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A focus on theory, measurement, and longitudinal associations

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ASSESSING THE PROFESSIONAL IDENTITY OF PRIMARY STUDENT TEACHERS: DESIGN AND VALIDATION OF THE TEACHER IDENTITY MEASUREMENT SCALE

CHAPTER III

This study aimed to design and validate the Teacher Identity Measurement Scale (TIMS) for assessing primary student teachers' professional identity. Based on identity theory and a systematic review into quantitative instruments of teacher identity, teacher identity was decomposed in four first-order constructs: motivation, self-image, self-efficacy, and task perception. This resulted in a measurement scale consisting of 46 items. The factorial design was examined by administering the TIMS to first- and second-year primary student teachers. In phase 1, involving 17 students, qualitative scale development methods were used to assess the construct validity. In phase 2, its second-order factor structure was tested and confirmed among a sample of 211 students. In phase 3, this structure was cross-validated among a new sample of 419 students. The instrument may contribute to understanding primary student teacher's professional development and can be used as a tool to support the process of developing a professional teacher identity.

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INTRODUCTION

BOTH RESEARCHERS and teacher educators in the field of primary teacher education recognize the importance of supporting the teacher identity of student teachers (cf. Nias, 2002). Research shows that teachers with a strong and stable teacher identity deal better with professional identity tensions (e.g., Hong, Greene, & Lowery, 2017; Pillen, den Brok, & Beijaard, 2013), provide better guidance to the socialization process of school children (Nias, 2002), and cope more rapidly with occurring social and curricular educational developments (Lasky, 2005). Additionally, various researchers suggest that a solid teacher identity results in higher emotional involvement and enthusiasm at school (Rots, Aelterman, Devos, & Vlerick, 2010; Zembylas, 2003).

To provide support for the development of the professional identity (Nias, 2002), teacher education could benefit from a quantitative instrument for assessing student teachers' professional identity. Such an instrument can be used to explore developmental patterns in teacher identity among student teachers and may function as a pedagogical tool to provoke discussion with and among student teachers about their professional development.

Over the last two decades at least, 20 instruments have become available (Hanna, Oostdam, Severiens, & Zijlstra, 2019a), most instruments have been designed and piloted within secondary education (e.g., Hasinoff & Mandzuk, 2005; Masoumpanah & Zarei, 2014). As a result, existing tools are less suited to assess the professional identity of primary teachers' teachers and to design appropriate support for this specific target group (Hanna et al., 2019a).

Although the overall psychometric properties of existing instruments are considered acceptable to good, none of them measure teacher identity itself directly and present a comprehensive score of teacher identity (Hanna et al., 2019a). For instance, the questionnaire of Canrinus, Helms-Lorenz, Beijaard, Buitinka, and Hofman (2012) investigates teacher identity by analyzing how four indicators—self-efficacy, job satisfaction, motivation, and commitment—are related to each other, whereas the instrument of Beijaard et al. (2000) assesses whether the domains didactical, pedagogical, and subject matter expertise are associated with each other. However, the capability of these instruments to measure the second-order construct teacher identity remains unclear (Hanna et al., 2019a). As a result, it is difficult for researchers and practitioners to evaluate, present, and discuss this construct as parsimonious as possible (cf. Little, 2013).

CONCEPTUALIZATION OF TEACHER IDENTITY

Teacher identity has been conceptualized from various perspectives, including Erikson's theory of identity (Friesen & Besley, 2013), Bourdieu's theory of social capital (Hasinoff & Mandzuk, 2005), and the possible selves theory (Chong & Low, 2009). Each perspective resulted into different terminology, such as role anticipation, occupational values, and feelings of intrinsic satisfaction. Similar to recent qualitative studies (e.g., van der Want, den Brok, Beijaard, Brekelmans, Claessens, & Pennings, 2018), the identity theory perspective (Brenner, Serpe, & Stryker, 2018; Burke & Stets, 2009) was used in the present study to understand the nature of teacher identity. Unlike used theories, identity theory explicitly supports quantitative measures of teacher identity and the possibility to conceptualize teacher identity as a second-order construct.

