There is also a positive, significant difference (t = -7.858; df = 124; p = .000) with regard to IA Extern on T1 (namely = 3.251) and T2 (namely = 3.634). Compared to T1, the group was also more homogeneous on both aspects at T2. The standard deviation between T1 and T2 decreased in both IA-Intern and IA-Extern, from respectively .480 to .317 and .570 to .423.

There were no significant differences between T1 and T2 with regard to: Openness to change (t = -.157; df = 124; p = .118); Openness to ideas (t = -.381; df = 124; p = .704) and Epistemic curiosity interest (t = -.653; df = 124; p = .515). With Epistemic curiosity deprivation, there appeared to be positive significant progress score between T1 (namely = 2.27) and T2 (namely = 2.37) (N = 125, t = -2.241; df = 124; p = .027).

No relation was found between the IA progress scores and background variables such as: gender, age, experience, work setting, job description, type of master and geographic location of the master's course (See Table 2. Findings Progression IA controlled by background variables).

No significant relation emerged in the correlation analysis (See Table 3. Correlation traits and IA-progression-scores) between progress scores and the traits. The stepwise multiple regression analysis showed that the progression score on IA Extern can be partially explained by Openness to Ideas (r = .418; p = .000) and Openness to change (r = .242; p .045). As might be expected based on the correlation analysis, this association is too weak to allocate a predictive to it (Baarda et al., 2014).

Table 2. Findings Progression IA controlled by background variables.

Paired T-test	Gender	No significant difference between men (n = 26) and women (n =99) concerning the progression-score IA-Intern (t = -.437; df = 123; p = .791) and the progression-score IA-Extern (t = -.322; df = 123; p = .838).
One-way Anova	Age	No significant difference between age: 20- 25 (n = 27), 26-30 (n = 21), 31-35 (n = 14) 36-40 (n = 18), 41-45 (11), 46-50 (n = 17) and older than 50 year (n = 17) concerning the progression-score IA-Intern (F (6,118) = .682; p = .664) and the progression score IA-Extern (F (6,118) = .649; p = .691)
Pearsons correlation analysis	Teacher-experience in years	No significant relation between teacher- experience in years and the progression-score IA-Intern (r =.043; p =.632; n=125)and the progression-score IA-Extern (r =.065; p=.459; n=125)
One-way Anova	Work setting	No significant difference between work-setting: primary (special) education (n=79), secondary (special) education (n = 25), vocational education (n = 18) or other (n = 3) concerning the progression-score IA-Intern(F (2,122) = .969; p = .382) and the progression score IA-Extern (F (2,122) = .749; p = .475).
One-way Anova	Job description	No significant difference between the job description: teacher (n = 105), coach/team leader (n = 13), other (n = 7) concerning the progression-score IA-Intern (F (2,122) = .969; p = .382)
Paired T-test	Type of master	No significant difference between MSEN (n = 102) and MLI (n = 23) concerning the progression-score IA-Intern (t = -.169; df = 123; p = .866) and the progression-score IA-Extern (t = -.042; df = 123; p = .372).
One-way Anova	Geographic location of the master's course	No significant difference between the location: 1 (n =19), 2 (n = 5), 3 (n = 4), 4 (n = 20), 5 (n = 77) concerning the progression-score IA-Intern (F(4,120) = .585; p = 674)and the progression score IA-Extern (F(4,120) = '.585; p = .674).

Table 3. Correlation traits and IA-progression-scores.

Measures	1	2	3	4	5
1. Progression IA-Intern	---				
2. Progression IA-Extern	.303**	---			
3. Openness Change	.071	- .009	---		
4. Openness Ideas	- .104	- .046	.224*	---	
5. Curiosity Interest	- .153	- .197*	.300**	.477**	---
6. Curiosity Deprivation	- .085	.044	- .051	.093	.189*

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

Research question 4: Analysis

Addressing our fourth research question asking how and to what extent IA-development is stimulated and how this is related to the factors of time and educator, we analysed our data using the 'Engaging-IA in Education Questionnaire'. Before analysing, we created a dataset on students´ level by merging the datasets of the three time-points (T1, n = 184; T2, n = 215; T3, n = 157), and checked outliers and missing values. Next, per time-point, we explored the means and standard deviations and correlation of students' engagement in knowledge-sourcing, understanding, reflection and critical reflection (hereinafter: IA-aspects) with the aim to gain insight into possible stimulation patterns. Subsequently, we explored the statistical differences of educators per scale by conducting a One-way Anova with a Tuckey's-b as post hoc to gain insight into the role of the educator in students' engagement in IA-aspects (hereinafter: IA-engagement). To do so, we had to create a dataset on educators' level that reported the IA-engagement scores per educator, per IA-aspect and per time-point.

To gain insight into the likelihood of the of variables time, educator and student-specific background-variables as predictors on students' IA-engagement, we conducted a GEE analysis. Before that, we had to restructure the dataset on students´ level into a long format, in which we used the One-way Anova results on educators' level to label the educators as low, medium or high, on average, per time-point and on each IA-aspect. With this GEE dataset (n =556 observations) we first explored the likelihood of time as a predictor, we then explored the interaction between time and the variable educator as a predictor and thirdly, we inspected the results with student-specific variables, measured on the right levels, as predictors on students' IA-engagement. By following these steps, we were able to present the predictors on students' IA-engagement, summarized in table 5 (GEE model 1), Table 6 (GEE model 2) and resulting in the summarized final model in Table 7 (Gee model 3). Every table reports the predictor's parameter estimate, the robust standard error of the parameter estimate, the robust z-value, and the p-value associated with the robust z-value.

To gain insight into the possible relationship between students' engagement in knowledge-sourcing, understanding, reflection and critical reflection, as well as their IA-progression scores, we conducted a stepwise regression analysis.

Results for research question 4

Based on visual examination of the data, we see different patterns in engagement in knowledge-sourcing, understanding, reflection and critical reflection (hereinafter: IA-Aspects) over the three time-points (See Table 4. Means and standard deviations of IA-Aspects at each time-point). Overall, critical reflection is observed the least (mean = 3.55) but shows a positive pattern over time; the means of knowledge-sourcing (mean = 3.95) and understanding (mean = 3.98) are approximately equal but vary in pattern over time; reflection has approximately the same average over time and is observed most (mean = 4.14). Overall, the standard deviation over time becomes smaller.

Table 4. Means and standard deviations of IA-Aspects at each time-point.

IA-Aspects	Time 1 n = 184	Time 2 n = 215	Time 3 n = 157	Mean over Time 1.2.3
Knowledge-sourcing	3.97 (0.70)	3.86 (0.80)	4.01 (0.58)	3.95
Understanding	4.09 (0.70)	3.96 (0.70)	3.89 (0.67)	3.98
Reflection	4.12(0.66)	4.21(0.64)	4.09 (0.61)	4.14
Critical reflection	3.42 (0.80)	3.56 (0.79)	3.66 (0.69)	3.55

Table 5. Correlation IA-engagement during education over time.

Time-point	T1	T2	T3	T1	T2	T3	T1	T2	T3
IA-Aspects	1 Knowledge-sourcing			2 Understanding			3 Reflection		
Knowledge-sourcing									
Understanding	.525**	.503**	.515**						
Reflection	.388**	.504**	.438**	.458**	.529**	.608**			
Critical reflection	.240**	.405**	.409**	.305**	.357**	.494**	648**	.610**	.756**

Over time, the relationship between critical reflection and other aspects will generally grow stronger (See Table 5). The link between reflection and critical reflection is strongest here. The average link between reflection and understanding also grows stronger over time. Between understanding and knowledge -sourcing, we see a similar average link overtime.

The results of the Anova with respect to exploring the differences between educators, shows statistical differences between educators in terms of their students engagement in knowledge-sourcing, understanding, reflection and critical reflection. With regard to the latter three, we could distinguish between

three categories per aspect and; labelled in line with the results, each educator per IA-Intern aspect: as 1 = low on average; 2 = medium on average and 3 = high on average. The results showed that an individual educator could have the same label on each aspect, but different labels were also a possibility. There were no educators with only label 3: high on average.

The GEE analysis with regard to the exploration of the interaction effect between students' engagement in knowledge-sourcing, understanding, reflection and critical reflection with (1) time (2) educator (3) student-specific variables, showed that time is indicated as a negative significant predictor for stimulating understanding, and a positive significant predictor for stimulating critical reflection (See Table 6). However, the second GEE analysis in which the effect of time was controlled per educator, indicated that time only continues to be a positive significant predictor with regard to critical reflection. These results also indicate that that educators are positive significant predictors on understanding, reflection and critical reflection (See Table 7).

Table 6. GEE model 1: Summary of the GEE analysis of the likelihood of time as predictor on engagement in IA-aspects.

IA-aspect	Predictor	Estimate	Robust SE	Robust z	p-value
Understanding	Time	-0.104	0.036	-2.924	0.004
Critical Reflection	Time	0.117	0.037	3.208	0.001

Table 7. GEE model 2: Summary of the GEE analyses of the likelihood of time and educator as predictors on engagement in IA-aspects

IA-aspect	Predictor	Estimate	Robust SE	Robust z	p-value
Understanding	Educator	0.286	0.033	8.550	0.000
Reflection	Educator	0.344	0.038	9.078	0.000
Critical reflection	Educator	0.404	0.050	8.169	0.000
	Time	0.076	0.036	2.106	0.035

The results of the third GEE analysis with regard to the interaction effect between IA-aspects, time and educator controlled with student- specific variables: gender, age, experience, work setting, job description, type of master and geographic location of the master's course, showed a collinearity-problem between age and experience due to their strong positive correlation (r = .772 / p = .000). We decided only to use experience in order to prevent this adverse inter-variable interference.

The results concerning predictors on engagement in IA-aspects are summarised in Table 8., GEE model 3. In this model, the variable educator continued being a significant positive predictor on engagement in understanding, reflection and critical reflection. The variable time continued being a significant positive predictor on critical reflection. The student-specific variable 'experience' appeared to be a significant negative predictor concerning knowledge-sourcing and critical-reflection; in other words, more experience means less engagement in critical reflection. With regard to the student-specific variable work-setting, the category 'lower vocational education' appeared to be a significant positive predictor on knowledge-sourcing and the work-setting 'outside education' is indicated as a significant negative predictor on understanding. With regard to the student-specific variable 'geographic location of the master's course', only location A is indicated as a significant positive predictor on knowledge-sourcing

Table 8. GEE model 3: Summary of the GEE analyses of variables predicting the likelihood of stimulating IA-development.

IA-Aspect	Predictor	Estimate	Robust SE	Robust z	p-value
Knowledge-sourcing	Work-setting: lower voc. Education	2.221	9.031	2.459	0.014
	Location: A	1.300	6.159	2.111	0.035
	Experience	-5.404	1.192	-4.533	0.000
Understanding	Educator	3.155	3.700	8.527	0.000
	Work-setting: outside education	-3.613	1.707	-2.117	0.034
Reflection	Educator	3.445	3.769	9.140	0.000
Critical reflection	Time	1.064	3.814	2.791	0.005
	Educator	4.035	5.125	7.874	0.000
	Experience	-3.485	1.574	-2.215	0.027

The results of the multiple regression analysis concerned the causal relation between IA-engagement, and IA-progression scores showed that only engagement in knowledge-sourcing during T1 has a positive significant, but very weak, causal relation with the progression-score op IA-intern (r = .277; p = .017) as well as IA-extern (r = .272; p .035). During time-points 2 and 3, no causal relation was found.

Discussion

Developing an Inquiry-Based Attitude (IA) (Meijer et al., 2016a) as an educational goal is a hot item in teacher education. However, empirical knowledge that contributes to the development of pedagogical approaches with the aim to stimulate IA during teacher-education, is lacking. This made it relevant to explore to what extent IA develops during teacher education, how IA development is stimulated and what variables predict the educational impact with regard to students' engagement in knowledge-sourcing, understanding, reflection and critical reflection. It was also relevant to explore the relationship between students IA-engagement and their IA-development. This study focussed on IA-development and IA-engagement during the first year of post-initial teacher education.

This study firstly resulted in an understanding of how IA development is related to the traits openness to ideas, openness to change and epistemic curiosity. We learned that IA develops positive significantly and independently from the abovementioned traits, and that epistemic curiosity is not as stable as openness. We found that the significant positive IA-development cannot be predicted by the personality traits of openness and epistemic curiosity, and is not related to student-specific background-variables. Therefore, we assume that IA-development can be indicated as a specific result of the attended education, and that IA development does not depend on the above mentioned traits. We found this remarkable because openness and epistemic curiosity predict professional growth, openness to stimuli and academic achievement (Chamorro-Premuzic & Furnham, 2009; Komarraju et al., 2011; Reio &Wiswell, 2000), it was in line with expectations that this was also the case with IA-development. The results also showed that, in our sample, epistemic curiosity (Litman, 2008) is not as stable as openness (e.g. Cobb-Clark & Schurer, 2012). Despite the fact that stability was more in line with expectations, it is conceivable that professional role expectations concerning how one should act facilitated students' epistemic curiosity change since they were expected and guided to search and study literature (Roberts, Walton, & Viechtbauer, 2006). The impact of the professional role expectations concerning IA during the followed education may possibly also explain why IA-development does not depend on someone's openness or curiosity, but on the expectations during education.

This study also resulted in an understanding of how and to what extent students are engaged in knowledge-sourcing, understanding, reflection and critical reflection during education, and how this is related to the factors of time and educator and to student-specific background-variables. We discovered that students' engagement in understanding, reflection and critical reflection can be predicted by the educators, and that time too is a predictor on critical reflection. We also indicated experience as a negative significant predictor on knowledge-sourcing and critical-reflection, and that some sub-categories of student-specific background-variables can be indicated as predictor. We also found a general pattern in students' engagement in knowledge-sourcing, understanding, reflection and critical reflection, that is in line with research concerning educators repertoire in stimulating students IA (Meijer et al., 2016b). Compared with knowledge sourcing and understanding, engagement in reflection observed is most and engagement in critical reflection is observed least. This is also in line with other research that showed that it is unlikely to expect critical reflection as much as reflection, because 'ingrained assumptions are hard to change'[…] and need 'a significant change of perspective' (Kember et al., 2000, p. 385). Our research indicated that time is a predictor on engagement in critical reflection. This finding adds to existing literature with regard to the difficulties of critical reflection as a learning goal (Avalos, 2011; Illeris, 2014; Mezirow & Taylor, 2009), that having enough time (in our research 1 year) might be crucial to investigate the validity of personal opinions which might lead to changes in beliefs and behaviour. Although we have no insight into exactly how much time actually matters, a possible explanation is that, when students are systematically taken out of their comfort during several courses over a longer time and per module, this commitment promotes critical reflection. If this assumption is correct, it raises the question of how the work fragmentation within curricula in the current higher professional education - after all, they use mostly relatively short courses - affects engagement in critical reflection as an aspect of IA.

Our assumption that IA-development can be indicated as a result of the attended education is supported by the fact that our sample, which was very diverse in nature, became more homogeneous during the academic year, but we have to consider, however, that this finding is partially due to regression toward the average. The finding that IA development is not predicted by traits and is not related to student-specific background-variables, in our opinion,

contributes to conceptual clarity of the concept IA as a goal in initial and post-initial teacher education.

Our research adds to the significant proven impact of teachers on the learning of students (Cochran-Smith & Zeichner, 2010; Hattie, 2003; Mourshed et al., 2010), that this also applies to the teacher-educators in our sample. The educator factor is convincingly indicated as a predictor on the extent to which knowledge-sourcing, understanding and reflection is triggered as a result of the followed education. The results also showed that it is possible to make a personal educator profile in stimulating students' engagement in IA. An example is a profile that clearly indicates that the educator specifically encourages engagement in reflection, but relatively little understanding of knowledge-sourcing. Insight into a personal profile in how and to what extent students' IA is engaged, might support educators critical refection with regard to personal beliefs and behaviour, and therefore contribute to their transformative learning (Illeris, 2014; Mezirow, 1991).

With regards to student-specific background-variables in our sample, 'years of work-experience' is indicated as a negative predictor on knowledge-sourcing and critical reflection. We assume that deconstruction and reconstruction of beliefs is more complicated as one grows older and more experienced, because beliefs are deeply rooted in one's identity (Meijer et al.,2016b; Illeris, 2014). The observed negative correlation between years of experience and knowledge sourcing raises the question of whether having a lot of experience is accompanied by the personal assumption that one has a lot of knowledge, making one less receptive to the incentive to actively search for new sources of knowledge.

With regard to the finding that 'work outside education' is a negative predictor to understanding we suspect that the lack of a conceptual educational knowledge base, is a possible explanation. Studying within a context where many of the professional conceptual knowledge is assumed to be known is perhaps prohibitive for engagement in understanding of students who do not work in education. Perhaps the background of these students is unnoticed by the educators. Based on this assumption it cannot hurt that, at the beginning of a course, educators identify which students work outside an educational context, so that they can take this into account. These findings may also be discussed in possible intakes in matching the expectations of students and courses.

That working in lower vocational education is a positive predictor in our sample possibly depends, according to the educators, on the fact that there exists relatively little specific educational theory for this target group, while it does have a great need for it. One specific course-location also appeared to be a positive predictor to knowledge-sourcing. We cannot explain this, student variables that we have not included in our study, may play a role in this.

In our research, we could not determine reliable links between the extent to which students are engaged in knowledge-sourcing, understanding, reflection and critical reflection during the three time-points, and their IA-development. An explanation for this might be that unravelling the impact of the multiple variables in our teacher education courses to students learning over one year, was too complex (Cochran-Smith & Zeichner, 2010).

Conclusion

Fostering and encouraging an Inquiry-Based Attitude (IA) is an important new goal in teacher education on both the initial as post-initial level. This study contributes to the theory of developing IA as a learning goal during the post-initial education of in-service teachers studying for a professional master's degree. Our research showed that IA can actually develop and that this development does not depend on the personality traits of openness and epistemic curiosity. This development cannot be explained by student-specific background-variables. This implicates that the development of IA as a result of teacher education is indicated as an achievable goal. In post-initial teacher education our instrumentation can be used to get insight in the IA development.

With regard to students' engagement in the four IA-aspects (i.e. knowledge-sourcing, understanding, reflection and critical reflection), we found a general pattern in which engagement is least observed in critical reflection, and most in reflection. The variable time predicts students' engagement in critical reflection and the variable educator predicts students' engagement in understanding, reflection and critical reflection. Educators vary from each other statistically with regard to stimulating IA. These findings underpin the impact of educators in the learning outcomes of students. Teacher training can use our instrumentation to gain self-insight into the way they promote the development of the Inquiry-Based Attitude.

Our findings that time is a positive predictor on engagement in critical reflection and that years of work experience is indicated as a negative predictor on both knowledge sourcing and critical reflection contribute to a deeper understanding of developing IA in teacher-education. Within education, these findings may be subject of discussion during guiding and coaching activities in and perhaps also outside the field of education and workplace learning.

Our study is subject to some limitations. Because we do not have longitudinal nested groups, we could not examine the interaction between and within groups. When interpreting the results, it should also be kept in mind that unmeasured influences like, for example, the person of the teacher-educator, the sequence of the teacher-educators, the specific course content and the group-dynamics might also interact with our findings (Cochran-Smith & Zeichner, 2010; Ropes, 2010; van Aken & Andriessen, 2011).

More research is needed to understand the relationship between educators actual behaviour with regard to stimulating IA, and the IA-development of students. In our opinion, it also makes sense to investigate the actual interventions of educators in order to gain insight into effective pedagogical approaches with regard to IA-development. Future research could also provide insight into what extent IA engagement depends on specific content and/ or the interaction with and between some teachers and some student groups. Furthermore, we advise research with the aim to gain more insight into the positive relationship between time and the development of being critical reflective, as well in the negative relationship between experience in years and students' engagement in knowledge-sourcing.

This study contributed to the theory of IA as a developable goal in teacher education. It resulted in practice-based scientific knowledge which post-initial teacher education can benefit operationalising IA and enhance students IA development. The results and instrumentation may also be useful in other post-initial development programmes in and outside education.

CHAPTER

4

Professional Development of Teacher-Educators towards Transformative Learning

This chapter was previously published: Meijer, M., Kuijpers, M., Boei, F., Vrieling, E., & Geijsel, F. (2016b). Professional development of teacher- educators towards transformative learning. Professional Development in Education. Advance online publication. Doi: http://dx.doi.org/10.1080/19415257.2016.1254107
Small adjustments were made to the form in which this chapter was published.

Abstract

This study explores the specific characteristics of teacher-educator professional development interventions that enhance educators' transformative learning towards stimulating the Inquiry-Based Attitude of students. An educational design research method was followed. Firstly, in partnership with five experienced educators, a professional development programme was designed, tested and redesigned. Secondly, a qualitative multiple case study was conducted to examine the active ingredients of the designed interventions with regard to educators changes in beliefs and behaviour. The study was carried out in four different educational settings in which 20 educators participated during nine months. Data sources included videos, questionnaires, interviews and written personal theories of practice. The analyses indicated that aligned self-study interventions on a personal, peer and group level guided by a trained facilitator supported the intended leaning.

