Exploring teachers' inquiry-based attitude

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Having a well-founded insight into the characteristics of teachers Inquiry-Based Attitude (IA) supports operationalizing IA as a learning goal in Teacher Education. The aim of this study is to refine the notion of IA from an ill-defined global concept into something with reliable and valid characteristics. To do so, data was 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 reconceptualization, was performed in collaboration with teacher educators. The results indicate that, statistically, IA 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.

Keywords: Teacher Education; Inquiry-Based Attitude; Personality; Professional Development

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) 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" (p.12). 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, Zwart, Meirink,

& Verloop, 2010; Veerman, 2010). In fact, it seems that having a body of knowledge regarding IA is essential for professional development (Lamb, Philipp, Jacobs, & Schappelle, 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, Boei, Kuijpers, & Geijsel, 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; Maclellan, 2015; Scheerens, 2010). To summarise, IA's theoretical characteristics reflect the ability to continuously and sustainably renew one's professional performance.

However, IA's characteristics are only theoretical described so far. Therefore scientific clarity about IA is needed to operationalize 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 (Avalos, 2011; Dyment & O'Connell, 2011; Mezirow & Taylor, 2009). Researchers generally agree on the skills that deep professional learning requires: being able to experience situations in a clear-headed, 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 (Argyris & Schön, 1997; Bolhuis, 2009; Jarvis, 2006; Kegan, 2009; Kolb, 1984). 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 (Kegan, 2009; Mezirow, 1994). 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, McKay, Sinclair, & Wong, 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 Behaviour

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, Silvester,

Cooper, Robertson, & Burnes, 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 McCrea 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, Glaser, Kruglanski, & Sulloway, 2003; Sibley & Duckitt, 2008). This tendency to adopt new ideas and changes also applies to intellectual curiosity (Hensel, 2010; Roberts, Walton, & Viechtbauer, 2006).

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, 1954); 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, Petrosko, Wiswell, and Thongsukmag (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 particularly focus on those aspects that may be developed through education. The main goal is to operationalize IA as a valid construct that can be differentiated from openness and epistemic curiosity as personality traits. The research questions are as follows:

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?

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 teacher education, 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 operationalization 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 operationalization 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 (McCrea, Kurtz, Yamagata, & Terracciano, 2010). 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, et al., 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 homogenous 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 section preparation phase) 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, p. 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.

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	EFA	This step resulted in a second

				version questionnaire by thematic analyses of qualitative data	(SPSS)	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
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

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 studied or were studying for a ‘Master’s in Special Educational Needs’ (MSEN) or a ‘Master’s in 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 amongst 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 two 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 two weeks, a reminder was sent to non-respondents to encourage participation.

Preparation 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 one or year two 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 one 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 three steps below.

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 operationalized IA in behavioural statements by following the focus group method (Bryman, 2012) and conceptualized and re-conceptualized the broad set of characteristics as derived from the theoretical exploration. Choosing to operationalize 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 six 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 4-point Likert scale was used, which included the option 'not applicable '. A low score means the intended behaviour is less present, whilst 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 .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 α .79. This resulted in a second version questionnaire with eleven 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 <u>adjusted my own actions</u> 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=.483/p=.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 .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 .71 and IA-E = α .56). The question was raised to what extent these three statements were confounded, i.e. 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

and Leung (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, i.e. 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; (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; (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 dataset included two steps: at first our theory of IA as a two factor model was tested by performing an 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 Pearsons correlation analysis was conducted.

Results 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 confirmative factor analyses (CFA) 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 ten statements with a factor loading above .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 .651; the other statements and both factors had a loading between .691-.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 .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=.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 .832 and IA-E =α .762), factor loadings between .682-.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.

Table 2 Two-dimensional structure matrix

	Dimension	
	IA internal α .83	IA external α .76
I adjusted my own actions based on new knowledge	.838	
I reflected on my actions to check whether I could have done things better	.827	
By thinking about my actions I have changed my usual approach in a number of ways	.816	
I kept reassessing my experiences to learn from them and improve my performance at work	.793	
I read publications or other sources to increase my knowledge about a specific educational topic		.801
I kept up with professional publications to keep up to date with what is happening in my field		.794
I read books and/or articles to find additional information for my teaching		.792
I surfed the Internet to find interesting sources to use in my work		.682

Extraction Method: Principal Component Analysis.
Rotation Method: Oblimin with Kaiser Normalization.

Results 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 .135-.305, or to state it otherwise: common variance lies between 2%-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 .135-.528 (common variance between 2%-28%). The relatively high correlation between OPACT and CURINT (.528) can be explained by the fact that both cases are about broad interests.

Table 3 Correlations traits and IA

		CURINT	CURDEP	OPACT	OPIDEA	IA-Internal	IA-External
CURINT	Pearson Correlation	1	.285**	.355**	.528**	.186**	.294**
	Sig. (2-tailed)		.000	.000	.000	.001	.000
	N	348	348	342	342	333	333
CURDEP	Pearson Correlation	.285**	1	-.021	.172**	.087	.070
	Sig. (2-tailed)	.000		.698	.001	.111	.205
	N	348	348	342	342	333	333
OPACT	Pearson Correlation	.355**	-.021	1	.256**	.135*	.163**
	Sig. (2-tailed)	.000	.698		.000	.014	.003
	N	342	342	342	342	333	333
OPIDEA	Pearson Correlation	.528**	.172**	.256**	1	.201**	.269**
	Sig. (2-tailed)	.000	.001	.000		.000	.000
	N	342	342	342	342	333	333
IA-INTERN	Pearson Correlation	.186**	.087	.135*	.201**	1	.305**
	Sig. (2-tailed)	.001	.111	.014	.000		.000
	N	333	333	333	333	333	332
IA-EXTERN	Pearson Correlation	.294**	.070	.163**	.269**	.305**	1
	Sig. (2-tailed)	.000	.205	.003	.000	.000	
	N	333	333	333	333	332	333

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

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

Conclusion and Discussion

As a result of this exploratory study, we can now characterise an inquiry-based attitude (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. Firstly, 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 operationalization of IA.

Because of this operationalization, 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 teacher education, 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 in its value in monitoring the development of IA during education.

Because developing an IA isn't 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 generalizability we have to take in account that our specific population was motivated to professionalize 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.

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