Professional Development of Teacher-Educators towards Transformative Learning

Introduction

Because of current economic and social developments, professionals need to be able to respond quickly and adequately to new and changing circumstances more than ever before (Coonen, 2006; OCW/EZ, 2009). These professionals are characterised by the ability to continuously renew their own performance throughout their professional lives based on quality information, knowledge and the experience of others (Leijnse, Hulst, & Vroomans, 2006, Vijlder, 2007, Hargreaves & Fullan, 2012). Both international organisations (Cochran-Smith & Zeichner, 2010) and the Dutch Education Council (2014) assume that having an 'Inquiry-Based Attitude' contributes to this ability to innovate and to the circulation of knowledge, which will boost the economy (Mourshed, Chijioke, & Barber, 2010). Based on this assumption, the Dutch Education Council (2014) states that teacher education should educate teachers with an Inquiry-Based Attitude (IA).

According to Snoek, Swennen, & van der Klink (2011), intensive international exchange of learning by educators will contribute to the professionalism of teacher educators. Until now, however, there have been no empirical studies that provide specific insight into how teacher-educators (hereinafter: 'educators') can enhance the development of the IA of teachers-in-training (hereinafter: 'students'). Moreover, this general lack of knowledge in teacher education research concerning active ingredients, conditions or contexts that may have a positive impact on what and how educators learn (Cochran-Smith & Zeichner; 2010, Lunenberg, Dengerink, & Korthagen, 201,4) complicates the development of educators.

The aim of the study is to understand the specific characteristics of professional development interventions that encourage the deep learning of educators. In order to do this, a professional development programme was designed in collaboration with these educators (Biesta, 2007; McKenney & Reeves, 2013). The subject of this programme was enhancing the IA of their students. We used the 'Educational Design Research' method (McKenney & Reeves, 2013) in which a study is conducted in an authentic educational setting

with practitioners to explore *how* and *why which* kinds of approach truly help to solve 'real problems' (Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006). This collaboration of researchers with practitioners is also referred to as 'engaged scholarship' (Van de Ven, 2007), and according to Kessels (2012) and Martens (2009) this approach supports innovation processes in teaching practice, whilst simultaneously contributing to professional development.

Theoretical background

First of all, this section describes the already published results of effective ingredients for professional development of TEs from a theoretical perspective and then, secondly, recent insights in the field of stimulating IA.

Professionalising Teacher-Educators

Educators are expected to train teachers with an IA (Onderwijsraad, 2014). When designing a professional development programme for educators that helps them to stimulate the development of IA in students, it is not possible to rely on scientifically validated training interventions. This is because systematic professional development training for educators in and outside the Netherlands is either severely limited or lacking altogether (Cochran-Smith & Zeichner, 2010; Dengerink, Lunenberg, & Kools, 2015).

In order to contribute to the professionalisation of the profession of educator, Lunenberg et al. (2014) defined six professional roles based on a review study, namely: teacher of teachers, researcher, facilitator, curriculum developer, gatekeeper and bridge builder. For the professional development programme to be designed to promote the IA of students, the role of 'teacher of teachers' is especially important. The main characteristics are promoting active learning, being a role model and explaining and legitimising being a role model. The latter does not occur very often, because it is so complicated that educators 'do not know what they know at a conscious level and may have had few experiences of articulating their knowledge of practice either for themselves or others' (Berry, 2009, p. 307).

With regard to the professional development of educators, Lunenberg et al. (2014) distilled some useful generic features: learning from and with peers has a particularly positive effect, research into one's own practice also turns out to

be effective; and training must support learning and must be suitable for the educators. Empirical knowledge about specific professional development features for educators is not available, however.

Because of the lack of specific knowledge about the professional development of educators, we consider knowledge about the professionalisation of teachers in general to be relevant as well. Here too, however, there is a lack of a thorough evidence base for the specific features of professional development interventions (Desmione, 2009, Van Veen, Zwart, Meirink, & Verloop, 2010; Vermunt & Endedijk, 2011). Generic characteristics related to effective professional development interventions were found, however (Van Veen et al., 2010). These characteristics correspond to the generic professional development features provided by Lunenberg et al. (2014), and include: learning with and from peers, studying one's own daily classroom practice; and learning support. As a precondition, professional development should be in line with school policy and given adequate time (van Veen et al. 2010).

Learning at a Professional Identity Level

Because the professional identity of educators has implications for taking up their professional roles (Berry, 2014), the overarching principle of professional development concerns the importance to focus on changes in beliefs and behaviour related to personal growth at a professional identity level (Geijsel & Meijers, 2005, Illeris, 2014, Kelchtermans, 2009). Although the general view is that beliefs and behaviour characterise the identity and that personal growth should focus on both, there is still much uncertainty about the exact nature of the relationship between beliefs and behaviour (Taylor, 2007, van der Schaaf, Stokking, & Verloop, 2008). Identity is a complex concept with a complicated structure, which does not simply change under the influence of professionalisation (Beijaard, Meijer, & Verloop, 200; Dinkelman, 2011). Development psychology has demonstrated that identity consists of a part that is stable and insensitive to change and a part that is sensitive to change (for example, Day, Kington, Stobart, & Sammons, 2006). In order to determine this difference in stability in relation to learning, Illeris (2014) developed a model in which the general structure of identity is worked out on the basis of available learning and personality theories. This three-layer model helps to explain which expectations are realistic with regard to changes in beliefs and behaviour in relation to the intended level of learning. The 'preference layer' is the least stable and includes

preferences and routines with regard to acting, thinking and feeling in everyday situations. The 'personality layer' includes values, attitudes, beliefs, behavioural patterns, manners and attitude and is relatively stable, but can be influenced by professionalisation. The 'core identity layer' includes personality traits and is therefore so stable that professionalisation hardly influences it (Boekaerts, 1996; McCrae et al., 2000).

The type of learning we are aiming for is learning that brings about changes in the so-called personality layer. In order to achieve this learning, most professional development literature greatly emphasises 'deep learning' (cf. Fullan & Langworthy, 2014; Van Veen, et al., 2010). However, the intended level of learning in this study is 'transformative learning', as introduced by Mezirow (1991). This learning is characterised as 'not something to be remembered and recalled, but something that has become part of the person' (Illeris, 2009, p. 142). According to Flores and Day (2006), teacher training even involves 'in essence, the (trans)formation of the teacher identity' (p. 220). Transformative learning is therefore considered to be the highest level of deep learning and requires critical reflection (Illeris, 2014; Mezirow & Taylor, 2009). Critical reflection involves the deconstruction and reconstruction of personal beliefs, which can lead to new beliefs (Kember et al., 2000, Mezirow & Taylor, 2009). Although the impact of critical reflection on the intended learning is generally recognised (for example, Avalos, 2011, Dyment & O'Connell, 2011), this does not mean that a change in beliefs automatically leads to matching behaviour (Taylor, 2007; van der Schaaf, et al., 2008). However, the meta-analysis of Webb and Sheeran (2016) revealed a positive causal relationship between intentions and behaviour. This indicates that interventions with greater impact on beliefs and intention engender greater impacts on behaviour.

Stimulating an Inquiry-Based Attitude

In this study we are particularly interested in what specific interventions in the professional development of educators affect their stimulation of the IA of students. In both scientific and practical publications, IA is generally used as a container concept that refers to a broad set of attributes that is associated with: personality traits such as openness and curiosity; characteristics of a reflective, deep-learning practitioner with a critical mind and research skills such as the systematic use of knowledge and working and thinking analytically (for example, Martens 2009; Cochran-Smith & Lytle, 2009; Bruggink & Harinck, 2012; Leeman

& Wardekker, 2014). In order to operationalise the container concept of IA into a well-founded concept that offers educators insight into its characteristics, Meijer, et al. (2016a) conducted a multiannual empirical study into the developable features of IA. The present study applies this operationalisation, in which IA is characterised as a construct with an internal and an external dimension that complement each other. These dimensions are referred to as IA-Internal and IA-External.

IA-Internal concerns the ability of teachers to gain 'new modes of understanding' about themselves, about knowledge and about the context, with the purpose to work on/refresh their professional behaviour (Meijer et al., 2016a). This ability is based on reflection, a key aspect of IA-Internal. Four levels can be distinguished within reflection, namely: (1) habitual action (acting routinely); understanding (comprehending theoretical concepts); reflection (intellectual and affective activities to facilitate thinking about personal professional practice experiences) and critical reflection: (the deconstruction and reconstruction of personal beliefs, which can lead to new beliefs) (Kember et al., 2000; Lethbridge, Andrusyszyn, Iwasiw, Laschinger, & Fernando, 2013). The latter three levels are related to a deep approach to learning (Leung & Kember, 2003) and are relevant in the present study.

IA-External relates to active knowledge-sourcing behaviour focused on professional development in response to specific questions and/or problems (Meijer et al., 2016a).

This means that a person actively seeks new relevant knowledge sources in response to specific questions. IA-External has strong similarities with what is described as 'looking past one's own professional borders' and 'learning from others' in educational and organisational studies (Leijnse et al., 2006; Hargreaves & Fullan, 2012). In addition, this concept is similar to the intellectual exploratory behaviour or epistemic curiosity described in psychology (Litman & Spielberger, 2003; Reio, Petrosko, Wiswell, & Thongsukmag, 2006). Knowledge management literature also defines IA-External as: 'intentional actions taken to locate and access others' expertise, experiences, insights, and opinion' (Gray & Meister, 2006, p. 144).

Research questions

In order to examine the extent to which and the manner in which the specifically designed interventions in the professional development programme support the development of educators at the level of transformative learning with regard to stimulating an Inquiry-Based Attitude in students, we seek to answer the fifth and sixth research question of this dissertation:

5. To what extent and in what way do the designed professional development interventions support the transformative learning of educators?
6. How do these interventions influence changes in beliefs and/or behaviour of educators with regard to the stimulation of an Inquiry-Based Attitude in students?

Before we can start finding the answers to these questions, we will first describe the design of the professional development programme.

Design of the Professional Development Programme

This section describes the theoretical design of the professional development programme. In this design, the two key preconditions 'being in line with the policy of the university' and 'adequate time for professional development' (Van Veen et al., 2010) have been complied with. The subject of our professional development is stimulating the IA of students, which is in line with the first precondition because the policy of the university is to promote IA as a spear point. In line with the second precondition, participants will be given 30 hours of professionalisation time by the management for seven peer-meetings, each three hours long, which are distributed evenly over nine months (see Figure 1). The design of the specific interventions is based on the following three generic design principles: 'learning with and from peers'; 'studying one's own practice'; and 'supporting transformative learning'. These will be described in the following. From now onwards the professional development programme will be referred to as the 'Teacher-educator Inquiry-based Professional development Programme' (TIPP).

Learning with and from Peers

The most powerful driver for educational innovations is learning from peers (Mourshed, Chijioke, & Barber, 2010). Hord (1997) refers to learning from peers as the 'professional community', which is all about the shared responsibility of practitioners to develop a shared vision on meaningful practice questions with the aim of improving this practice. According to Hargreaves and Fullan (2012), this type of learning is fuelled by actively collaborating with peers, studying practice, and discussing both scientific knowledge and personal expert knowledge about effective teaching. A prerequisite for this kind of professional learning is 'critical friendship' with the emphasis on 'friendship', meaning 'equality', 'trust', 'openness' and 'vulnerability' (Schuck, Aubusson, & Buchanan, 2008). In order to realise learning from and with peers on the basis of critical friendship during the TIPP, it was decided to work with relatively small groups of five colleagues (peers) who know each other and participate on a voluntary basis.

Studying one's own practice

An intervention set with 'Theory of Practice' was designed in order to explore the *beliefs* that the educators utilise as a framework for the way in which they act (Miles, Huberman, & Saldaña, 2013) and promote professional self-understanding based on this exploration (Berry, 2009). This intervention set consists of three sub-interventions that we refer to as 'personal', 'peer' and 'group'. First of all, a personal theory of practice is written prior to the TIPP (Kelchtermans, 2009) which demands a critical exploration of one's own profile as an educator who educates teachers with an IA. The format in which this is written can be decided by yourself, and the content is based on guiding questions about aspects such as one's own beliefs, how these beliefs originated and how they are related to the beliefs of 'others' and to the gained knowledge. Secondly, the theories of practice are sent to the peers prior to the peer meeting, so they can prepare reflective and clarification questions. Thirdly, the theories of practice are discussed at the group meeting. At the end of TIPP this theory of practice is written once again to reveal any changes in beliefs.

In order to explore educator *behaviour* with regard to stimulating the IA of students, the intervention set 'Video Analysis' was designed. This also consists of three sub-interventions: 'personal', 'peer' and 'group'. In the week prior to

the TIPP each participant can choose one of their lessons, which will then be recorded on video. First of all, the participants' own behaviour is analysed by themselves using the same analysis codes based on theory. The codes concerned their promotion of IA-Internal (i.e. understanding, reflection and critical reflection) and IA-External (i.e. knowledge-sourcing behaviour). Secondly, the educators also analysed a video of one peer. Thirdly, the analysis dilemmas are explored during the group meeting using selected video clips. This approach is supported by the meta-analysis of Fukkink, Trienekens and Kramer (2010) regarding video feedback, which shows that video analyses and discussing dilemmas can have a positive effect on learning, provided that the psychological impact of 'self-confrontation' is taken into account. The use of this approach within a professional learning community is supported by the research of Schuck et al. (2008), which shows that peer observations in combination with professional learning conversations promote critical reflection. At the end of the TIPP a second video is recorded and analysed to reveal any changes in behaviour.

Supporting Transformative Learning

In order to support transformative learning, five interventions were implemented. Firstly, transformative learning is supported by 'trained facilitators' who co-designed, tested and improved the TIPP as an expert group and who are prepared for their role of facilitator during two half-day training sessions (McKenney & Reeves, 2013; Van den Akker, et al., 2006). These facilitators practised offering feedback – 'what progress is made towards the learning objective?'- and 'feed forward' – 'what action needs to be undertaken to make better progress?' (Hattie & Timperley, 2007, p. 86). They also practised asking critical reflective questions aimed at understanding, explaining and improving or rebalancing behaviour and beliefs (Mezirow & Taylor, 2009; Taylor & Jarecke, 2009). Such guided reflection by facilitators during group meetings has proved to be helpful in supporting self-study (Lunenberg, Zwart & Korthagen, 2010). Finally, they practised functioning as a role model for elaborating on and legitimising their own actions (Lunenberg, et al., 2014). In order to ensure the continuity of the learning process, the facilitator draws up process reports of the group meetings that are read prior to the meetings.

Secondly, the participants formulate a personal 'learning objective' to give direction to their learning (Segers & Dochy, 1999). Thirdly, 'reflective memos'

(Akister et al., 2003; Ovens, 2011) are written during and after teaching and are discussed during the group meetings. Fourthly, 'a personal log' is written to support reflection (Verkuyl & Korthagen, 1999). Finally, 'reading and discussing theory' is done to support the conceptual understanding of stimulating IA (Hargreaves & Fullan, 2012).

Method

This qualitative Educational Design Research was carried out as a multiple case study within the context of four different teacher training courses (bachelor's and master's level) at a professional university in Central Netherlands. The investigation followed the generic Educational Design Research model as described by McKenney and Reeves (2013, p. 78) and was characterised by iterative cycles of design, evaluation and redesign. The research consisted of two phases: a preparatory phase and a main study phase. The preparatory phase consisted of designing, testing, evaluating and improving the theory-based professional development programme together with an expert group. The resulting design (see Figure 1) was implemented during the main study.

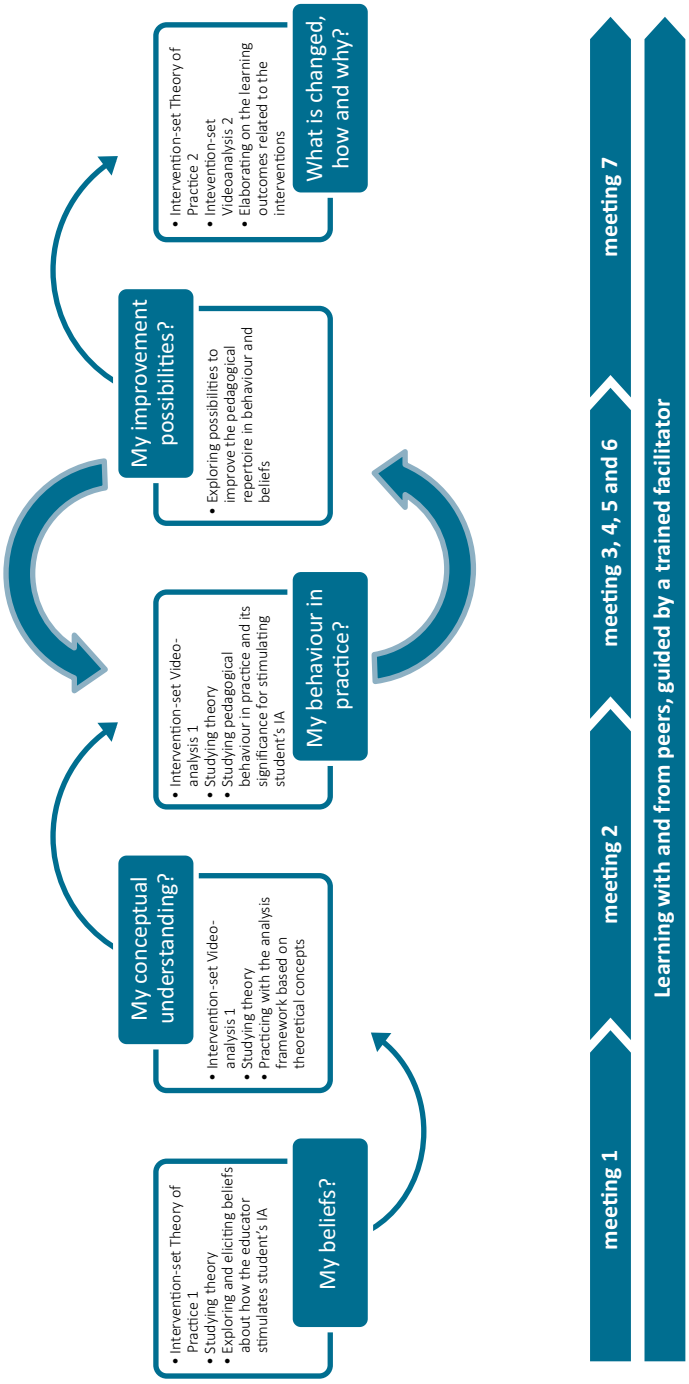

Figure 1. Overview of the intervention.

The main study phase consisted of four parallel case studies in which four fairly homogeneous groups of TEs at four different teacher training courses were followed during TIPP over a period of nine months. In order to understand what TIPP means for professional development, we explored which interventions worked and how and why, and which parts of the interventions needed improvement (McKenney & Reeves, 2013, Swanborn, 2010). The main study phase contributed to answering both investigation questions.

Reliability was improved by safeguarding the researcher's objectivity as much as possible. The researcher only facilitated the TIPP in the try-out stage, while the trained facilitators did this during the main study (van Aken & Andriessen, 2011). Moreover, four different data sources were used to obtain as complete a picture as possible of any changes in the theory that a person may endorse (i.e. beliefs) and in a person's behaviour (Argyris, 2004). Behavioural observations (i.e. videos) were combined with analyses of theories of practice, written evaluations and in-depth interviews. The interviews were conducted by the researcher and an assistant and were taped. During analyses the reliability was improved by coding with two researchers together, so that it could be ensured that the data were interpreted properly (Patton, 2015). In addition, the analysis was both deductive and inductive during the analysis phase; deductive with a pre-set analysis framework based on the interventions, the theory regarding the IA (i.e. understanding, reflection and critical reflection and knowledge-sourcing behaviour) and the theory with regard to transformative learning; and inductive through open coding non-coded material to find any unexpected variables or themes and also to expose any supplemental functions of the design (Baldwin & Clark, 2000).

To improve the validity, the researcher discussed any threats to validity with the facilitators during the main study after each TIPP meeting (Ropes, 2010). Examples of these threats were not filming on time, loss of two participants or adopting the conceptual framework at a different pace. During these meetings various approaches to facilitation were explored to coordinate as well as possible. Because educational practice makes it impossible to control all variables, the aim was to produce results that had the nature of plausible interpretations and transferable knowledge (Ropes, 2010; van Aken & Andriessen, 2011). This means it is plausible that the knowledge about the interventions evaluated in this specific context can be used in other relevant contexts.

Participants

Preparation phase participants

These participants formed the expert group (N=5), consisting of experienced educators from a master's programme (experience 8 - 18 years, age 43 - 58, mean age 53.3, gender five female) who participated out of personal interest. They took part with the knowledge that they would participate first of all as co-designer and then as facilitator. They were given 30 hours for the preparatory phase and 60 hours for the main study phase.

Main study participants

These participants (*N* = 20) were experienced educators from two master's programmes (M1 and M2) and two bachelor's programmes (B1 and B2) who participated on a voluntary basis (10 male, 10 female, age 29 - 68, mean age 50.8, experience 4 - 25 years). The participants formed four groups (M1, M2, B1 and B2) of five colleagues. They were given 30 hours and were recruited through an email from the management. Further explanation was provided during a team meeting. Two participants quit during the TIPP due to personal circumstances and have not been included in the analysis.

Data sources for the main study

In order to explore the extent to which interventions (A) supported the professional learning of educators and whether they influenced (B) changes in beliefs and/or (C) behaviour of the educators, four data sources were used (See Table 1).

Questionnaire for the TIPP

This questionnaire was related to the experienced learning support concerning the interventions and the change in beliefs (Table 1, row 1, columns A and B). Participants were first asked to give a general impression of their learning results. A sample question was: 'What are the main insights you gained from the TIPP?' For each intervention the participant was asked about how their beliefs were influenced, what this meant and whether there were any suggestions for

improvement. A sample question was: 'How did writing a theory of practice affect your beliefs with regard to training teachers with an IA?' The questionnaire was completed prior to the last group meeting. The aim of this approach was to explore the experiences and perspectives thoroughly to prepare the educators as well as possible for the evaluation interview (Seidman, 2013).

Table 1. Main themes analysis and data sources.

Data source	Analysis main themes		
	A. Experienced learning support Interventions	B. Change in beliefs	C. Change in behaviour
Questionnaire for the TIPP	x	X	
Theory of practice 1 and Theory of practice 2		X	
Video 1 and Video 2			x
Interview for the TIPP	x	X	

Theories of practice

To explore changes in beliefs (Table 1, row 2, column B) as a framework for actions, educators wrote a personal theory of practice regarding educating teachers with an IA prior to and after the TIPP.

Videos

To explore changes in behaviour (Table 1, row 3, column C), videos were recorded prior to and after the TIPP (30 - 50 minutes long, depending on the class). The videos were transcribed prior to the analysis.

Interview for the TIPP

Individual, semi-open, in-depth interviews were conducted to explore the learning experiences of the educators and their significance with regard to beliefs (Table 1, row 4, columns A and B). The interviews were structured according to the structure of Seidman (2013), the topics of Silverman (2011) and the question categories of Merriam (1998). The questions were flexible and implemented just in time during an interview that lasted 30 - 45 minutes and had the following structure: introducing and explaining the procedures; exploratory depersonalised questions based on an ideal position, such as: 'What

do you think the ideal teacher-educator who encourages an optimum Inquiry-Based Attitude looks like?' and interpretation questions to explore the participant's own opinions and reasoning, such as 'To what extent will your students have noticed that you were participating in the TIPP?'

Data analysis

The qualitative exploratory analyses of the data from the main study were performed using QDA miner (Cuva, 2014). There were three separate analyses: the kind of learning support experienced in the interventions; changes in beliefs and changes in behaviour. For units of analysis we used TIPP groups as cases (i.e. M1, M2, B1, B2). Coding was based on meaningful units/passages, with one code per dimension of the IA (i.e. IA-Internal or IA-External) as a starting point. When coding IA-Internal (i.e. understanding, reflection and critical reflection) the coding was always based on the highest possible level of reflection.

For interpretation of the results in terms of the efficacy of the interventions we used a variable-by-variable matrix (See Appendix 1) based on an example by Miles, Huberman and Saldaña (2013, p. 224). Our first objective was to understand the efficacy and 'inter-relationship' between the interventions. We then critically examined whether the image at group level matched the image of the sub-units within the cases (i.e. participants) (Swanborn, 2010). Interventions that were found to be supportive by at most five participants were not analysed. For the interventions that were considered to be supportive, based on the relationships between the frequencies and the interpretation of the content of the statements, the extent to which interventions were supportive and the active ingredients were charted. Because it was not expected that participants would indicate the significance with regard to learning for all interventions, we also included 'generic' statements about the interventions in the analysis. Representative quotes from the participants were used to illustrate the results. A number of these quotes fit several interventions. However, every quote was only used once in order to draw an as rich picture as possible. Finally, the extent to which interventions affected change was explored by charting changes in the variations of the intervention repertoire on the one hand and changes in frequencies within the repertoire on the other hand.

Results for research question 5

Regarding research question 5, Table 2 shows a quantitative summary with the results for the support of the interventions for learning. The subsequent sections explain these results: what worked in this intervention, and why and to what extent is transformative learning supported? If relevant, improvement suggestions are made. A qualitative summary of the supporting interventions and their active ingredients is presented in Table 3.

Learning with and from peers

All groups and all participants experienced 'learning with and from peers' as generically supportive for professional development (See Table 2, row 1 and Table 3, rows 2 and 3). It is explicitly stated by 66.7% (of this 100%) that the enhancement of their own reflection is one of the results. Learning with and from peers is often mentioned in relation with another intervention, for example: 'The fact that colleagues view my recordings also results in some degree of reflection: why do I do things the way I do? What is the reason? What are my blind spots?' (Reinier, M2). According to the participants, learning together provides support because (summarised): people 'force' each other to take a step back and examine themselves, it offers the opportunity to flesh out specific concepts together, to learn from each other by 'looking into each other's kitchen', and compare themselves with someone else and discuss this. These threads are a common theme in the example quotes for other interventions in the following sections. As a particular supportive aspect of learning together, 27.7% of the participants mentioned 'safety'. Herbert (B1) illustrates this as follows: 'I feel inspired and secure […] in an atmosphere of trust and openness'. It was found that 22.2% of participants referred to learning together in relation to transformative learning, as illustrated by Anna (M1):

> 'thinking things through in a focused manner and exchanging thoughts with colleagues are of particular value. Previously, I was more in 'do mode', this process forced you to have a good look at what you were doing, which was great. It does reflect in your behaviour in the end.'

These results from the main study corresponded with the experiences of the expert group during the try-out: 'Thanks to the discussions within the group I

have made a better connection with my work concept. My teaching behaviour has matured' (Hennie).

Table 2. Quantitative results of interventions' support on learning

Interventions' support on learning		General learning support (group level) (%)	General learning support (sub-unit level) (%)	Transformative Learning (sub-unit level) (%)	Specific learning support IA-Intern (sub-unit level) (%)	Specific learning support IA-Extern (sub-unit level) (%)
Learning with and from Peers	Learning with and from peers	100	100	22.2	11.1	0
Studying one's own practice	Intervention-set Theory of Practice	100	94.4	27.7	38.8	0
	Intervention-set Video Analysis	100	83.3	44.4	38.8	0
Learning support	General quality facilitator	100	83.3	5.6	5.6	0
	Studying theory	100	88.3	5.6	0	5.6
	Formulating a personal learning objective	75	62	0	0	0
	TIPP as a whole	100	94.4	94.4	61.1	5.6

Studying one's own practice

Two intervention sets were implemented to facilitate studying one's beliefs and behaviour in practice.

Intervention set 'Theories of practice'

Participants in all groups, and 94.4% of all participants, stated that the exploration of 'beliefs' through the intervention set 'theories of practice' supported learning (See Table 2, row 2 and Table 3, rows 3 and 4). According to the participants, this 'worked' because it encouraged the recalibration or adjustment of their own beliefs and/or behaviour: 'By writing a personal theory and discussing it, I thought about how I educate for the first time in my life and

discovered recurring themes' (Youp, M1). Writing was most frequently mentioned as being supportive (88.9%), while 38.8% mentioned reading theories/having their theories read by 'peers' and 44% stated that discussions in the group enhanced further elaboration and reflection. In this intervention set there was a relationship with transformative learning in 38.8%, of which 87% concerns IA-Internal. This learning related to changing 'beliefs' regarding (critical) reflection and resulted in a change in how people viewed their pedagogical approach. Dave (M1) illustrates this change:

> 'I now allow students to express, substantiate and share their views as much as possible. In this way they get a greater understanding of their theories of practice. This is a precondition to figure out if and how adjustment is needed.'

The experiences of the expert group in the try-out match the results in the main study.

The analysis showed that writing the second theory at the end of the TIPP had relatively little significance. Only 16.6% wrote a complete new version, while 55.6% commented and adjusted their first version. The remaining 27.7% indicated no changes and therefore did not write a second version as illustrated by Dave (M1):

> 'I have not rewritten my theory of practice […] if I'd been 25, I would probably have learned more from this intervention [...] I'm 60 [...] My theory represents a deeper layer, […] it goes deeper than the level of action, at which I still have things to learn.'

When asked, most respondents indicated that the workload at the end of the school year stopped them from rewriting the theory of practice.

Intervention set 'Video Analysis'

Studying one's own 'behaviour' in practice through the intervention set 'Video Analysis' was considered to be supportive by 100% of the groups and 83.3% of the participants (See Table 2, row 3 and Table 3, rows 5 and 7). Working with Video Analysis revealed discrepancies between how people think that they behave and their actual behaviour. It also reveals incongruities between how one feels one should behave and how one actually behaves. The following quote by Miranda (M2) illustrates this: 'Yes, conceptual enhancement and

personal confrontation with how do we actually want to do it in practice and what do we actually see?'

The participants indicated that self-analysing and analysing videos from peers and vice versa intensified personal scrutiny and enhanced reflecting about their own pedagogical approach. They also stated that sharing the videos and group discussions about dilemmas resulted in conceptual enhancement and a joint clarification of concepts. This is illustrated by Michel (B2):

> 'Then [when viewing videos] it really emerged that we talked a lot, and that we tended to push students in a direction that we had in mind. And once we'd clarified concepts such as 'reflection' and 'critical reflection' and 'understanding', and reflected about the differences between them, it turned out that I, and other colleagues too, often provided 'the' answer that we had in our mind without allowing our students to think about it. At that moment I became very aware of the fact that I really needed to do this less often in order to get students engaged in 'critical reflection.'

Personal analysis was considered to be supportive most frequently (66.7%), followed by peer analysis (61.1%) and group analysis (44.4%). This intervention set was mentioned most often in relation to transformative learning (44.4%), which concerned IA-Internal. This experience corresponds with the experience of the expert group during the try-out: 'Through the analysis of actual behaviour and the behaviour of others on video I gained more tools for getting students to reflect more deeply and focus more on their curiosity' (Hennie).

An improvement suggestion for this intervention was to film shorter clips, because the analyses took too much time.

Learning support

Five interventions were also implemented to support learning in a generic sense and transformative learning in a specific sense. With regard to these interventions, only 'facilitator', 'studying theory' and 'personal learning objective' were stated to be supportive. Only three participants stated that reflective memos were supportive and nobody mentioned writing a personal log as being supportive. In the following we will discuss the interventions that were regarded as being supportive.

Qualities of facilitators

All groups and 83.3% of the participants considered the facilitator (See Table 2, row 4 and Table 3, row 8) to be supportive for learning because of their ability to ask reflective questions, to continue asking questions and encourage participants to define things carefully, to create a flexible balance between controlling and providing room without losing sight of the objective, although this depended on the group, to summarise, to refrain from judging and to appreciate. This is illustrated by the following quotes: 'She is continuously setting an example with in-depth questions. Focusing and carefully dividing her attention. Responding to questions by asking more questions. Understanding the hectic pace of our lives' (Ellert, B2); and 'Her discussion techniques, that is to say, continually asking questions, reformulating, encouraging people to explain their opinions […] in a neutral way, were very skilled' (Tosca, B1).

Studying theory

Participants in 100% of the groups and 88.3% of the participants regarded the offered theory as being supportive (See Table 2, row 5 and Table 3, row 9), because it offers background information, on the one hand (44.4%), and is significant for professional development on the other (38.8%). Reinier (M2) illustrates this as follows: 'Reading articles creates something of an inner dialogue: a conversation with yourself'. Interestingly, only 22.2% of the participants read everything, 5.6% read nothing and 72.2% read one to three sources. A possible explanation for 'not reading everything' was given by participant John (B1): 'Mainly due to time constraints I only read one article'. Only one participant associated 'studying theory' with transformative learning: Yes, I am now more aware of the significance of basing things on sources. This has definitely been stimulated' (Carla, M2).

A suggestion for improvement was to focus more on reading and discussing the theory together.

Formulating a personal learning objective

Formulating a personal learning objective (Table 2, row 6 and table 3, row 10) was regarded as being supportive by 62% of the participants, because it provides a learning direction, as illustrated by Reinier (M2): 'by formulating a personal learning objective, you create focus: what do I want; and why?' This corresponds with the experience of the expert group.

TIPP as a whole: the whole is more than the sum of its parts

Not all learning outcomes could be attributed to specific interventions. The sum appears to be more than the parts (See Table 2, row 7). All groups and 94.4% of the participants experienced transformative learning. For 65% of the participants this constituted changes in beliefs with regard to reflection and critical reflection, and was therefore IA-Internal. There were no notable differences between the groups. Only 5.8% of the 94.4% constituted changes in beliefs with regard to IA-External (i.e. knowledge-sourcing behaviour). All groups provided examples concerning their transformative learning: 'Perhaps they also noticed that I ask more questions than before and that I am also more aware. I also tend to ask students about their views more often' (Anna, M1); '[During the lessons] I make more room to move from reflection towards critical reflection' (Alette, M2); 'Never before have I been this aware of the way various types of interventions/questions can affect the thought process of students' (Melinda, B1); and

> 'I have managed to develop myself and my students professionally thanks to the transfer of knowledge and experience between us ... I think that they [the students] believe that I have created peace and quiet and room for them to formulate their thoughts and views and continue ask questions about them. I only realised this year that reflection is actually the basis of an Inquiry-Based Attitude. I used to regard them as two separate matters, but now I see the connection' (Saskia, B2).

Table 3. Active ingredients of interventions

Generic interventions	Specific interventions	Active ingredients	Result
Learning with and from peers	Critical friendship	'Looking into each other's kitchen' and being able to compare oneself with colleagues.	Taking a step back to look at one's own beliefs and behaviour.
		Critical dialogues about each other's beliefs and behaviour.	Encouraging (critical) reflection and perhaps experimenting with new behaviour or confirmation of one's own approach.

Generic interventions	Specific interventions	Active ingredients	Result
		Critical discussions about the conceptual meaning of key concepts.	Shared vision
	Safety	Because of the safe setting people are not afraid to be critical.	Daring to learn/be vulnerable
Studying one's own practice	Theory of Practice personal	Elaborating on personal views and expectations about one's own behaviour in practice.	Elaborating on one's own working theory, discovering one's own 'common theme'
	Theory of Practice peers/group	Critical dialogue and discussion after reading one another's theory of practice.	More informed personal theory of practice and/or modification of the theory of practice
		Finding out about other people's views and discussing them.	Discovering joint patterns
		Further elaborating on one's own beliefs and views in response to the questions of peers.	Contributes to the development of a shared vision.
	Video Analysis personal	Recording and analysing one's own performance in practice.	Reveals any discrepancies and mismatches between expected behaviour and actual behaviour.
	Video Analysis peer	Analysing someone else's video.	Confrontation with one's own behaviour→ increases one's understanding of one's own behaviour.
	Video Analysis group	Critical dialogue about interpretations of the observed behaviour based on video clips.	Conceptual enhancement and joint clarification of concepts.

Generic interventions	Specific interventions	Active ingredients	Result
Learning support	General quality facilitator	Asking reflective questions; continue asking questions; encouraging people to explain carefully/elaborate; flexible balance between control and giving room; targeted; summarise; do not judge; appreciate.	Facilitates (the courage to) learn.
	Studying theory	Relevant sources; time to read	Acquisition of new knowledge, encourages reflection.
	Formulating a personal learning objective	Help formulate a guiding objective.	Provides focus for learning and gives direction.

Results for research question 6

Regarding research question 6, the next sections show a quantitative summary with the results concerning changes in beliefs and changes in behaviour

Changes in beliefs

After the TIPP, participants in all four groups reported a change in beliefs with respect to the stimulation of IA-Internal (i.e. understanding, reflection and critical reflection). For IA-External (i.e. knowledge-sourcing behaviour) 75% reported a change in beliefs in the interviews, while reflecting on the questionnaire and theory of practice. At a group level it was interesting to see that all four groups went through the greatest change in the beliefs regarding reflection and critical reflection. For knowledge sourcing the changes varied for each group, from a decrease of 20% to an increase of 75%. One group stands out because its participants reported the lowest for all aspects during T1: however, they reported 100% increase for all aspects during T2, with the exception of understanding. These results have been checked on the basis of background variables, but this does not explain this difference.

Changes in behaviour

During the TIPP the pattern of the behavioural repertoire with regard to encouraging IA-Internal (i.e. understanding, reflection and critical reflection) and IA-External (i.e. knowledge-sourcing behaviour) hardly changed at a group level or at a participant level. Interestingly, the two master's groups had and maintained a richer behavioural repertoire than the bachelor's groups. A different picture emerged when examining the frequencies of the interventions (See Tables 4 and 5). We saw a substantial frequency increase in reflection and critical reflection. Zooming in on a group level, it became clear that this increase could be explained by one master's group and one bachelor's group. For the other interventions we could not establish notable (less than two) frequency changes in any of the groups.

The virtual absence of changes in one master's group can be explained by the fact that, at the start, the behavioural repertoire was broad and the frequencies were relatively high, and this situation did not change. The lack of changes in one of the bachelor's groups was explained by its participants by the fact that their lessons primarily focus on theory without linking it to possible pedagogical approaches in the students' practice.

Table 4. Overall changes in IA intervention frequencies

Repertoire	Count		Cases	
	Video T1	Video T2	Video T1	Video T2
Understanding	38	36	13	12
Reflection	46	80	13	12
Critical reflection	12	27	7	9
Knowledge sourcing	15	14	8	8

Table 5. Group level changes in IA intervention frequencies

Repertoire	Group M1 (n=3)			Group M2 (n=5)					Group B1 (n=3)			Group B2 (n=3)		
Understanding														
Reflection			+3	+3	+4	+3	+6					+6	+7	+8
Critical reflection				+4								+3	-3	+8
Knowledge sourcing														

Conclusions and discussion

This study intended to explain to what extent and in what way a specifically designed professional development programme (TIPP) supports the transformative learning of experienced teacher educators' (TEs) with regard to stimulating IA in students. The design of the TIPP was built on the following generic design principles: 'learning from and with peers', 'studying one's own beliefs and behaviour in practice' and 'learning support' (Hargreaves & Fullan, 2012; Lunenberg et al., 2014; Van Veen, et al., 2010). The added value of the present research is the design of a specific intervention mix and a clarification of the active ingredients that support the intended development. The study also elucidates to what extent interventions influence changes in TEs beliefs and/or the behaviour in stimulating IA-Internal (i.e. understanding, reflection and critical reflection) or IA-External (i.e. knowledge sourcing).

Although the specific value of the professional interventions is clarified, the TIPP as a whole is more than the sum of its parts. As a whole the programme contributes convincingly to transformative learning with regard to the beliefs relating to the stimulation of both IA-Internal and IA-External. Our explanation is that an aligned mix between a trained facilitator and the intervention sets 'Theory of Practice' and 'Video Analysis' designed to support systematic self-study of professional beliefs and behaviour in combination with sharing, discussing and elaborating on the findings within a safe peer group stimulates professional learning at the level of transformative learning.

The intervention set 'Theory of Practice' confirms Kelchterman's (2009) theory that an explicit expression of one's personal theory of practice creates an understanding of who one is and how one wants to be. Our research adds to this that sharing theories of practice with peers, and combined with in-depth group discussion supports both transformative learning and the development of a shared vision. The intervention set 'Video Analysis' confirms that peer observations, combined with professional learning conversations, encourage critical reflection (Schuck et al., 2008). New in our research is the fact that the personal confrontation and elaborating on inconsistencies and discrepancies between intended and actual behaviour in particular, contributes to transformative learning.

Noteworthy is that almost every participant defined specific facilitator qualities and emphasised the importance of these qualities in supporting personal and group learning, which is in line with the research of Lunenberg,

Zwart and Korthagen (2010). The explicit appreciation of the specific qualities of facilitators raises the question of to what extent the facilitator can be separated from the interventions. Also noteworthy was the lack of appreciation for the reflective memos and personal logs, even though personal logs are very common in teacher education. On the basis of theories this lack of appreciation is not easy to explain. Presumably it has to do with the specific mix of interventions, in which those interventions had no added value.

Although we see positive changes in the beliefs regarding IA-Internal in all groups, where behaviour is concerned we only observe this in two groups. This discrepancy between beliefs and behaviour is a known phenomenon, but is difficult to explain (Taylor, 2007; van der Schaaf, et al., 2008). Concerning IA-External, it is conceivable that this discrepancy is affected by the situation in higher professional education in the Netherlands, where the emphasis is on working with prescribed theories. The question is to what extent this impedes the stimulation of IA-External.

One master's and one bachelor's group hardly showed any behavioural changes. For the master's group the behavioural repertoire and frequencies were already so optimal at the start that further improvements were almost impossible. For the bachelor's group this was not the case, but it was notable that the focus of this educator's practice was on the transfer of knowledge and not on the intention to be a role model as a teacher as emphasised by Lunenberg et al. (2014) and Berry (2009). The positive causal relationship between changes in intentions and changes in behaviour (Webb & Sheeran, 2006) might indicate that a greater emphasis on the educators' intention to be a role model as a teacher is an important condition to engender greater impact on educators' behaviour. It was also notable that the master's groups had a richer repertoire of behaviour and that they also utilised this more frequently than the bachelor's groups. Furthermore, the group that scored the least at the start for all parts showed the greatest development. It may be worthwhile to check the extent of development that can be expected prior to participation in the TIPP.

The main limitation of this study is the small sample size. However, by closely following the participants and triangulating behavioural observations with instruments with a self-reporting nature combined with facilitators' meetings where we discussed and monitored the research quality, we increased the validity and reliability. Nevertheless, the method of data collection may have played a role in our results. At baseline, the data collection consisted of a

single source (Theory of Practice 1), and the post-test consisted of multiple sources (Theory of Practice 2, questionnaire and interview). The use of the second practice theory as the source had particular restrictions because most participants merely added things to the first version. As a consequence, the interviews turned out to be a better source for exploring changes than the differences between the first and second theories of practice. However, the rewritten theories of practice showed that it is indeed important it is taken seriously, because it 'forces' someone to reflect. In addition, although the relatively high average age of the TEs (50.8 years) is representative of our setting, the question is whether the results for younger and less experienced educators will be different.

For a more thorough understanding of the specific meaning of the studied interventions regarding the transformative learning of TEs, we advise that this study is scaled up to a large-scale study within and outside an educational context, also linking the results of the TIPP to the results achieved for students. We also recommend performing research into the development of the IA of students during and after teacher education and an exploration of the extent in which IA development can be explained by background variables and personality traits. Finally, we recommend further investigation of the influence of the qualities of specific facilitators on transformative learning in other research on professional development interventions.

CHAPTER 5

Bridging the Research-to-Practice Gap in Education: the design principles of mode-2 research innovating teacher education

This chapter was previously published:
Meijer, M. J. & Kuijpers, M. (2016, November). Bridging the Research-to-Practice Gap in Education: the design principles of mode-2 research innovating teacher education. *UAS Journal, 6*. Retrieved from https://uasjournal.fi/in-english/bridging-the-research-to-practice-gap-in-education-the-design-principles-of-mode-2-research-innovating-teacher-education/
Small adjustments were made to the form in which this Chapter was published.

Abstract

This paper is a conceptual contribution to the debate about how partnership between educational researchers and practitioners in mode-2 research can bridge the gap between theory and practice. Through the theoretical lenses of transfer of learning, we reflect on professional development, practitioners' knowledge creation, and organisational innovation in a multi-annual mode-2 research project in which socially robust scientific knowledge was produced in the context of teacher education. This reflection resulted in a working hypothesis that highlights the importance of having three interwoven research designs in mode-2 research: (1) one design concerning the scientific knowledge creation process based on practitioners' knowledge creation; (2) one design concerning the practitioners' learning support and (3) and one design that guarantees the implementation into practitioners' practice at the organisational level. It also highlights what additional qualities researchers need to monitor a mode-2 research project.

Bridging the Research-to-Practice Gap in Education: the Design Principles of Mode-2 Research Innovating Teacher Education

Introduction

Current changes in society address new demands on professionals' ability to respond to new and changing circumstances quickly and adequately (Coonen, 2006; Hargreaves & Fullan, 2012; 2002; OCW/EZ, 2009). This implies the necessity of continuous development to improve professional performance throughout the entire career. This general professional demand has consequences for teacher education (Darling-Hammond & Foundation, 2008; Scheerens, 2010). To support this lifelong professional learning, the development of an Inquiry-Based Attitude (hereinafter: IA) is specifically recommended as a goal in teacher education (e.g. Cochran-Smith & Lytle, 2009). In Dutch teacher education at both initial and post-initial level, it is assumed that IA will allow teachers to create new knowledge of practice continuously with the aim to develop themselves as a professional and to improve their school context (Onderwijsraad, 2014). To be able to gain more understanding about IA as a developable goal in teacher education, Meijer, Geijsel, Kuijpers, Boei and Vrieling (2016a) conducted a multiannual empirical study and refined IA from an ill-defined global concept into a concept with reliable and valid characteristics. Their results indicated IA as a concept with two dimensions: an internal reflective dimension and an external knowledge-sourcing dimension. The internal dimension concerns intentional actions to acquire new professional modes of understanding and behaviour. The external dimension concerns intentional actions to gain new information and knowledge from relevant knowledge-sources. Our goal in this study was to create knowledge to support teacher educators' in their pedagogical approaches to stimulate their students' IA. However, the transfer of results from educational research into educational practice has proven to be complex (e.g.Broekkamp & van Hout-Wolters, 2007; OCW, 2011). To help bridge this gap, practice-based scientific mode-2 research design is presented as a research method that can help (Martens, Kessels, De Laat, & Ros, 2012). The assumption in this method is that partnership between researchers and practitioners will contribute to creating

meaningful, generalisable knowledge and contribute to the transfer of this knowledge into practice. We therefore used this research design in our two-year follow-up study. In partnership with educators, we designed, tested and redesigned a professional development programme and we conducted a multiple case study. In this study (Meijer, Kuijpers, Boei, Vrieling, & Geijsel, 2016b) we gained insight into specific characteristics of professional development interventions that encourage teacher educators' deep learning in stimulating IA-development of their students.

To our knowledge, there are few studies that provide specific insight into the design of practice-based scientific mode-2 research (hereinafter: mode-2 research) or into the actual impact of this methodology. To contribute to an understanding of how mode-2 research can help to bridge the gap between educational research and practice, this conceptual paper will reflect on how the partnership between the researcher and five educators resulted in creating practice-based scientific knowledge, professionalising teacher educators and simultaneously contributed to innovating teacher education practice. With this reflection, we aim to contribute to the development of mode-2 research as promoted in a research manifest on practice based scientific research (Martens et al., 2012). The study we are reflecting on is summarised in Table 1 and 2.

In what follows we first describe mode-2 research as a relatively new mode in social science and the general scientific requirements and usability criteria our research had to meet. Secondly, we report researcher's role; recruiting practitioners and organising research meetings. Thirdly, we reflect from theoretical perspectives as to how and why our research in partnership with educators affected their professional development and brought innovation to teaching practice [research question 7 of this dissertation]. In conclusion, we present our working hypothesis on design principles in mode-2 research and discuss its complexity in design and the demands researchers must meet to monitor and facilitate simultaneously the quality of the research process and the learning of the practitioners.

Table 1. Process display of the mode-2 study we are reflecting on.

Research question 5:To what extent and in what way do the designed professional development interventions support the transformative learning of educators?

Research question 6:How do these interventions influence changes in beliefs and/or behaviour of educators with regard to the stimulation of an Inquiry-Based Attitude in students?

Research phase 1: Designing, testing and redesigning with an expert group practitioners						Research phase 2: multiple case study with the expert group practitioners under supervision of the researcher		
Literature study	Consulting	Designing	Testing	Evaluation	Redesigning	4 Parallel Multiple case studies	Evaluation	Analysis and report
6 months (m)		3 m.	<-9 m->	1 m	1 m	<-9 m->	1m.	5 m.

Mode-2 research

Traditional methods of knowledge production and dissemination are the subject of debate in social science. Current scientific knowledge production does not transfer to practice adequately and opinions differ regarding the measures that should be taken to close the gap (Broekkamp & van Hout-Wolters, 2007). To bridge this gap, fundamental changes are suggested as a new research mode with regard to the interaction between science and society (Nowotny, Scott, & Gibbons, 2001). Social science production, in which socially robust knowledge is produced by social interventions in the context of application, was labelled by Gibbons et al. (1994) as Mode-2 research. Martens et al. (2012) promote this mode-2 research as an alternative to traditional educational research, in which randomised controlled trials still seem to be the golden standard. This, despite the fact that the complexity in educational research makes it impossible to control all variables (Cochran-Smith & Zeichner, 2010). Research based on randomised controlled trials aims to prove universal causal patterns in teaching and disparages the need for a stronger body of knowledge with practical, context-related relevance. The lack of knowledge with practical relevance is seen as one of the causes of the gap between science and practice. Hargreaves (1999) therefore even urged teachers to produce the knowledge they need by themselves. Martens et al. (2012) assume that research for which the questions are provided by practice - a partnership between researchers and practitioners -

will contribute to creating meaningful, generalisable knowledge. From the perspective of learning, they argue that if practitioners participate in the knowledge creation process while participating in a practice-based scientific educational research in their own context, practical relevant knowledge will not only be created but it will also support the transfer of scientific knowledge into practice. Bronkhorst, Meijer, Koster, Akkerman and Vermunt (2013) found that collaboration with educators enabled the researcher to benefit from their expertise and that researchers' position as a learner and researchers' appreciation of the partnership impacts educators' engagement 'agency' in the research. This means being an 'agent' and 'owner' instead of being an 'instrument' or in other words 'a tool for the researcher' (p. 93). They also found that, compared to other research designs, collaboration supported the experience of research as an integrated part of everyday practice, which is also one of the goals in teacher education (Onderwijsraad, 2014). Researchers' support of practitioner agency is thus seen as important because the more agency, the greater the chance that a solution will be found for the problem being researched (Bolhuis, Kools, Joosten-ten Brinke, Mathijsen, & Krol, 2012; Cochran-Smith & Lytle, 2009) and this will, as stated before, support the transfer of knowledge into practice.

Scientific requirements

Creating socially robust and practice-based educational scientific knowledge, under mode-2 conditions, has to meet the same generally accepted scientific standards as any other scientific research (Martens et al., 2012; Ros et al., 2012). However, in mode-2 research, the relevance of the knowledge created is rooted in the (educational) context, in which the 'problem' occurred (Martens et al., 2012; Nowotny et al., 2001). A characteristic in this process of 'local' knowledge creation is to strive for external validity (i.e. generalisable insights) beyond the locus of knowledge production. Because practice-based research often works with small populations, it means that an attempt must be made, fitting within this type of search, to maximise generalisability without affecting the usability of the knowledge for the context in which the research took place (Ros et al., 2012; Verschuren, 2009). Furthermore, mode-2 research must be carried out in the wording of the scientific criteria that relate to the internal validity; controllability; cumulativeness and ethical aspects. The research must also meet the usability criteria with a view to the practice (Martens et al., 2012;

Ros et al., 2012). The usability criteria define that the results must be accessible and understandable for the field of education; the results must be perceived as relevant and legitimate and the research must provide handles to improve educational practice.

Meeting scientific requirements in our study

In our two-year mode-2 research, we have secured internal validity by conducting it in the educational context in which the issue occurred. The study was executed in collaboration with an expert group of five teacher educators as co-researchers (Meijer et al., 2016b). The research process was characterised by iterative cycles of design, evaluation and redesign (McKenney & Reeves, 2013) and consisted of two phases: (1) a preparatory phase of designing, testing, evaluating and improving a theory-based professional development programme and (2) a main study phase in which the designed development programme was carried out. To build a strong partnership between the researcher and the participating practitioners, we followed Eri's (2013) advice and involved them in constructing the design, and not only in testing the design, with the aim of supporting practitioners' agency and ownership in the subject of the study.

To create generalisable knowledge we conducted the research as a parallel multiple case study (Swanborn, 2010) in four different teacher training courses. Four fairly homogeneous groups of teacher educators on four different teacher training courses at bachelor's and master's level at a professional university in the Netherlands were followed. The study resulted in clarification of the active ingredients of the designed interventions that supported the targeted development. We found that aligned 'self-study' interventions at personal, peer, and group level, guided by a trained facilitator, supported the aimed learning (Meijer et al., 2016b). To be able to reflect on this research from the perspective of partnership between researchers and teacher educators as co-researchers (hereinafter: expert group), we recorded and transcribed the research meetings (See Table 2) with the expert group.

To meet the usability criteria we described our process of scientific knowledge construction and associated ethical aspects in a scientific publication and shared the results in the locus of the research. The way in which we further comply with the usability requirements is in fact seen in the focus of this reflective paper. In it, we look at how our collaboration with practitioners in the

role of co-researcher resulted in socially robust scientific knowledge which contributed to professional development and is being implemented in practice. It should be noted that this implementation took place outside the scope of this research. This is because of the time that this implementation process took. In fact, the implementation process is still underway two years after the completion of this research.

Partnership between researcher and teacher educators in our study

The collaboration between practitioners and researchers is argued as a thriving force in developing new practices and educational change. To reflect on this assumption from our own research experience we will first successively report researchers role; recruiting practitioners and the research meetings between researcher and practitioners. Subsequently, we will reflect on how our partnership between researcher and practitioners contributed to bridging the gap between science and practice. We reflect from theoretical perspectives on transfer of learning and development; practitioners' knowledge creation and innovation and organisational learning.

Researcher

For mode-2 research it is important that the researcher(s) has coaching and consultancy skills in addition to research expertise and is able to find a balance between the relevance for the participating practitioners and the precision required by in scientific research (Martens et al., 2012). The researcher in this study (i.e. the first author) conducted research in her own professional context. She has an extensive experience as a teacher educator, trained supervisor/coach and is also responsible for the design of the professional master's curriculum in the faculty where this research was conducted. This dialectic and simultaneous relationship between being a scholar and practitioner is an increasing phenomenon in educational research (Cochran-Smith, 2005). Before starting, and while conducting our research, the interwoven roles of the researcher were an explicit object of attention and reflection.

Recruiting the Practitioners

As pointed out above, besides creating practice-based scientific knowledge, the professional development of the collaborating practitioners is also one of the goals of mode-2 research. For this reason, we firstly based our research design on two preconditions in teacher-professionalisation, as reported by Van Veen, Zwart, Meirink and Verloop (2010): the subject of our study was in line with school policy and the participants were facilitated adequately by the management. Secondly, we decided to use the model of a professional learning community because this supports professional development (Lunenberg, Dengerink, & Korthagen, 2014; Van Veen et al., 2010), it supports innovation processes (Hargreaves & Fullan, 2012; Mourshed, Chijioke, & Barber, 2010) and it supports collaboration in designing, experimenting and re-designing (McKenney & Reeves, 2013; Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006).

To recruit practitioners as co-designers and co-researchers in our research project, we organised a meeting with five experienced educators who were proposed by the management for practical reasons such as availability. We presented our research goal, basic design principles and the requirements that the participants had to meet. By being clear about our expectations of the participants' qualities and commitment, we aimed to avoid drop-out on account of disappointment (e.g. Walk, Greenspan, Crossley, & Handy, 2015). First we presented our research goal as designing and redesigning a professional development programme based on theory and on practitioners' knowledge and exploring which specific intervention characteristics support teacher educators' professional development in stimulating students' IA (Meijer et al., 2016b). We explained the importance of commitment in participating in a professional learning community during a two- year educational design-research within their own context. We also explained the importance of being an experienced teacher educator since we needed expert knowledge in designing a professional development programme. Experience was also important considering the plan that in the second phase of the study, the participants themselves would offer the designed programme to colleagues, and therefore we assumed that their credibility as a teacher educator should be beyond doubt. Furthermore, we highlighted the importance of being motivated to contribute to generalisable and reliable practice-based scientific knowledge by systematically, inimitably and accurately questioning their own practices. They also had to enjoy designing and redesigning interventions with the aim of improving them. Finally, we explained

that they had to demonstrate commitment to participating in all the research meetings planned over these two years. Collaborating on this planning was presented as the first step in our partnership

This meeting resulted in the voluntary participation of all five experienced (8-18 years) educators (hereinafter: expert group) aged between 43-58 and all female. They were facilitated with 90 hours of extra 'professional development' time over the two years, in addition to the standard annual time.

Research meetings

Before reflecting on 'our' partnership, we will give a short chronological overview of the research meetings between the researcher and the expert group (See Table 2). All meetings can be characterised as 'reflective dialogues' (Mezirow & Taylor, 2009) between the researcher and the practitioners. Based on the practitioners' wishes, we aligned our planning with the rhythm of our educational year. This meant no meetings during the busiest periods and not at the start and end of the year. The period between the meetings varied between two and three weeks.

Table 2. Overview of research meetings.

Phase 1: Designing, testing, evaluating and improving (1 year)		
1 meeting	Recruiting participants as co-researchers	1 hour
7 meetings	Experimenting with theory-based interventions; Developing an instrument (video-analysis); defining interventions as good practice. Before the meetings, the practitioners prepared by, for instance, reading the minutes of the meetings, studying theory, video analysis, reflection in and on action and/or writing a log	7x 2.5 hours
1 meeting	Extra meeting to practise analysing the videos	1 hour
4 meetings	Evaluation, (re)design the programme and preparation of the practitioners as facilitators for the next phase	4 x 5 hours
Phase 2: Facilitating, following and exploring four parallel case studies (1 year)		
6 meetings	Facilitating the practitioners as 'facilitators'; monitoring the research quality; facilitating practitioners' further professional development	6 x 2.5 hours
Interviews	Researcher and practitioners interview the participants together to explore the impact of the interventions.	45 minutes per interview
1 meeting	Evaluating the design and redesign.	5 hours

Transfer of scientific knowledge into practice

To understand how collaboration with practitioners supported the transfer of scientific knowledge into practice, we firstly need to understand the underlying theories on the transfer of learning and professional development. Secondly, we need to comprehend the theories of practitioners' knowledge creation and thirdly, we need to understand the theories of innovation and organisational learning. In these next sections, we will reflect - through the lenses of these theories - on our research journey, and illustrate our experiences with some vignettes.

Transfer of learning

The 'changed and more experienced person is the major outcome of learning' (Jarvis, 2006, p. 132) is an important goal in mode-2 practice-based scientific educational research. In our research design, this learning concerned the development of teacher educators who participated as co-researchers. Since researchers in mode-2 research have to guide the participants' learning and the transfer of this learning into educational practice, we built our research design on knowledge of learning theories in which the transfer of learning is a key concept.

Transfer of learning and its underlying mechanisms, is still one of the most important educational research themes of the 21st century (e.g. Lobato, 2006). Thorndike (1906) introduced the concept of transfer and stated that the transfer of what is learned is dependent on the extent to which the new situations are the same as the original learning context. Thorndike conducted various empirical experiments and found that if an individual learns something in task A, it can be of benefit in task B if there are similarities between the two tasks. Although Thorndike's view about transfer appeared to have been around for a century, later follow-up research showed that people can abstract things they have learned previously and subsequently apply this knowledge in contexts that are not obvious (e.g. Tomic & Kingma, 1988). However, the transfer is stronger the more the contexts are alike. According to Piaget (1974), transfer occurs only if a measurement comes to the fore to show that what was learned had a demonstrable effect on the cognitive structure (knowing more) and that this knowledge can be operationalised in new situations. Piaget refers to this form of transfer as accomodating, by which he meant the capacity to adjust or

transform familiar strategies when a problem cannot (or can no longer) be resolved using the available tools and familiar methods. If this succeeds, previously acquired knowledge and insight is demonstrably transformed to a higher level.

The theory of the transfer of knowledge to other contexts was further illuminated by Branson and Schwarz (1999) in their AERA award winning review of research into transfer. They described Thorndike's original view on transfer as the 'Direct application theory of transfer' which means that a person can apply previous learning directly to a new setting or problem. Based on their review, Branson and Schwarz proposed an alternative view of transfer that broadens this traditional concept by 'including an emphasis on people's 'preparation for future learning'' (p. 68). They explicated the implications of this view for educational practices and elaborated Broudy's (1977) instructional procedures with the aim of supporting the ability to adapt existing knowledge, assumptions and beliefs to new situations. Bransford and Schwartz highlight that people 'actively interact' with their environment to adapt to new situations 'if things don't work, effective learners revise' (Bransford & Schwartz, p. 83) (See for example vignette 1). This so-called active transfer involves openness to others' ideas and perspectives and seeking multiple viewpoints that are also important as a characteristic of critical reflection.

Vignette 1: Effective learners revise if things don't work

Expert group reflection: 'We find that the interventions with respect to the understanding of theoretical concepts is still too concerned with 'testing that the literature has been read.' The risk of superficial knowledge thus persists… but how can we transform the questions so that answering the questions is coupled with thinking, so that it adds something to what you already know?'

From the perspective of transfer, Illeris (2003, 2004, 2007; 2009) analyses leading theories of learning and differentiates four different learning types and looks at them in relation to their transfer capabilities. It is about mechanical learning, assimilating, accommodating and transforming. Each learning type is activated in different contexts, aims for different learning outcomes and varies according to the amount of energy learning requires. His learning theory rests on three different dimensions and two inseparable processes. He differentiates the cognitive (content), emotional (motivation) and social (interaction) dimension as

well as the internal acquisition process in which new impulses are linked to earlier learning outcomes and the external interaction process that plays out between the learner, the teaching material and the social environment. According to Illeris (2014), professional learning already includes a change in practitioners' work identity, the level of transformative learning. This happens only when the learner experiences a change in their own mental models with a perceivable impact on bringing about a change in attitude or behaviour. The individual then looks at the reality differently and also acts differently than previously (See for example vignette 2).

Vignette 2. Transformative learning

Expert group member: 'I have become aware of the fact that to achieve deep learning, which changes your professional identity, there are two supplementary routes: the route via curiosity for knowledge, which acts as an internal motivation, and the route via reflection, looking critically at your own actions and underlying values, standards and convictions. This conviction was present latently but has now become specific and has become essential in my colleges.'

Supporting Practitioners' Transformative Learning

To facilitate transformative learning Greeno (2006) calls for a learning environment in which stimulating and organising broad meaningful domain knowledge and autonomously founded actions are applied as two pro-transfer and inseparable factors. In this context, Kessels (2001) and Kessels and Keursten (2002) call for a knowledge-productive learning environment in which no educational material is prescribed, and instead research and reflection are the prime tools used to stimulate and facilitate meaningful learning. This is in line with the meta-review by Taylor (2007) which indicates that accumulating personal learning experiences in a unique context about which there is critical reflection from various perspectives is one of the most powerful tools in promoting transformative learning. This is a process of communicative learning in which identifying and problematising ideas, convictions, values and feelings are critically analysed and given consideration. This requires a setting in which the participants dare to give themselves over to uncertainty and a certain degree of 'discomfort' so that they can learn personally. It is about daring mutual questioning of personal 'truths' and being prepared to modify existing paradigms

on the basis of new insights. The shape transformative learning takes in education is in part dependent on the lecturer's personal ideas about learning theories combined with the understanding of the reciprocal relationship between: (life) experience; critical reflection; dialogue; holistic orientation; context understanding and authentic relationships (Mezirow & Taylor, 2009). 'Transformative learning is always a combination of unlearning and learning' (Bolhuis, 2009, p. 62). It is a radical process of falling down and getting back up again. According to Bolhuis, the unlearning element receives too little attention in research into and the forming of theories about learning. The helping hands that are offered with regard to 'unlearning' are implicit and are focused on reconstructing mental models and experimenting with new behaviour that can respond to behaviour and context through repetition and reflection.

In summary, this means that if mode-2 practice-based scientific educational research wants to contribute to the professionalisation of teachers, the research design must be based on ideas about learning theories with respect to the level of learning that is intended. In research into the professional beliefs and behaviour of the educator, a research setting in which transformative learning by the practitioners is facilitated is one of the design principles. This means that a research setting that is productive to knowledge is created, one which encourages and facilitates shared interactive research and the (re-)development of practical knowledge, beliefs and behaviour from different perspectives, with the aim of contributing to creating a 'changed and more experienced person' (See for example vignette 2).

Looking back over our research, we can typify our design of the learning environment in which the researcher and educators design and research together as a learning environment in which various levels can be learned. The accent in this was (1) having reflective dialogue which was dominated by: obtaining conceptual clarity about key concepts and the significance of this for practical actions and research into personal beliefs and the impact of these on actions; (2) the design of a theory-based analysis tool that, over a number of cycles, we 'tested, reflected on, modified and again tested until we could work satisfactorily with it and were confident that the participants in the follow-up study could deal with effectively; (3) the design of interventions at 'individual, peer and group level' (Meijer et al., 2016b) via cycles of testing, reflecting on what worked, why it worked and how it could be improved; and (4) the design of a coherent professional development programme based on the interventions with the associated supporting materials and the basic premises of supporting

learning from the participants. Because the practitioners researched with the researcher what interventions had an impact on their own development as well as how and when, they created new knowledge about professional development. They also integrated conceptual scientific knowledge about the subject of the research, 'stimulating the Inquiry-Based Attitude', into their own educational repertoire.

Supporting Practitioners' knowledge productivity

Following on from European and Americans examples (e.g. Cochran-Smith & Lytle, 2009; Loughran, 2007; Pickering et al., 2007), in the Dutch educational context and teacher training, we increasingly see practitioner research used as a professional learning strategy to support individual and organisational learning. The teachers do their own research within their own context and the research itself as seen as an intervention (Bolhuis et al., 2012). According to Bolhuis et. al, practically-focused research by professionals contributes to more conscious consideration about the aims and effects of the work and promotes this approach where professionals create practical knowledge and use other people's knowledge more in their work. The concept of practitioners' knowledge productivity as a process in which new knowledge is created to contribute to innovation in the workplace was introduced by Kessels (1995; 2001). It refers to using relevant information to develop and improve products, processes and services. Supporting processes of practitioners' knowledge creation requires expertise, such as 'making tacit knowledge explicit, facilitating work and teambuilding, and supplying mentors and coaches with appropriate guidance abilities' (Kessels, 1998, p. 2). Knowledge productivity refers to 'breakthrough' learning' which means that learners develop new approaches and are able to break with the past (Verdonschot, 2009). Both Kessels and Verdonschot believe that innovation processes are denoted as social communicative processes in which participants work in collaboration, whereby the quality of the interaction is important and should provide access to each other's knowledge and connect these (See for example vignette 3). Paavola, Lipponen and Hakkarainen (2004) introduced the knowledge creation metaphor as a learning metaphor that concentrates on mediated processes of knowledge creation. A learning model based on knowledge-creation conceptualises 'learning and knowledge advancement as collaborative processes for developing shared objects of activity […] toward developing […] knowledge' (p. 569)

Vignette 3. Social communicative knowledge creation.

Situation : Someone raises a video fragment of a lesson in which information transfer is central. The problem is that is nothing seems to observe in terms of stimulating the Inquiry-Based Attitude. Initially, two expert group members thought that this type of lessons has fewer opportunities to encourage the Inquiry-Based Attitude and that 'there should not be anything to observe.' This was discussed. Someone says that she can see a lot of opportunities in such a lesson to link the content to reflection and understanding: 'In particular, do not reach too many interrogative interventions. Try to incentivise students to think about the meaning of the subject. Give feedback on their attitude as consumers, ask how students can take over the role of the teacher…'
The conclusion of one of the expert group members who initially did not consider the lesson from the example to be suitable for use as video material to stimulate exploration of the Inquiry-Based Attitude, is: 'I myself am continually working.' The gained insight is that educators have to let the students 'work' themselves to stimulate their Inquiry-Based Attitude and that stimulating this is not dependent on the type of lesson.

Collaborative learning

In collaborative learning, the literature makes frequent reference to professional learning communities, group learning or learning from peers, and is seen as the most powerful driver for educational innovations (Hargreaves & Fullan, 2012; Mourshed et al., 2010). The concept of a professional community is multidimensional in nature and can be unpacked as practitioners' peer learning with the goal of developing a shared vision that provides a framework for shared decision making on meaningful practice questions (See for example vignette 4). The aim is to improve practice from the perspective of collective responsibility, in which both group and individual learning are promoted. (Hord, 1997; Stoll, Bolam, McMahon, Wallace, & Thomas, 2006).

The positive impact of collaborative learning methods is convincingly present in research literature. The meta analysis by Pai, Sears and Maeda (2015) showed that compared to individualistic learning methods, learning in small groups (2-5 participants) promotes students' acquisition of knowledge and has also positive effects on increasing the transfer of students' learning experiences and outcomes into practice. From the perspective of cognitive load theory, that considers a collaborative learning group as an information processing system

(Janssen, Kirschner, Erkens, Kirschner, & Paas, 2010), students working in a group outperform students working individually, because a group has more processing capacity than individual learners have. Sharing the cognitive load increases the cognitive capacity to understand the learning objectives at a deeper level (Kirschner, Paas, & Kirschner, 2009).

Pai, Sears and Maeda (2015) found that the positive interdependence between the group members, interpersonal skills and carefully structured interaction contributed effectively to collaborative learning achievements. There is also general agreement that the reflective dialogue plays a key role in the interaction in collaborative learning (e.g. Fielding et al., 2005; Lomos, Hofman, & Bosker, 2011) and that critical friendship, with the emphasis on 'friendship', in the sense of equality, trust, openness and vulnerability (Schuck, Aubusson, & Buchanan, 2008) is a prerequisite for collaborative learning. Personal commitment, as in the sense of learner engagement (See for example vignette 5), is indicated as another precondition to resolve complex practice-based problems and find acceptable solutions. (Bolhuis et al., 2012; Fielding et al., 2005)

In their exploration of the relation between teacher learning and collaboration in innovative teams, Meirink, Imants, Meijer and Verloop (2010) found that collaboration in teams that focused on both 'sharing of ideas and experiences' and 'sharing identifying and solving problems' contributed to a higher level of interdependence. Collegial interaction that can be typified as 'joint work' is indicated as interaction with the highest level of interdependence. This is in line with other findings from research into factors that influence the transfer of good practice (e.g. Fielding et al., 2005). In this study, the transfer of good practice is seen as 'joint practice development' which depends on relationships, institutional and teacher identity, having time, and most important learner engagement. The importance of 'the quality of relationships between those involved in the process' (p. 3) is highlighted because the transfer of practice is relatively intrusive and hard to achieve.

Vignette 4. Developing a shared vision

Situation: We practise with analysing video material and it is agreed that we stop the video if we want to score something. The next moment is a moment when someone says that they want to code the intervention observed as 'stimulating reflection'. The moment comprises a question from the teacher about the teaching material.

Results of the discussion about the video fragment: This is not stimulating 'reflection' but promoting 'understanding'. This student is not incited to think about how she does her work, but is instead encourages to give an opinion about the teaching material. She is not required to link the content to its significance for her work.

Reflection on the results: Here we see the pitfalls of personal interpretation. This is a moment for reflection since even the observant reflected: 'what does this mean for me? - she assumed that the student would reflect.

We agree that next time, everyone will watch a video with a number of scenes selected about which you have questions or where you want to check whether you have the right interpretation. We can now look at whether we have the same conceptual interpretation in what we perceive.

On the basis of this, the observation form was again updated.

Vignette 5: Personal commitment and agency

Situation: at the start of the research meetings expert group members discuss personal issues or dilemma's related to their personal agency.
Someone brings in:
'I am working on 'Reflect together', the article that we received recently, [Didactic design rules for reflective education, Kinkhorst, 2010]. You can ask the other person mandatory questions which you struggle with yourself.
I experimented with this during a workshop in Tielt/Leuven by reflecting in groups of two.
Reflecting by entering into dialogue. I wonder if anything more is known about this. As two people you can't get away, but in a group you can…
Can we explore this issue a bit further some time'?

In summary, this means that supporting practitioners' knowledge productivity during mode-2 research requires a research design incorporates the theoretical ideas regarding collaborative workplace learning. Here, the practitioners use practice-focused as a professional learning strategy and not just as a tool to create knowledge.

Looking back on the knowledge productivity of the educators in our research design, we see strong correlations with, for example, the practitioner research self-study method (Loughran, 2007; Lunenberg, Zwart, & Korthagen, 2010). The aim of our research is very close to the central goal of the self-study methodology. This goal is to uncover deeper understandings of the relationship between teaching and learning about teaching, with the aim of improving the alignment between intentions and actions in the practitioners' teaching practice. Like the self-study approach, our research design strongly appeals to individuals' scholarly notions and qualities, where the systematic collation and analysis of personal data in a personal context supports a personal deeper professional understanding that can be shared with other colleagues. However, where we differ explicitly from the self-study approach is that our research design centred around 'collective' learning in multiple settings with the aim of creating a collective deeper understanding and generalizable scientific knowledge, and implementing this new knowledge into the practice of teacher educators. The importance of well-guided collaborative knowledge creation in small-peer groups is thereby emphasised by the expert group. The expert group highlighted the importance of flexible research guidance that is aligned with the 'reality of the daily working context' as a precondition to staying motivated to participate in this research project (See for example vignette 6).

Vignette 6. Flexible guidance

Quote from someone during a research meeting where we explored research dilemmas concerning tracking and directing:
'Research in education is not a laboratory, we cannot manage all the variables, so in terms of research we have to do what we can.'

Innovation in education

As well as professional teaching, mode-2 research also aims for innovation in the professional context. Therefore it is relevant to understand the relationship

between individual and collective organisational learning (Argyris, 2002; Senge, Cambron-McCabe, Lucas, Smith, & Dutton, 2012). Innovation in education programmes is a complex, broad concept and concerns multiple relations and dimensions within multiple programme components. For a definition of what we can understand innovation in education, we use Waslander's (2007) description in her review of scientific research on sustained innovation in secondary education. To her, an innovation is a set of activities which together comprise a concept or an idea which if implemented improves practice. An innovation is something 'new' that has added value for the future. Further, there is only an innovation of this 'news' manifests itself in people's behaviour and is embedded in their day-to-day routine.

Innovations at the organisation level always relate to relationship between individual and collective learning and successfully triggering collective learning is a first step towards innovating. The research by Peck, Gallucci, Sloan and Lippincott (2009) into teacher education practices shows that the problems related to individual practice (raised by new policies) are often the trigger for faculty (collective) learning. Even though collective learning still delivers such well-designed interventions and knowledge, it is no guarantee of successful implementation at the level of the organisation (Verdonschot, 2009). Based on her meta-analysis of innovation practices, Verdonschot established that the skills and ambition of the individual implementing the intervention influence its success. In addition, the new knowledge that is to be integrated must be well-timed, relevant and appropriate (Eraut, 2004, 2007; Peck et al., 2009). If the knowledge was not acquired in a personal context, but through formal learning such as, for example, schooling, it often has to be transformed to the personal situation because the new knowledge doesn't fit the actual situation in which it is required. To integrate the new knowledge requires practitioners' meta-cognitive skills in transforming knowledge and skills to the personal situation.

Supporting innovation in education

In supporting professional learning that is focused on innovating, it is essential to facilitate the generation of new reality constructions (Homan, 2005). Generating new reality constructs is central to the theory on organisational learning in the familiar work by Argyris and Schön (1978) and is aligned with the previously discussed theory on transfer of learning. Argyris (1992; 2002) differentiates between single-loop learning and double-loop learning. With single-loop learning, a lot is learned but nothing is learned about how to learn

better. It is generally about solutions that are more of the same. Single-loop learning will therefore not contribute to innovations because it only concerns correcting errors without altering underlying governing values. To resolve complex problems for which new solutions are needed, double-loop learning is needed. This means calling on the ability to fundamentally think the problem through and learn from this through critical reflection. Argyris stated that to change organisational routines with success, organisational and individual double-loop learning processes should both be encouraged. In his opinion, it is impossible to change organisational routines without changing individual routines, and vice versa. Senge, Cambron-McCabe, Lucas, Smith and Dutton (2012) talk in this context about fundamental changes in mental models, systems and interactions which are a prerequisite to redesigning and changing the current situation. To support double loop-learning, Argyris calls for an increase in people's capacity 'to confront their ideas, to create a window into their minds, and to face their hidden assumptions, biases, and fears by acting in these ways toward other people' (2002, p. 217). He highlights the importance of encouraging self-reflection and advocating personal principles, values, and beliefs in a way that invites inquiry into them. This is in line with Eraut's research (2004, 2007) in which he emphasises the critical importance of support and feedback in enhancing organisational learning, especially within a working context of good relationships and supporting managers. In addition, opportunities for working alongside others or in groups, where it is possible to learn from one another, are important.

In summary, this means that if mode-2 practice-based scientific educational research wants to help in innovating educational context, more is needed than stimulating double-loop learning by practitioners during joint design and research. Encouraging transfer between individual and collective learning and securing its implementation in the professional context requires a research design that is based on innovation theories that are leading in the monitoring of this complex form of learning.

Looking back over our research, we have experienced that the transfer of personal learning into organisational learning and innovation is highly complex and time-consuming. In our opinion, a well-designed implementation plan that is guided by principles from theories on organisational learning and innovation is needed prior to the start of the research. In our view, this plan must include management support and implementation facilities to ensure that the implementation doesn't come to a halt when the researcher leaves.

In the study we are reflecting on, the researcher had a management position in two of the four participating educational settings and was able to influence the organisational policy concerning educating teachers and the demands the educators have to meet. In these two settings, our mode-2 research resulted in a successful transfer of scientific knowledge into our practice policy (See for example vignette 7).

Vignette 7. Transfer of scientific knowledge into organisational policy

'The course teaches and stimulates students to develop their Inquiry-Based Attitude. To this end, the course encourages behaviour that acquires knowledge, a deep understanding of theoretical concepts and high-level self-reflection as well as reflection on the theory'
(Course examination regulations, 2016-2017, p.9).

'[…] This means that we see the Inquiry-Based Attitude as a concept with two dimensions: (1) An 'internally' focused dimension which is all about the capacity to acquire 'new modes of understanding' about yourself, about knowledge and about the professional context with the aim of elaborating/revising professional behaviour, and (2) An 'externally' focused dimension which is all about active behaviour to acquire knowledge focused on professional development following specific questions and/or problems. In concrete terms, this means that within the course, the following student behaviour is stimulated and 'provoked' (course and test framework draft version 2016-2022, p.12).

In the other two settings, our research design was only successful from the perspectives of knowledge creation and professional development. Once the (co-) researcher had left, further implementation came to a halt. Our explanation is that having an implementation plan that is supported by the management (e.g. Eraut, 2004, 2007; Van Veen et al., 2010) is a prerequisite to implementing the innovation at the organisational level. We recommend that that if the researcher is not to execute the implementation plan personally, this should be done by an engaged practitioner who, in line with Verdonschot's research (2009), has the courage, ambition and mandate to make the implementation a success. Looking back on our innovation we can see that, like many other innovations, it was triggered by new policy (Peck et al., 2009). This

policy concerns the ambition of the Dutch Educational Council (2014) to promote the development of an Inquiry-Based Attitude on the part of teachers.

Working hypothesis concerning design principles in mode-2 research

This conceptual paper is a reflection of our previous two-year mode-2 research journey (Meijer et al., 2016b) in which our partnership between researcher and practitioners successfully contributed to bridging the research-to practice-gap in education. That research concerned a multiple case study as part of which we worked with five experienced educators to design, test and explore a professional development programme. Our reflection shows that the partnership in our research helped to create socially robust scientific knowledge and that this collaboration contributed to the transfer of the knowledge created into the practice in which the research was conducted. The new knowledge was not just integrated into the practitioners' actions, in two of the four settings where the research was conducted, it was also translated into internal policy documents. These policy documents are definitive in ensuring curriculum innovation and thus the required educational behaviour in the setting in which the researcher works.

Our contribution in shaping the theory regarding the design of mode-2 research comprises firstly the finding that partnership between the researcher and practitioners in creating practice-based scientific knowledge succeeds in closing the gap between theory and practice if the research design includes the objectives and a theoretically-based approach to both practitioners' knowledge creation, practitioners' development and the proposed organisational learning and innovation. Secondly our reflection resulted, from various theoretical perspectives of the partnership with practitioners, in concrete design principles, preconditions and recommendations for supporting and guiding practitioners during mode-2 research. We have set these out in the next table (See Table 3) and these can be seen as a working hypothesis for designing and guiding this kind of research. Allocation to the categories used is not a distinction because some of the recommendations apply within multiple categories.

Table 3: Design principles of mode-2 research

Basic design principle of mode-2 research:	Three interwoven research designs with clear goals concerning: (1) knowledge creation, (2) professional development and (3) organisational learning and innovation. Meet general scientific standards and usability criteria.
General preconditions before starting mode-2 research:	Adequate time and facilities; Adequate planning aligned with practitioners' regular workload; Clarity about researchers' and practitioners' roles; Clarity about expectations; Management support.
To support knowledge creation and knowledge transfer, incorporate:	Working with small groups in which the members can learn from each other; Support individual agency and commitment; Facilitate the creation of conceptual clarity; Facilitate the creation of shared visions; Support creating relevant usable knowledge at the 'right' time while meeting the required scientific standards.
To support practitioners' professional development, incorporate:	Support social communicative learning; Elements of self-study and other practitioner research as learning strategy; Support the generation of new reality constructions.
To support organisational learning and innovation, incorporate:	Support practitioners' agency and ambition to implement the intervention in their own practice; Design an implementation plan that is facilitated and supported by the management; Ensure execution of the implementation plan by someone with influence and ambition.
To support partnership with practitioners, we recommend that researchers should be aware of the need to be a(n):	Flexible project manager; Facilitator of professional development; Facilitator of reflective dialogues; Adequate 'role manager' (acts as researcher and other roles); Adequate equilibrist between context and research.

To summarise: in this conceptual paper, we have reflected on the theoretical aspects of transfer of learning; professional development; practitioners' knowledge creation; innovation and organisational learning on how partnership with practitioners can help in bridging the gap between theory and practice.

Our reflections have highlighted the importance of having three interwoven research designs in mode-2 research: (1) one design concerning the scientific knowledge creation process based on practitioners' knowledge creation; (2) one design concerning the practitioners' learning support in knowledge creation, professional learning and knowledge transfer and (3) and one design that

guarantees implementation into practitioners' practice at the organisational level. To gain a deeper scientific understanding in critical design variables in mode-2 research which at the same time help to create scientific practice-based knowledge, professionalise practitioners and ensure innovation, we recommend that mode-2 researchers write conceptual papers from the perspective of three interwoven designs to allow further meta-analysis to be carried out in the future. We also advise further investigation into the qualities a mode-2 researcher must demonstrate as a facilitator of professional development and innovation. The researchers can use the design principles we have proposed as a working hypothesis for designing and guiding their own mode-2 research. Follow-up research into these design principles can support deeper understanding of how mode-2 research in education can bridge the gap between theory and practice.

CHAPTER 6

General Discussion

General Discussion

This dissertation reports on a research project exploring Inquiry-Based Attitude as a relatively new objective in teacher education. Until now, the concept of Inquiry-Based Attitude as an objective in teacher education has been under-explored. As Chapter 1 of this thesis shows, in order to increase the scientific understanding of Inquiry-Based Attitude, a number of theoretical perspectives can and must be used, concerning the fields of inquiry, learning and development. These theoretical notions point in the direction of a broad set of characteristics that seem to be related to personality traits, professional development competences, research skills and academic study skills as has been described and examined throughout the chapters of this thesis. The development perspective was particularly important to this research. The attention paid to Inquiry-Based Attitude from a development perspective is understandable because theoretical assumptions suggest a positive relationship between this attitude, lifelong learning and the ability to innovate in teaching practice (Cochran-Smith & Lytle, 2009; Cochran-Smith & Zeichner, 2010; Leeman & Wardekker, 2014; Mason, 2009; OCW/EZ, 2009; Onderwijsraad, 2014). Teacher educators therefore have the responsibility to educate teachers with an Inquiry-Based Attitude as a characteristic of their professional identities. However, the lack of empirical clarity hinders the development of a pedagogy to enhance the inclusion of Inquiry-Based Attitude as a characteristic of teachers' professional identity. Therefore, this dissertation aims to build a well-founded scientific understanding of Inquiry-Based Attitude and the derived consequences regarding this concept as an objective in the teacher education curriculum. To achieve socially robust conceptual clarity, this research project includes teacher educators as co-researchers (Martens, Kessels, De Laat, & Ros, 2012; Nowotny, Scott & Gibbons, 2001).

In the light of the dissertation aims, this chapter discusses and outlines the studies' major findings as they relate to the research questions of this dissertation as reported in Chapters 2 to 5. Chapter 2 explored the characteristics of teachers' Inquiry-Based Attitude, Chapter 3 studied teachers' Inquiry-Based Attitude development predictors during their education, Chapter 4 reported the exploration of active ingredients in professional development interventions towards educators' transformative learning in stimulating Inquiry-Based Attitude, and Chapter 5 made a conceptual contribution to the discussion of how partnership between educational researchers and practitioners in

mode-2 research can help to bridge the gap between theory and practice. This general discussion concludes the study by providing a reflection on the limitations of the research, offering suggestions for future research and discussing implications for practice.

Chapter 2: Exploring Teachers' Inquiry-Based Attitude

In this chapter, the first two research questions were answered by three studies concerning an exploration of the characteristics of teachers' Inquiry-Based Attitude and how these characteristics are related to the (probably associated) personality traits of openness and epistemic curiosity.

The research questions in Chapter 2 were:

1. What characteristics of the 'Inquiry-Based Attitude' of teachers can be distinguished?
2. To what extent are 'openness' and 'epistemic curiosity' related to the 'Inquiry-Based Attitude' of teachers?

It is necessary to have a well-founded insight into the characteristics of teachers' Inquiry-Based Attitude in order to operationalise it as an objective in teacher education. To explore and reconceptualise Inquiry-Based Attitude, an exploratory procedure of questionnaire design, redesign and literature study (Oppenheim, 2005) was carried out in co-creation with teacher educators. Data were gathered on three different occasions among three different cohorts of teachers (N= 867). Their distribution by gender and age represented the current situation within the Dutch educational system and is in line with most European countries (EACEA, 2012). All teachers entered a master's in education programme at a Dutch university for applied sciences in three different geographic locations.

With regard to research question 1, the results indicated that, statistically, Inquiry-Based Attitude has an internal reflective dimension and an external knowledge-sourcing dimension. The internal reflective dimension relates to the ability to acquire new professional modes of understanding and behaviour, while the external knowledge-sourcing dimension relates to the professional behaviour of increasing one's professional knowledge by drawing on the expertise of others. This outcome of Inquiry-Based Attitude as a two-dimensional construct add

empirical evidence to Illeris's assumptions that all learning includes external interaction and internal acquisition. The analogy between the two-dimensions of the Inquiry-Based Attitude with Illeris's learning process theory supports the assumption that Inquiry-Based Attitude facilitates professional development (Cochran-Smith & Zeichner, 2010; Onderwijsraad, 2014).

Regarding research question 2, both the internal reflective dimension and the external knowledge-sourcing dimension can statistically be differentiated from the personality traits of openness to ideas, openness to change as measured in the 'Five-Factor Model' by McCrae and Costa (1989) and epistemic curiosity as measured by Litman (2008). As pointed out in Chapter 2, this distinction is relevant, because higher education focuses on goals that can be developed, in contrast with personality traits which remain reasonably consistent over a lifetime (e.g. Cobb-Clark & Schures, 2012; Roberts & DelVecchio, 2000).

Chapter 3: Developing an Inquiry-Based Attitude during Post-Initial Teacher Education

In this chapter, research questions 3 and 4 were answered by a quantitative longitudinal survey study which added a student development perspective to Inquiry-Based Attitude as an objective in teacher education. Building on the findings in Chapter 2, this study was carried out to explore the Inquiry-Based Attitude development of a cohort of in-service teachers (N=409) during their first year as master's students, and to discover to what extent this development could be linked to students' characteristics or other relevant educational variables, such as time and educator.

The research questions in Chapter 3 were:

3. To what extent do teachers develop Inquiry-Based Attitude during their first year of post-initial teacher education, and to what extent is this development related to the personality traits of openness and epistemic curiosity?
4. How and to what extent is Inquiry-Based Attitude development stimulated during the first year of post-initial teacher education, and what impact do the variables of time, educator and student-specific background have?

To measure Inquiry-Based Attitude development, data were collected at the start and end of the first year. To explore the relationship between Inquiry-Based Attitude development and students' characteristics or other relevant variables, data were collected at three time-points in their first year as master's students. When measuring students' Inquiry-Based Attitude engagement during education, the two Inquiry-Based Attitude dimensions (See Chapter 2) were operationalised in four aspects. The Internal Inquiry-Based Attitude dimension concerned understanding theoretical concepts, reflection on practice and critical reflection on beliefs, the External Inquiry-Based Attitude dimension concerned; knowledge-sourcing behaviour (See Chapter 3). An analysis of the relationships between the multiple variables at different levels and different time-points was conducted to answer both research questions.

As regards research question 3, the results showed a significant positive Inquiry-Based Attitude development, while student traits did not change significantly. This development of Inquiry-Based Attitude appeared not to be predicted or explained by the traits of openness to ideas, openness to change as defined by McCrae and Costa (1989) or epistemic curiosity as defined by Litman (2008). This finding was remarkable because studies in the field of developmental psychology offer strong evidence that openness and/or curiosity are consistently related to the need for professional growth (e.g. Hensel, 2010), deep learning (e.g. Chamorro-Premuzik & Furnham, 2009) and academic performance (Komarraju et al., 2011; Reio et al., 2006). The finding that these traits are not related to Inquiry-Based Attitude development suggests that a low level of openness or curiosity in the subject's nature does not hinder the development of either dimension of Inquiry-Based Attitude as a professional characteristic during the first year of their master's programme. Finally, the results indicate that Inquiry-Based Attitude development cannot be predicted or explained by student-specific background variables such as gender and age.

With regard to research question 4, the variable of 'educator' turned out to be a positive predictor of students' engagement in the internal Inquiry-Based Attitude dimension (i.e. understanding, reflection and critical reflection). In line with theories about the proven impact of teachers on pupils' learning outcomes (e.g. Cochran-Smith & Zeichner, 2010; Hattie, 2003), these findings indicate that educators also make a difference, in this case in the field of Inquiry-Based Attitude. Furthermore, the findings indicate that the variable 'time' is a positive predictor of engagement in critical reflection. This adds to existing theories regarding critical reflection as a learning goal (Avalos, 2011; Illeris, 2014;

Mezirow & Taylor, 2009), which indicate that having sufficient time (in this research, one year) might be crucial to reaching the level of transformative learning that is required to be able to change beliefs and behaviour. Finally, the findings indicate that 'years of work experience' is a negative predictor of engagement in Inquiry-Based Attitude. This may be explained by the theory that a deeply rooted professional identity resulting from experience complicates identity learning (Illeris, 2014; Geijsel & Meijers, 2005), which makes it plausible that more years of experience can hinder engagement in Inquiry-Based Attitude.

Chapter 4: Professional Development of Teacher-Educators towards Transformative Learning

In this chapter, research question 5 and 6 were answered by a two-year qualitative study which examined the active ingredients in teacher educators' professional development interventions. This study added an educator development perspective to Inquiry-Based Attitude as an objective in teacher education. Building on the findings in Chapters 2 and 3, a professional development programme was designed for educators teaching both bachelor's and master's courses. The aim of this programme was to encourage the transformative learning of educators to stimulate Inquiry-Based Attitude in their students. Transformative learning is considered to be the highest level of deep learning and requires critical reflection (Illeris, 2014; Mezirow & Taylor, 2009).

The research questions in Chapter 4 were:

5. To what extent and in what way do the designed professional development interventions support the transformative learning of educators?
6. How do these interventions influence changes in beliefs and/or behaviour of educators with regard to the stimulation of an Inquiry-Based Attitude in students?

An educational design research method was followed to create socially robust knowledge, which means, as pointed out in Chapter 1, that the process of knowledge production is perceived as 'participative' (Nowotny, Scott & Gibbons, 2006). Five experienced educators worked together with the researcher in a design and research team. Following the design, testing and redesign of the

professional development programme, a qualitative multiple case study was carried out. The qualitative analysis focused on examining the active ingredients of the interventions designed for this study with regard to changes in educators' beliefs and behaviour in stimulating students' Inquiry-Based Attitude. The study was conducted in four different educational settings in which 20 educators participated for nine months. Data sources included videos, questionnaires, interviews and written personal theories of practice.

In terms of research question 5, the findings indicated that the programme that had been designed contributed convincingly to transformative learning with regard to the beliefs relating to the stimulation of both dimensions of Inquiry-Based Attitude. Regarding transformative learning in terms of educators' behaviour, the findings were less convincing. In two of the four groups, a discrepancy between beliefs and behaviour was noticed. This discrepancy is a known phenomenon, but it is difficult to explain and needs to be made the specific object of study (Taylor, 2007; Van der Schaaf, Stokking & Verloop, 2008), as, for example, in the recent small-scale observation study (Assen, Meijers, Otting & Poell, 2016) which again showed that experienced tutors' beliefs do not predict their interventions. Since critical reflection is an essential learning strategy in transformative learning concerning changes in beliefs and behaviour (Illeris, 2004, 2014; Mezirow & Taylor, 2009; Taylor & Jarecke, 2009), the finding in the previous study in Chapter 3, in which time was indicated as a positive predictor of critical reflection, seems relevant. It is plausible that more time was needed to align beliefs and behaviour in all four groups.

Concerning research question 6, the findings provide insight into the active ingredients in the professional development interventions designed for this study. All participating educators confirmed that learning from and with peers, studying one's own beliefs and behaviour in practice and receiving adequate learning support are helpful. This coincides with existing teacher and educator professional development theories (Hargreaves & Fullan, 2012; Lunenberg, Dengerink, & Korthagen, 2014; Van Veen et al., 2010). A new and additional finding regarding educator development theories is that an aligned combination of a trained facilitator and the specific intervention sets 'Theory of Practice' and 'Video Analysis' stimulates transformative professional learning. These intervention sets supported systematic self-study of professional beliefs and behaviour in combination with sharing, discussing and elaborating on the personal findings within a safe peer group. It is noteworthy that personal confrontation and elaborating on inconsistencies and discrepancies between

intended and actual behaviour made a particular contribution to transformative learning and aligning behaviour and beliefs. This finding, in combination with the earlier result that time is a predictor for learning on the level of critical reflection with transformative learning as an outcome, contributes to an understanding of factors which can help to align the behaviour and beliefs of professionals both within and outside teacher education.

Chapter 5: Bridging the Research-to-Practice Gap in Education: the Design Principles of Mode-2 Research Innovating Teacher Education

In this chapter, research question 7 was answered through a reflection on the partnership between educational researchers and practitioners in practice-based scientific research through the theoretical lens of the transfer of learning. As such, this chapter was especially concerned with so-called mode-2 research (Gibbons et al., 1994; Nowotny, Scott & Gibbons, 2006). The aim of this reflection was to contribute to the conceptual debate surrounding the claim made at the start of this research in Chapter 1, that partnership between educational researchers and practitioners supports the creation of socially robust knowledge whilst simultaneously contributing to professional development and innovation (Martens et al., 2012).

The research question in Chapter 5 was:

7 How and why affected our research in partnership with practitioners educators' professional development and how did it bring innovation to teaching practice?

To reflect on partnership between researcher and practitioners during mode-2 research, the study presented in Chapter 4 was used as an object of reflection. Various theoretical perspectives on research into partnership with practitioners were taken into account. Through the lens of transfer of learning, the study reflected on practitioners' knowledge creation, professional development, and organisational innovation. This reflection resulted in a working hypothesis for mode-2 researchers, highlighting the need for three interwoven research designs in mode-2 research. One design should concern the scientific knowledge creation process based on practitioners' knowledge creation theories. This led to the

suggestion to design a research setting that encourages and facilitates shared interactive research and the (re-)development of practical knowledge, beliefs and behaviour from different perspectives. A second design should concern practitioners' learning support, which needs to be based on learning theories regarding practitioners' intended learning level. Learning on the level of critical reflection, for example, means facilitating the de- and reconstruction of personal beliefs (Kember et al., 2000). The third design should concern an implementation plan based on innovation theories to reinforce implementation guarantees on the different levels of practitioner, practice and educational policy. This addresses the complex task of mode-2 researchers as the facilitators of practitioners' knowledge construction, professional development and innovation.

Limitations

This dissertation is a first step towards understanding Inquiry-Based Attitude as a relatively new objective in teacher education. Several critical remarks on this dissertation should be taken into account when evaluating the outcomes. Most limitations have already been reported in the subsequent studies that were carried out. The main limitations are summarised and discussed in the following paragraphs.

Inquiry-Based Attitude

Considering the understanding of teachers' Inquiry-Based Attitude as a two-dimensional construct, further testing of the validity of this understanding is needed. The Inquiry-Based Attitude questionnaire that was developed through the studies reported in Chapters 2 and 3 is specifically intended to measure Inquiry-Based Attitude in practising teachers taking part in post-initial master's programmes. This means that it must be re-developed for use in other target groups in education such as those in initial teacher education. Although the research population in the current studies was comparable with the regular teacher population in the Netherlands and Europe (EACEA, 2012), from the perspective of generalisability it must be taken into account that this population was motivated to enter a post-initial master's programme.

Development of Inquiry-Based Attitude

With regard to the development of Inquiry-Based Attitude as an achievable goal of education, it should also be kept in mind that unmeasured influences such as the specific teacher educator, the sequence of the teacher educators, the specific course content and the group dynamics may also interact with the findings (Cochran-Smith & Zeichner, 2010). Because educational practice makes it impossible to control for all variables, the results have the nature of plausible interpretations (Ropes, 2010; Van Aken & Andriessen, 2011; Veerman & Van Yperen, 2007). This limitation is linked to a broader debate about the limitations of local knowledge creation and the scientific requirements this practice-based research must meet in order to create knowledge with external validity (Martens et al., 2012; Nowotny et al., 2001; Verschuren, 2009).

Educators' professional development

Considering the findings regarding active ingredients in professional interventions that support educators' transformative learning, it is important to consider that the study was conducted in the context of one institute of higher professional education with a small sample size. Although the reported research describes how scientific criteria were met, the findings need more validation through testing in other professional development programmes within and outside the context of teacher education. It must also be kept in mind that this study provides no insight into the relationship between the impact of the professional development achieved by educators and the development of Inquiry-Based Attitude in students.

Suggestions for future research

This dissertation reported on a series of studies on a relatively new and under-explored topic. More research is needed to validate, enhance and extend the findings.

Inquiry-Based Attitude

Because the development of Inquiry-Based Attitude as an objective in education is not exclusive to Dutch teachers, a clear concept would also be relevant for

professionals in other countries. Therefore, the research presented could be replicated in other (international) contexts in higher professional education to gain a deeper understanding of the possibility of Inquiry-Based Attitude as a universal construct. In addition to the limitations already mentioned, the issue of criterion validity must be considered. Given that this is the first measure of Inquiry-Based Attitude as an objective in teacher education, and thereby can be used to gain insight in the development of Inquiry-Based Attitude, future research is needed in which IA is related to other outcomes of learning to better understand the value of IA as an objective in teacher education. The current study allows to make steps in that direction by the construction of an instrument for measuring IA. In addition, future research needs to focus on triangulating the Inquiry-Based Attitude instrument with other measure.

Development of Inquiry-Based Attitude

To provide a more profound understanding of the ways in which education can boost the development of both dimensions of Inquiry-Based Attitude as output variables, it is advisable to follow students both during their time as a student and after their graduation. This approach could also provide insight into the sustainability of their Inquiry-Based Attitude development and can contribute to empirical insight into the assumed impact on innovating practice and facilitating lifelong learning. To gain insight in the relationship between educators' behaviour with regard to stimulating Inquiry-Based Attitude and the development of students, more longitudinal and large-scale research is needed. In this regard, it may be helpful to observe and explore the interventions of educators in enhancing students' Inquiry-Based Attitude. This might support the pursuit of a deeper empirical understanding of the specific characteristics of effective pedagogical approaches regarding Inquiry-Based Attitude development. This kind of research could also provide insight into the extent to which Inquiry-Based Attitude engagement depends on specific course content and/or on the interaction with and between various teachers and student groups. Given the attention paid to critical reflection in higher professional education, the finding that there is a positive relationship between time and the development of a habit of critical reflection seems an interesting topic for further exploration.

Educators' professional development

The validity of the findings regarding the active ingredients of educators' professional development needs further exploration. Adopting these ingredients in other research geared towards transformative learning and congruency between the behaviour and beliefs of educators and other professionals in higher education can provide more insight into the power and applicability of these ingredients and offer the opportunity to improve them. A more profound understanding of specific characteristics researchers need in order to facilitate practitioners learning in mode-2 research requires specific attention in follow-up research.

Mode-2 research

To gain a deeper scientific understanding into the design principles of mode-2 research, mode-2 researchers could use the proposed design principles and reflect on their research from the perspective of the three interwoven designs presented. This approach will also create the opportunity to carry out a meta-analysis in the future to provide a more profound understanding of opportunities and impediments in designing mode-2 research.

Implications for practice

The design of the reported studies contributed to create socially robust scientific clarity regarding the ways in which Inquiry-Based Attitude as an objective in teacher education can be understood. This understanding refers to Inquiry-Based Attitude as a developable educational goal for students and a 'tool' in curriculum development and the professional development of educators. This dissertation also contributed a conceptual insight into how research in partnership with practitioners, as promoted by many researchers (e.g. Hargreaves, 1999; Martens et al., 2012; Nowotny, Scott & Gibbons, 2001), can support the proven complex transfer of results (e.g. Broekkamp & Van Hout-Wolters, 2007; OCW, 2011) from educational research into educational practice. This section discusses implications for teacher education practice in general and subsequently focuses on the implications for teacher education, professional development and the research culture in teacher education.

Teacher Education

In Dutch educational policy, teacher educators have a responsibility to educate teachers with a professional identity characterised by an Inquiry-Based Attitude (OCW/EZ, 2009; Onderwijsraad, 2014). Students must provide evidence of this Attitude in their portfolios and demonstrate it during teaching practice, and educators are required to assess the Inquiry-Based Attitude of their students. This dissertation contributes to an empirical understanding of Inquiry-Based Attitude as a two-dimensional construct that consists of an internal reflective dimension and an external knowledge-sourcing dimension. This understanding can help teacher training institutes to develop their curricula with an aligned pedagogy to enhance the development of Inquiry-Based Attitude as an objective of their programmes. Educators and students can use the two dimensions to diagnose to what extent and in what way Inquiry-Based Attitude plays a role in improving their professional performance or practice. The 'Inquiry-Based Attitude Questionnaire' developed for this study may be of use in achieving this goal. Understanding the impact of educators in engaging students' Inquiry-Based Attitude development and the statistical differences between educators in their professional behaviour may be useful in educators' professional development. With the help of the 'Engaging IA in Education-Questionnaire' presented for this study, teacher educators can explore the extent to which they enhance their students' Inquiry-Based Attitude. This information can be used as a tool for personal reflection and can provide a possible direction towards personal or organisational professional development. Other disciplines in higher professional education can easily adapt the instruments presented to their own context and benefit from the findings of this dissertation.

Professional development in higher professional education.

From an economic perspective, teacher educators and other lecturers in higher professional education play a key role in the development of society. As such, they are expected to improve their own professional performance throughout their career (Mourshed, Chijioke & Barber, 2010; Kuijpers, 2012; Onderwijsraad, 2014). Improving professional performance requires learning on the level of professional identity. Learning on this level implies changes in deeply rooted professional beliefs and/or behaviour (Illeris, 2014). When this kind of learning is required, higher professional education institutes can profit from the finding

that 'guided' personal confrontation and elaborating on inconsistencies and discrepancies between intended and actual behaviour contribute to transformative learning (Mezirow & Taylor, 2009) and aligning behaviour and beliefs. This finding, in combination with the result that time is a predictor for learning on this level, can be helpful in creating professional development conditions. The clarification, provided here, of the specific active ingredients that support transformative learning can be of use in designing other professional development programmes both within and outside educational settings. The findings can also be used at an institute or faculty level to develop well-informed professional development policy with respect to Inquiry-Based Attitude as a required characteristic of professionals with higher-education qualifications (OCW/EZ, 2009; Onderwijsraad, 2014).

Research culture in higher professional education

As pointed out in the introduction of this dissertation, a trend has recently appeared towards the development of a research culture within the context of higher professional education (e.g. Griffioen, 2013). The aim of this research culture is to help bridge the research-to-practice gap. This dissertation provides a working hypothesis in designing mode-2 research with the focus on conducting research in partnership with practitioners. This hypothesis highlights the importance of having three interwoven designs, namely (1) creating socially robust scientific knowledge; (2) professional development; and (3) innovating practice to safeguard the sustainability of the results of mode-2 research. This working hypothesis may be helpful in the further development of a research policy geared towards the level of students, educators or qualified researchers. The working hypothesis presented can serve as a guide to the design of mode-2 research at the different levels and can serve for example as a lens to examine the research requirements students must meet before graduation. The conceptual insight provided into the three interwoven designs for socially robust knowledge creation, professional development and innovation provide fodder for further debate, for instance, surrounding the need for shared responsibility between all stakeholders involved in this kind of research. This seems relevant because a single researcher can hardly be held responsible for aligned results in all three designs.

General conclusion

Overall, this dissertation contributes to empirical and socially robust conceptual clarity regarding Inquiry-Based Attitude as an objective in teacher education. Inquiry-Based Attitude is defined as a concept with both an internal reflective dimension and an external knowledge-sourcing dimension. It became clear during the research that Inquiry-Based Attitude can be developed during education and that this development is not related to the personality traits of openness and curiosity. More important, it became clear that educators and time are predictors of this development. Furthermore, this research contributed to a deeper understanding of the active ingredients in the professional development of teacher educators. Finally, this study addresses the need for three interwoven research designs in mode-2 research to bridge the gap between theory and practice.

With this contribution, the study has the potential to support the development of a pedagogy to enhance the development of Inquiry-Based Attitude as a characteristic of teachers' professional identity as well as to support educators' professional development with regard to their performance in practice. The level of attention paid to Inquiry-Based Attitude as a characteristic of professionals with higher-education qualifications suggests that further research in this field is needed. Future research would build on the results and methods of the empirical studies presented here and on the three design characteristics of practice-based scientific research with practitioners.

The expectation that an Inquiry-Based Attitude will contribute to innovative and lifelong learning professionals has been a center point of this research. In closing, this research has contributed to conceptual clarity regarding the Inquiry-Based Attitude as an objective in teacher education. This has increased the potential to direct professional identity development of educators and their students towards accepting and embracing innovative and lifelong learning as an inherent part of their professional work.

Summary

This dissertation reports on a research exploring Inquiry-Based Attitude as a relatively new objective in teacher education. Until now, the concept of Inquiry-Based Attitude as an objective in teacher education has been under-explored. As Chapter 1 of this thesis shows, in order to increase the scientific understanding of Inquiry-Based Attitude, a number of theoretical perspectives can and must be used, concerning the fields of inquiry, learning and development. These theoretical notions point in the direction of a broad set of characteristics that seem to be related to personality traits, professional development competences, research skills and academic study skills as has been described and examined throughout the chapters of this thesis. The development perspective was particularly important to this research. The attention paid to Inquiry-Based Attitude from a development perspective is understandable because theoretical assumptions suggest a positive relationship between this attitude, lifelong learning and the ability to innovate in teaching practice (Cochran-Smith & Lytle, 2009; Cochran-Smith & Zeichner, 2010; Leeman & Wardekker, 2014; Mason, 2009; OCW/EZ, 2009; Onderwijsraad, 2014). Teacher educators therefore have the responsibility to educate teachers with an Inquiry-Based Attitude as a characteristic of their professional identities. However, the lack of empirical clarity hinders the development of a pedagogy to enhance the inclusion of Inquiry-Based Attitude as a characteristic of teachers' professional identity. Therefore, this dissertation aims to build a well-founded scientific understanding of Inquiry-Based Attitude and the derived consequences regarding this concept as an objective in the teacher education curriculum. To achieve socially robust conceptual clarity, this research project includes teacher educators as co-researchers (Martens, Kessels, De Laat, & Ros, 2012; Nowotny, Scott & Gibbons, 2001).

In the light of the dissertation aims, this chapter discusses and outlines the studies' major findings as they relate to the research questions of this dissertation as reported in Chapters 2 to 5 and provides a general conclusion.

Chapter 2

In this chapter, the first two research questions were answered by three studies concerning an exploration of the characteristics of teachers' Inquiry-Based Attitude and how these characteristics are related to the (probably associated) personality traits of openness and epistemic curiosity.

The research questions were:

1. What characteristics of the 'Inquiry-Based Attitude' of teachers can be distinguished?
2. To what extent are 'openness' and 'epistemic curiosity' related to the 'Inquiry-Based Attitude' of teachers?

It is necessary to have a well-founded insight into the characteristics of teachers' Inquiry-Based Attitude in order to operationalise it as an objective in teacher education. To explore and reconceptualise Inquiry-Based Attitude, an exploratory procedure of questionnaire design, redesign and literature study (Oppenheim, 2005) was carried out in co-creation with teacher educators. Data were gathered on three different occasions among three different cohorts of teachers (N= 867). Their distribution by gender and age represented the current situation within the Dutch educational system and is in line with most European countries (EACEA, 2012). All teachers entered a master's programme in Education at a Dutch university for applied sciences in three different geographic locations.

With regard to research question 1, the results indicated that, statistically, Inquiry-Based Attitude has an internal reflective dimension and an external knowledge-sourcing dimension. The internal reflective dimension relates to the ability to acquire new professional modes of understanding and behaviour, while the external knowledge-sourcing dimension relates to the professional behaviour of increasing one's professional knowledge by drawing on the expertise of others.

Regarding research question 2, both the internal reflective dimension and the external knowledge-sourcing dimension can statistically be differentiated from the personality traits of openness to ideas, openness to change as measured in the 'Five-Factor Model' by McCrae and Costa (1989) and epistemic curiosity as measured by Litman (2008). As pointed out in Chapter 2, this distinction is relevant, because higher education focuses on goals that can be developed, in contrast with personality traits which remain reasonably consistent over a lifetime (e.g. Cobb-Clark & Schures, 2012; Roberts & DelVecchio, 2000).

Chapter 3

In this chapter, research questions 3 and 4 were answered by a quantitative longitudinal survey study which added a student development perspective to

Inquiry-Based Attitude as an objective in teacher education. Building on the findings in Chapter 2, this study was carried out to explore the Inquiry-Based Attitude development of a cohort of in-service teachers (N=409) during their first year as master's students, and to discover to what extent this development could be linked to students' characteristics or other relevant educational variables, such as the time and educator.

The research questions were:

3. To what extent do teachers develop Inquiry-Based Attitude during their first year of post-initial teacher education, and to what extent is this development related to the personality traits of openness and epistemic curiosity?
4. How and to what extent is Inquiry-Based Attitude development stimulated during the first year of post-initial teacher education, and what impact do the variables of time, educator and student-specific background have?

To measure Inquiry-Based Attitude development, paired data were collected at the start and end of the first year. To explore the relationship between Inquiry-Based Attitude development and students' characteristics or other relevant variables, data were collected at three time-points in their first year as master's students. When measuring students' Inquiry-Based Attitude engagement during education, the two Inquiry-Based Attitude dimensions (See Chapter 2) were operationalised in four aspects. The External Inquiry-Based Attitude dimension concerned; knowledge-sourcing behaviour and the Internal Inquiry-Based Attitude dimension concerned understanding theoretical concepts, reflection on practice and critical reflection on beliefs (See Chapter 3). An analysis of the relationships between the multiple variables at different levels and different time-points was conducted to answer both research questions.

As regards research question 3, the results showed a significant positive Inquiry-Based Attitude development, while student traits did not change significantly. This development of Inquiry-Based Attitude appeared not to be predicted or explained by the traits of openness to ideas, openness to change as defined by McCrae and Costa (1989) or epistemic curiosity as defined by Litman (2008). The finding that these traits are not related to Inquiry-Based Attitude development suggests that a low level of openness or curiosity in the subject's nature does not hinder the development of either dimension of

Inquiry-Based Attitude as a professional characteristic during the first year of their master's programme. Finally, the results indicate that Inquiry-Based Attitude development cannot be predicted or explained by student-specific background variables such as gender and age.

With regard to research question 4, the variable of 'educator' turned out to be a positive predictor of students' engagement in the internal Inquiry-Based Attitude dimension (i.e. understanding, reflection and critical reflection). Furthermore, the findings indicate that the variable 'time' is a positive predictor of engagement in critical reflection which indicate that having sufficient time (in this research, one year) might be crucial to reaching the level of transformative learning. Finally, the findings indicate that 'years of work experience' is a negative predictor of engagement in Inquiry-Based Attitude.

Chapter 4

In this chapter, research question 5 and 6 were answered by a two-year qualitative study which examined the active ingredients in teacher educators' professional development interventions. This study added an educator development perspective to Inquiry-Based Attitude as an objective in teacher education. Building on the findings in Chapters 2 and 3, a professional development programme was designed for educators teaching both bachelor's and master's courses. The aim of this programme was to encourage the transformative learning of educators to stimulate Inquiry-Based Attitude in their students. Transformative learning is considered to be the highest level of deep learning and requires critical reflection (Illeris, 2014; Mezirow & Taylor, 2009).

The research questions in Chapter 4 were:

5. To what extent and in what way do the designed professional development interventions support the transformative learning of educators?
6. How do these interventions influence changes in beliefs and/or behaviour of educators with regard to the stimulation of an Inquiry-Based Attitude in students?

An educational design research method was followed to create socially robust knowledge, which means, as pointed out in Chapter 1, that the process of knowledge production is perceived as 'participative' (Nowotny, Scott &

Gibbons, 2006). Five experienced educators participated as partners and worked together with the researcher in a design and research team. Following the design, testing and redesign of the professional development programme, a qualitative multiple case study was carried out. The qualitative analysis focused on examining the active ingredients of the interventions designed for this study with regard to changes in educators' beliefs and behaviour in stimulating students' Inquiry-Based Attitude. The study was conducted in four different educational settings in which 20 educators participated for nine months. Data sources included videos, questionnaires, interviews and written personal theories of practice.

In terms of research question 5, the findings indicated that the programme that had been designed contributed convincingly to transformative learning with regard to the beliefs relating to the stimulation of both dimensions of Inquiry-Based Attitude. Regarding transformative learning in terms of educators' behaviour, the findings were less convincing. In two of the four groups, a discrepancy between beliefs and behaviour was noticed. Since critical reflection is an essential learning strategy in transformative learning concerning changes in beliefs and behaviour (Illeris, 2004, 2014; Mezirow & Taylor, 2009; Taylor & Jarecke, 2009), the finding in the previous study in Chapter 3, in which time was indicated as a positive predictor of critical reflection, seems relevant. It is plausible that more time was needed to align beliefs and behaviour in all four groups.

Concerning research question 6, the findings provide insight into the active ingredients in the professional development interventions designed for this study. All participating educators confirmed that learning from and with peers, studying one's own beliefs and behaviour in practice and receiving adequate learning support are helpful. This coincides with existing teacher and educator professional development theories (Hargreaves & Fullan, 2012; Lunenberg, Dengerink, & Korthagen, 2014; Van Veen et al., 2010). A new and additional finding regarding educator development theories is that an aligned combination of a trained facilitator and the specific intervention sets 'Theory of Practice' and 'Video Analysis' stimulates transformative professional learning. These intervention sets supported systematic self-study of professional beliefs and behaviour in combination with sharing, discussing and elaborating on the personal findings within a safe peer group. It is noteworthy that personal confrontation and elaborating on inconsistencies and discrepancies between

intended and actual behaviour made a particular contribution to transformative learning and aligning behaviour and beliefs.

Chapter 5

In this chapter, research question 7 was answered through a reflection on the partnership between educational researchers and practitioners in practice-based scientific research through the theoretical lens of the transfer of learning. As such, this chapter was especially concerned with so-called mode-2 research (Gibbons et al., 1994; Nowotny, Scott & Gibbons, 2006). The aim of this reflection was to contribute to the conceptual debate surrounding the claim made at the start of this research in Chapter 1, that partnership between educational researchers and practitioners supports the creation of socially robust knowledge whilst simultaneously contributing to professional development and innovation (Martens et al., 2012).

The research question was:

7 How and why affected our research in partnership with practitioners educators' professional development and how did it bring innovation to teaching practice?

To reflect on partnership between researcher and practitioners during mode-2 research, the study presented in Chapter 4 was used as an object of reflection. Various theoretical perspectives on research into partnership with practitioners were taken into account. Through the lens of transfer of learning, the study reflected on practitioners' knowledge creation, professional development, and organisational innovation. This reflection resulted in a working hypothesis for mode-2 researchers, highlighting the need for three interwoven research designs in mode-2 research. One design should concern the scientific knowledge creation process based on practitioners' knowledge creation theories. This led to the suggestion to design a research setting that encourages and facilitates shared interactive research and the (re-)development of practical knowledge, beliefs and behaviour from different perspectives. A second design should concern practitioners' learning support, which needs to be based on learning theories regarding practitioners' intended learning level. Learning on the level of critical reflection, for example, means facilitating the de- and

reconstruction of personal beliefs (Kember et al., 2000). The third design should concern an implementation plan based on innovation theories to reinforce implementation guarantees on the different levels of practitioner, practice and educational policy. This addresses the complex task of mode-2 researchers as the facilitators of practitioners' knowledge construction, professional development and innovation.

Overall, this dissertation contributes to empirical and socially robust conceptual clarity regarding Inquiry-Based Attitude as an objective in teacher education. Inquiry-Based Attitude is defined as a concept with both an internal reflective dimension and an external knowledge-sourcing dimension. It became clear during the research that Inquiry-Based Attitude can be developed during education and that this development is not related to the personality traits of openness and curiosity. More important, it became clear that educators and time are predictors of this development. Furthermore, this research contributed to a deeper understanding of the active ingredients in the professional development of teacher educators. Finally, this study addresses the need for three interwoven research designs in mode-2 research to bridge the gap between theory and practice. With this contribution, the study has the potential to support the development of a pedagogy to enhance the development of Inquiry-Based Attitude as a characteristic of teachers' professional identity as well as to support educators' professional development with regard to their performance in practice.

Samenvatting

Deze dissertatie betreft een exploratief onderzoek naar de Onderzoekende Houding als relatief nieuw doel in lerarenopleidingen. Tot dusverre is het concept Onderzoekende Houding als doel binnen lerarenopleiding nog weinig geëxploreerd. Om een beter wetenschappelijk inzicht in dit concept te verkrijgen, werden verschillende theoretische perspectieven gebruikt die betrekking hadden op onderzoek, leren en ontwikkeling, beschreven in Hoofdstuk 1. De verkregen theoretische noties wezen op de Onderzoekende Houding als een concept met een brede set kenmerken die verband hielden met persoonlijkheidskenmerken, competenties aangaande professionele ontwikkeling, onderzoekvaardigheden en academische studievaardigheden. Het professionele ontwikkelingsperspectief was daarbij in deze dissertatie met name van belang omdat de theorie een positieve relatie suggereerde tussen een Onderzoekende Houding, levenslang leren en het vermogen tot innoveren van de onderwijspraktijk. (Cochran-Smith & Lytle, 2009; Cochran-Smith & Zeichner, 2010; Leeman & Wardekker, 2014; Mason, 2009; OCW/EZ, 2009; Onderwijsraad, 2014). Binnen deze context werd en wordt van lerarenopleiders verwacht dat zij leraren opleiden met een Onderzoekende Houding als een kenmerkend aspect van hun professionele identiteit. Echter, het ontbreken van empirisch gefundeerde conceptuele helderheid belemmert het ontwikkelen van een opleidingspedagogiek die de ontwikkeling van de Onderzoekende Houding als professioneel identiteitskenmerk van leraren bevordert. Deze dissertatie richt zich daarom op het vergroten van empirisch gefundeerd inzicht in de Onderzoekende Houding en de daaruit voortvloeiende consequenties voor het opleiden van leraren met een Onderzoekende Houding. Om sociaal robuuste, conceptuele helderheid te creëren, includeerde dit onderzoek lerarenopleiders als co-researchers (Martens, Kessels, De Laat, & Ros, 2012; Nowotny, Scott & Gibbons, 2001).

In het licht van de dissertatiedoelen worden hieronder per studie de belangrijkste bevindingen samengevat in relatie tot de onderzoeksvragen zoals gerapporteerd in de Hoofdstukken 2 tot en met 5 afgesloten met een algemene slotconclusie.

Hoofdstuk 2

In dit hoofdstuk werden de eerste twee onderzoeksvragen beantwoord aan de hand van drie exploratieve studies naar de kenmerken van de Onderzoekende

Houding van leraren en hoe deze kenmerken verband houden met de daarmee geassocieerde persoonlijkheidskenmerken openheid en epistemische nieuwsgierigheid.

De onderzoeksvragen waren:

1. Welke kenmerken van de 'Onderzoekende Houding' van leraren kunnen worden onderscheiden?
2. In hoeverre houden 'openheid' en 'epistemische nieuwsgierigheid' verband met 'de Onderzoekende Houding' van leraren?

Om de Onderzoekende Houding te gebruiken als een opleidingsdoel binnen lerarenopleidingen is een empirisch gefundeerd inzicht nodig in de kenmerken daarvan. Om de Onderzoekende Houding van leraren te exploreren werd een, op literatuurstudie gebaseerde, exploratieve ontwerp- en herontwerpprocedure van vragenlijsten gevolgd (Oppenheim, 2005). Deze procedure werd uitgevoerd in co-creatie met lerarenopleiders. De data werden verzameld op drie momenten binnen drie achtereenvolgende cohorten leraren (N= 867) die aan een Nederlandse educatieve master begonnen. Deze opleiding werd op drie verschillende locaties van een brede hogeschool aangeboden. De verdeling van geslacht en leeftijd in de onderzoeksgroep was representatief voor de actuele situatie in het Nederlandse onderwijs en de meeste landen in Europa (EACEA, 2012).

De resultaten met betrekking tot vraag 1 laten zien dat de Onderzoekende Houding bestaat uit twee statistisch te onderscheiden dimensies. Op basis van de inhoud blijken deze te typeren als een 'interne' en 'externe' dimensie. Bij de interne, op reflectie gerichte, dimensie draait het om het vermogen om professionele inzichten en professioneel gedrag te vernieuwen op basis van reflectief gedrag. Bij de externe, op kennisverwerving gerichte dimensie, draait het om gedrag dat zich richt op het actief vergroten van het professionele kennis door gericht op zoek te gaan naar kennis van anderen.

De resultaten met betrekking tot vraag 2 laten zien dat beide dimensies statistisch kunnen worden onderscheiden van de persoonlijkheidskenmerken 'openheid voor ideeën' en 'openheid voor veranderingen' zoals gemeten met de vragenlijst 'Five-Factor Model' door McCrae and Costa (1989). Ook kunnen zij statistisch worden onderscheiden van 'epistemische nieuwsgierigheid' zoals gemeten door de vragenlijst van Litman (2008). Dit onderscheid is relevant omdat het hoger onderwijs zich richt op ontwikkelbare doelen en niet op het

ontwikkelen van overwegend stabiele persoonlijkheidskenmerken (e.g. Cobb-Clark & Schures, 2012; Roberts & DelVecchio, 2000).

Hoofdstuk 3

In dit hoofdstuk werden de volgende twee onderzoeksvragen van deze dissertatie beantwoord aan de hand van een kwantitatieve longitudinale survey studie. Hierin werd, voortbouwend op de bevindingen in Hoofdstuk 2, de ontwikkeling van de Onderzoekende Houding van een cohort studenten, die werkten als leraar (N = 409), geëxploreerd tijdens hun eerste studiejaar aan een educatieve master. Daarbij werd ook nagegaan in hoeverre de eventuele ontwikkeling gerelateerd kon worden aan studentenkenmerken en relevante opleidingsvariabelen zoals bijvoorbeeld tijd (i.e. verstreken studieduur) en lerarenopleider.

De onderzoeksvragen waren:

3. In hoeverre ontwikkelen werkende leraren hun 'Onderzoekende Houding' tijdens hun eerste jaar aan een educatieve master en in hoeverre houdt deze ontwikkeling verband met de persoonlijkheidskenmerken openheid en epistemische nieuwsgierigheid?
4. Hoe en in hoeverre wordt de ontwikkeling van de Onderzoekende Houding tijdens het eerste jaar aan een educatieve master gestimuleerd en wat is daarbij de impact van de variabelen tijd, lerarenopleider en van student-specifieke achtergrondvariabelen?

Om de ontwikkeling van de Onderzoekende Houding te meten werden aan begin en eind van het eerste jaar gepaarde data (i.e. dezelfde data van een respondent over verschillende tijdstippen) verzameld. Om de relatie te kunnen exploreren tussen de ontwikkeling van de Onderzoekende Houding, studentenkenmerken en andere relevante variabelen werden op drie verschillende momenten verspreid over het studiejaar ook gepaarde data verzameld. Om te meten hoe het inzetten van de Onderzoekende Houding tijdens het onderwijs werd gestimuleerd werden de twee dimensies van de Onderzoekende Houding (Zie Hoofdstuk 2) geoperationaliseerd in vier aspecten. De 'Interne Onderzoekende Houding' betrof het reflecteren op theoretische concepten, reflecteren op het handelen in de praktijk en kritisch reflecteren op persoonlijke overtuigingen. De

'Externe Onderzoekende Houding' betrof kennisverwervend gedrag (Zie Hoofdstuk 3). De relaties tussen de verschillende variabelen op verschillende niveaus en op verschillende meetmomenten werden geanalyseerd om antwoord te kunnen geven op beide vragen.

De resultaten met betrekking tot vraag 3 laten een significante positieve ontwikkeling zien op beide dimensies van de Onderzoekende Houding terwijl de persoonlijkheidskenmerken stabiel bleven. De resultaten laten ook zien dat de ontwikkeling op beide dimensies niet kan worden voorspeld door de persoonlijkheidskenmerken openheid voor veranderingen en openheid voor ideeën zoals gemeten door McCrae and Costa (1989) of door epistemische nieuwsgierigheid zoals gemeten door Litman (2008). Een lage score op deze kenmerken lijkt de ontwikkeling van een Onderzoekende Houding tijdens het eerste opleidingsjaar niet te beïnvloeden. Ten slotte laten de resultaten ook zien dat de ontwikkeling van de Onderzoekende Houding niet kan worden voorspeld door student-specifieke achtergrondvariabelen zoals bijvoorbeeld geslacht of leeftijd.

De resultaten met betrekking tot vraag 4 laten zien dat de variabele lerarenopleider significant van invloed is op de mate waarin studenten tijdens het onderwijs gestimuleerd worden om hun Interne Onderzoekende Houding in te zetten op alle drie de aspecten (i.e. reflecteren op theoretische concepten, reflecteren op het handelen in de praktijk en kritisch reflecteren op persoonlijke overtuigingen). Bovendien blijkt uit de resultaten dat de variabele tijd een positieve voorspeller is op het laten zien van kritisch reflectief gedrag. Dit suggereert dat het hebben van voldoende tijd (in dit onderzoek minimaal een jaar) cruciaal kan zijn om transformatief te kunnen leren (Zie Hoofdstuk 4). Tenslotte bleek in deze studie dat het aantal jaren werkervaring een significant negatieve samenhang vertoont met het inzetten van beide dimensies van de Onderzoekende Houding.

Hoofdstuk 4

In dit hoofdstuk werden twee onderzoeksvragen beantwoord op basis van een tweejarige kwalitatieve studie. Hierin werd onderzocht wat de actieve ingrediënten zijn (Cochran-Smith & Zeichner, 2010) in interventies die het leren van lerarenopleiders bevorderen. In deze studie werd, voortbouwend op de eerdere bevindingen een professionaliseringsprogramma ontworpen voor

lerarenopleiders in opleidingen op het niveau van bachelors en masters. Het doel van dit programma was het transformatief leren van lerarenopleiders bevorderen ten aanzien van het stimuleren van de Onderzoekende Houding van hun studenten. Transformatief leren wordt daarbij beschouwd als het hoogste niveau van diep leren en vereist kritische reflectie (Illeris, 2014; Mezirow & Taylor, 2009).

De onderzoeksvragen waren:

5. In hoeverre bevorderen de ontworpen professionaliseringsinterventies het transformatief leren van lerarenopleiders?
6. Hoe beïnvloeden deze interventies veranderingen in overtuigingen en/of gedrag van lerarenopleiders met betrekking tot het stimuleren van de Onderzoekende Houding van studenten?

Er werd een educatieve design methode gevolgd waarbij het proces van kennisconstructie door de praktijk als participatief wordt ervaren om sociaal robuuste kennis te creëren (Nowotny, Scott & Gibbons, 2006). Vijf ervaren lerarenopleiders participeerden als co-designer en co-researcher en vormden samen met de onderzoeker een design- en onderzoeksteam. Na het ontwerpen, testen en herontwerpen van het professionaliseringsprogramma werd een kwalitatieve meervoudige gevalsstudie uitgevoerd. In de analyse werd gefocust op het identificeren van de actieve ingrediënten in de interventies die bijdroegen aan veranderingen in overtuigingen en/of gedrag van lerarenopleiders ten aanzien van het stimuleren van de Onderzoekende Houding van studenten. Deze studie werd uitgevoerd in vier verschillende settingen waarin 20 lerarenopleiders verdeeld over vier groepen gedurende een heel studiejaar participeerden. Databronnen omvatten videos, vragenlijsten, interviews en geschreven persoonlijke praktijktheorieën.

De resultaten met betrekking tot vraag 5 laten zien dat het ontworpen programma in alle vier groepen overtuigend bijdroeg aan het transformatief leren ten aanzien van opvattingen over het stimuleren van de Onderzoekende Houding. Met betrekking tot opleidersgedrag waren de resultaten minder overtuigend: in twee van de vier groepen werd een discrepantie tussen overtuigingen en gedrag waargenomen.

Ten aanzien van vraag 6 benoemden alle deelnemende lerarenopleiders als ondersteunend voor hun leren in het algemeen: het leren van en met 'peers', het onderzoeken van eigen overtuigingen en gedrag in de praktijk, en het

ontvangen van adequate leersupport. Transformatief leren bleek met name te worden bevorderd door een bekwame facilitator in combinatie met op elkaar afgestemde interventies. Kenmerkend voor deze interventies is het bevorderen van systematische zelfstudie van professionele overtuigingen en gedrag in combinatie met het delen, bediscussiëren en elaboreren van persoonlijke analyses en bevindingen binnen een veilige 'peer' groep. Tot slot bleek dat een confrontatie met inconsistenties en discrepanties tussen gewenst gedrag en feitelijk gedrag, bijdroeg aan transformatief leren en de congruentie tussen gedrag en overtuigingen bevorderde.

Hoofdstuk 5

In dit hoofdstuk werd de laatste vraag van deze dissertatie beantwoord door vanuit het theoretisch concept 'transfer of learning' te reflecteren op de samenwerking tussen onderwijsonderzoekers en praktijkexperts in een mode-2 praktijkgericht wetenschappelijk onderzoek (Gibbons et al., 1994; Martens et al., 2012; Nowotny, Scott & Gibbons, 2006). Deze reflectie beoogde bij te dragen aan het conceptuele debat over de claim dat samenwerking tussen onderwijsonderzoekers en praktijkexperts bijdraagt aan het creëren van sociaal robuuste kennis terwijl dat proces tegelijkertijd bijdraagt aan professionele ontwikkeling en innovatie van de praktijk.

De onderzoeksvraag was:

7 Hoe en waarom beïnvloedde in ons onderzoek de samenwerking met lerarenopleiders hun professionele ontwikkeling en droeg dit bij aan innovatie van hun praktijk?

Om te kunnen reflecteren op de samenwerking tussen onderzoeker en praktijkexperts tijdens mode-2 onderzoek werd de studie in Hoofdstuk 4 gebruikt als object van reflectie. Door de 'bril van transfer of learning' werd gereflecteerd op kennisconstructie, professionele ontwikkeling en innoveren van organisaties. Deze reflectie resulteerde in een werkhypothese voor mode-2 onderzoek waarin de noodzaak voor drie verweven onderzoeksontwerpen wordt verondersteld. Het eerste ontwerp heeft betrekking op de omgeving die nodig is voor het ontwikkelen van wetenschappelijke kennis, gebaseerd op theorieën over kennisconstructie door praktijkexperts. Er blijkt een onderzoek-setting nodig

waarin het vanuit verschillende perspectieven interactief (her)ontwikkelen van praktijkkennis, overtuigingen en gedrag wordt gestimuleerd en gefaciliteerd. Het tweede ontwerp betreft een begeleidingsaanpak die, op basis van theorieën over leren en ontwikkeling, het beoogde niveau van professionalisering ondersteunt. Leren op het niveau van kritische reflectie vereist bijvoorbeeld begeleiding in het de- en reconstrueren van persoonlijke overtuigingen (Kember et al., 2000). Het derde ontwerp betreft een implementatieplan met betrekking tot de geconstrueerde kennis op basis van theorieën over innovatie en organisatie-ontwikkeling. Dit betekent dat voorafgaand aan het onderzoek zoveel mogelijk voldaan wordt aan de randvoorwaarden voor succesvolle implementatie.

Concluderend, dit proefschrift draagt bij aan empirisch gefundeerde helderheid over het concept Onderzoekende Houding als een relatief nieuw doel binnen lerarenopleidingen. De Onderzoekende Houding van leraren is geoperationaliseerd als een tweedimensionaal construct met een interne reflectieve dimensie en een externe kennisverwervende dimensie. Gebleken is dat de ontwikkeling van de Onderzoekende Houding van studenten kan worden beïnvloed door onderwijs en niet afhangt van de persoonlijkheidskenmerken openheid en nieuwsgierigheid. De lerarenopleider en tijd komen naar voren als positieve voorspellers van deze ontwikkeling. Het aantal jaren werkervaring blijkt een negatieve voorspeller te zijn.

De resultaten van dit proefschrift kunnen bijdragen aan het empirisch gefundeerd ontwerpen van curricula binnen lerarenopleidingen waarin de ontwikkeling van een Onderzoekende Houding een doel is. Het is ook goed voorstelbaar dat deze resultaten kunnen worden benut in curricula van andere opleidingen in het hoger beroepsonderwijs. Daarnaast draagt dit proefschrift empirisch gefundeerde bouwstenen aan voor het ontwerpen van professionaliseringsinterventies die transformatief leren van lerarenopleiders bevorderen. Tot slot draagt dit proefschrift bij aan het conceptuele debat over mode-2 onderzoek door een werkhypothese aan te reiken voor het ontwerpen van dit soort onderzoek.

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Appendix 1

Group		Group M1				Group M2					Group B1				Group B2				
Participants Interventions		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Learning from and with peers		TR	x	x	x	x	TR	TR CR	x			x	x	x				TR CR
2	Learning from and with friends		x		x		x			x			x						
3	Theory of Practice personal	TR CR	x	TR CR	TR CR	X RE	x	X CR	TR CR			x	x	x	x	x	x	x	X RE
4	Theory of Practice Peers							x	TR CR	x		x	x		TR	x	x		
5	Theory of Practice group	x	x		TR CR			x				x	x			x			x
6	Video Analysis personal			TR CR		CR	TR	TR	TR CR		x	CR			TR		x	x	x
7	Video Analysis Peer	TR CR		AC CR		TR		X CR	TR CR	x		x	x		TR		x	x	x
8	Video Analysis group			x			x	x		x		x			TR	x	TR CR		
9	Facilitator's general quality	x	TR RE	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
10	Studying theory	x	TR KS	x	x		x	x	x	x	x	x	x	x	x	x	x		
11	Personal learning objective	x	x	x	x		x		x			x		x					
12	Non-specified interventions TIPP	TR RE CR	TR	TR CR	TR		TR RE	TR CR	TR CR	TR	TR RE CR	TR	TR KS	TR CR	TR RE	TR RE CR	TR RE CR	TR CR	TR

Variable-by-variable-matrix Interventions.

Reading instruction: x = general learning support; TR = transformative learning; RE = reflection; CR = critical reflection; KS = knowledge-sourcing behaviour.

Dank

Het volgen van de kunstacademie was voor mij de best denkbare vooropleiding tot wetenschappelijk onderzoeker. Ik ben mijn ouders dankbaar dat ze mij stimuleerden om mijn hart te volgen en mijn talent als vormgever te ontwikkelen. Mam en pap, dat jullie daar vertrouwen in hadden was best bijzonder vanwege de vele opgetrokken wenkbrauwen. Een kunstacademie zou immers opleiden tot een werkeloos bestaan. Echter, wat jullie en ik destijds niet konden vermoeden is dat de kunstacademietijd de basis legde voor mijn werk als wetenschapper. Ik ontwikkelde er een basishouding en vaardigheden om de fenomenen om ons heen systematisch en onbevooroordeeld te bestuderen. Daarbij leerde ik om alles van zoveel mogelijk kanten te bekijken, te blijven experimenteren, te twijfelen en door te gaan tot het gaatje. Het grote doel daarbij was om 'iets' tot op het bot te doorgronden en het vervolgens zo goed mogelijk in unieke beeldtaal weer te geven. De drijfveer om iets nieuws te creëren is volgens mij het warme, kloppende hart in het werk van iedere kunstenaar en wetenschapper. In beide disciplines komen nieuwe ideeën, beelden en kennis niet zomaar uit de lucht vallen. Kunstenaars en wetenschappers 'staan op de schouders' van het werk van anderen. Het resultaat van mijn proefschrift is dan ook te danken aan de inspanningen van vele voorgangers die de moeite namen hun werk met anderen te delen.

Terugblikkend op mijn promotieproject realiseer ik mij hoeveel mensen hieraan hebben bijgedragen. Allereerst wil ik alle lerarenopleiders en studenten bedanken die meewerkten en meededen aan dit onderzoek. Mede dankzij jullie hebben we nu een beter begrip van het concept onderzoekende houding in onze opleidingen. Mijn speciale dank gaat daarbij uit naar: Eveline Feldbrugge, Hannie Fokkens Diana Kolbe, Jeanet Spijksma en Ellen van Wetter. Jullie vormden mijn researchteam en fungeerden als mijn critical friends. Dankzij jullie konden we bijvoorbeeld verschillende gevalsstudies uitvoeren en samen uitpluizen wat er nu toe doet in de professionalisering van lerarenopleiders. Jullie waren enerzijds practitioner en anderzijds onderzoeker maar bovenal geweldige collega's. Dank daarvoor.

Veel dank ben ik verschuldigd aan mijn promotor Prof. Dr. Marinka Kuijpers. Ik had dit onderzoek nooit kunnen doen zonder jouw begeleiding, expertise en vertrouwen. Je bent met mij in zee gegaan terwijl ik natuurlijk geen doorsnee promovendus was. Met een kunstacademie achtergrond, aangevuld met onderzoeksmodules aan de Open Universiteit was ik maar minimaal weten-schappelijk geschoold. Bovendien was ik met mijn ervaring als lerarenopleider en onderwijskundig manager een echt praktijkmens. Jij zag er echter een uitdaging

in. Dat heeft vast te maken met je vermogen om het potentieel in mensen te zien en dit aan te spreken, hetgeen ook essentieel is in je leerstoel leeromgeving & -loopbanen. Je wist de balans te vinden tussen vertrouwen geven en kritisch zijn. Je dacht mee over het onderzoeksdesign en de beste aanpak voor de analyses. Je scherpte mijn denken en jouw optimisme en humor sloten aan bij mijn karakter. Ik bewonder jou als een rolmodel in je liefde voor de ontwikkeling van anderen. Heel veel dank.

Vanzelfsprekend bedank ik ook Prof. Dr. Femke Geijsel. Veel dank ben ik ook aan jou verschuldigd. Je stimuleerde mij om mijn conceptuele denken op een hoger plan te tillen. Met minder nam je overigens ook geen genoegen. Als ik weer eens alles met alles verknoopte, wist jij me terug te brengen naar de relevante delen. En als ik eindelijk dacht dat ik een verhaallijn goed te pakken had, ontdekte jij toch nog rafelranden. Mede dankzij jou heb ik een beter begrip gekregen van de complexiteit en de schoonheid van kwantitatieve data-analyse. De laatste fase van mijn onderzoek werkte je bevlogen aan het opstarten van je leerstoel en het leiding geven aan de NSO-CNA Leiderschapsacademie. Ondanks dat dit veel van je tijd vroeg, gaf je op cruciale momenten, soms midden in de nacht, onmisbare input om mijn onderzoek verder aan te scherpen. Veel dank daarvoor.

Mijn speciale dank gaat ook uit naar dr. Fer Boei. Jij maakte als dagelijks begeleider altijd tijd vrij voor mij. Zelfs voordat ik bij Marinka en later bij Femke aanklopte als promotoren, dacht jij al met me mee. Je bevestigde me in de relevantie van mijn onderzoek en liet me de complexiteit ervan doorgronden. Dat deed je zonder me af te schrikken, hetgeen ik achteraf gezien best bijzonder vind. Veel van mijn analyses zijn ook door jouw hoofd en handen gegaan. Vooraf bespraken we de beste aanpak, oefenden we een stuk en uiteindelijk checkten we samen de resultaten. Het met jou hardop denken was daarbij van grote waarde. Daarnaast heb ik genoten van onze gesprekken waarin we het dagelijkse leven met uiterste precisie exploreerden. Dank je wel daarvoor.

Daarnaast wil ik dr. Emmy Vrieling bedanken. Emmy ik heb heel veel geleerd van je schrijflessen en van je feedback op mijn schrijfaanpak. Dank voor je tijd en je respectvolle support. Je was belangrijk voor me.

Ik bedank Hogeschool Windesheim voor de mogelijkheid om mijn onderzoek binnen ons onderwijs in vier verschillende educatieve opleidingen uit te voeren. Ik mocht mijn werk als hoofddocent van de master (Special) Educational Needs en master Learning & Innovation verweven met mijn promotietraject en kreeg

daar ook extra tijd voor. Daardoor werd het mogelijk om dit onderzoek na ruim vijf jaar af te ronden. Het management van het domein Bewegen & Educatie dank ik ook omdat zij een groep van 25 lerarenopleiders faciliteerden om soms meerdere jaren te participeren in dit onderzoek. Dank jullie wel daarvoor. Speciale dank ben ik ook verschuldigd aan mijn naaste groep inspirerende collega's: Lieke, Kees, Diana, Dewi, Robert, Jarise, Erna, , Marjanne, Truus en Lonny. Jullie droegen er aan bij dat ik niet alleen het onderzoek maar ook de hectiek van mijn werk het hoofd kon bieden. Dank jullie wel.

Wat ben ik blij dat ik een vaste groep lieve familie en vrienden om me heen heb op wie ik terug kon en kan vallen. Jullie belangstelling hielp me om het vol te houden. Als ik weer een stapje had gezet, leefden jullie mee. Ik ben blij dat jullie samen met mij vieren dat dit project is afgerond. Zonder iemand tekort te willen doen prijs ik me gelukkig met twee speciale vriendinnen. Lieke, lieve collega en vriendin. We delen samen een kantoor en leiden een vrolijk parallel bestaan waarin we elkaar regelmatig op de hak nemen. Het houdt ons gezond! Lieve Ink Berber, het prachtige kraampakket dat je me bracht na de 'geboorte' van mijn proefschrift is onvergetelijk. Dank jullie wel.

Tot slot de belangrijkste mensen in mijn leven: mijn gezin. Dit promotie-traject lukte alleen met jullie liefde en onvermoeibare steun. Erik, je bent mijn beste vriend en geliefde, daarnaast een verrukkelijke kok. Het is er tijdens mijn onderzoek ingeslopen dat jij bijna altijd kookte en de meeste huis- en tuinklussen voor je rekening nam. Je las veel van mijn stukken en voorzag me van heldere feedback. Dank je voor je steun, vertrouwen, geduld en je liefde voor mij en de kinderen. En dan mijn lieve Madelon en Jerom, jullie waren afgelopen jaren een belangrijke reden om af en toe te stoppen met werk en onderzoek. Lieve Madelon, als onderzoeker in de dop heb je tijdens je eigen studie veel van mijn geluidsopnames getranscribeerd. Wat een rotklus was dat en wat leuk dat je daardoor een idee kreeg van waar ik mee bezig was. Nogmaals dank. Lieve Jerom, je hield me bij de les als moeder. Ik heb veel van je geleerd over het 'leven', dat was heel belangrijk voor me. Ik hoop dat jullie van me leerden dat je een heel leven hebt om te leren en dat niet alles in één keer hoeft. Als begin twintigers hebben jullie de toekomst van onze samenleving in handen en die vertrouw ik graag aan jullie toe. Volg je hart, houd je hoofd erbij, blijf trouw aan jezelf en…blijf je leven lang leren.