At the heart of identity theory lies the idea that teacher identity is pre-existing and, as such, that it is not entirely self-generated and/or new. The process of developing a teacher identity results from an "ongoing and organized context and learning about the organization through socialization" (Burke & Stets, 2009, p. 34). This socialization provides the contours of what it means to be a teacher. Student teachers create professional identities that more or less already existed, and are to a large extent comparable to that of their peers. Professional teacher identity is considered as a role identity (cf. Brenner et al., 2018), the part of an individual that takes on, becomes and preserves the role of a teacher (cf. Stets & Burke, 2009). Teacher identity is understood as a socially shared and coherent set of meanings that define the particular professional role of teachers. In other words, each meaning reflects a small part of what teacher identity is. In general, these meanings can be any psychological construct – e.g., beliefs, attitudes – as long as they have the potential to guide teacher's behavior, thoughts, or emotions.

DOMAINS OF TEACHER IDENTITY

Based upon a review study about instruments measuring teacher identity a set of meanings of teacher identity was identified (Hanna et al., 2019a). Despite the wide variety of conceptualizations and instruments of teacher identity, the review uncovered that some conceptualizations were similar or closely related. More specifically, the analysis of available instruments revealed that the following six domains represent the set of meanings for teacher identity: (1) motivation (Why am I teaching?; e.g., Starr et al., 2006), (2) self-image (How do I see myself as a teacher?; e.g., Abu-Alruz & Khasawneh, 2013), (3) self-efficacy (How capable

do I believe I am to organize and perform my daily teaching activities?; e.g., Canrinus et al., 2012), (4) task perception (What is my task as a teacher?; e.g., Schepens et al., 2009), (5) commitment (How committed am I to the profession; e.g., Cheung, 2008), and (6) job satisfaction (How satisfied am I with my job; e.g., Hong, 2010).

For student teachers the domains job satisfaction and commitment can be considered as not meaningful. Job satisfaction refers to the way teachers feel about the school or institution they work for (Canrinus et al., 2012). The construct relates to an “emotional state” derived from a job experience at a particular school (cf. Menon & Athanasoula-Reppa, 2011). Given the fact that student teachers do not yet have an appointment, this domain is not meaningful in relation to their professional development. The domain commitment is often understood as being dedicated to the profession of being a teacher (cf. Abu-Alruz & Khasawneh, 2013). This domain mainly focuses on teachers’ commitment to the school or institute they are working. Since student teachers have explicitly opted for teacher education, commitment to the profession seems self-evident and commitment to an employer is not at issue. Substantially, commitment-related characteristics that can be considered important for the professional development of student teachers, such as engagement and willingness to become a teacher (cf. Nias, 2002; Stanley, VandenBerghe, Vandenberg, & Bentein, 2013), are generally not associated with commitment but with motivation (Hanna et al., 2019a).

PRESENT STUDY

The first aim of this study was to design and validate the Teacher Identity Measurement Scale (TIMS) which is an instrument intending to measure the professional identity of primary student teachers. Such an instrument can be used by researchers, for instance, in repeated quantitative measurements to expose patterns in the development of professional identity among student teachers. This offers possibilities to examine relations between teacher identity and other constructs, such as professional identity tensions (Hong et al., 2017) and emotional involvement (Nias, 2002). These relations have been theoretically hypothesized, but not yet investigated empirically (e.g., Hanna, Oostdam, Severiens, & Zijlstra, 2019b). Knowledge about the development of teacher identity in relation to other constructs may also be of interest for primary teacher education institutions to support their students. To date, primary teacher education institutions mainly relied on knowledge obtained by studies carried out within a secondary education setting, rather than research focusing on teacher identity within primary school settings (Nias, 2002). When institutions for primary teacher education are able to support and manage the development of their student’s teacher identity this may increase

their learning and enthusiasm for the profession (Nias, 2002), which in time, may decrease the risk of burnout and dropout during training or shortly after graduating (Hong, 2010). Burnout and dropout are in many other Western countries jeopardizing the quality of education (den Brok, Wubbels, & van Tartwijk, 2017).

The second aim of this study was to contribute to the empirical debate about teacher identity by suggesting that teacher identity is made up of the underlying domains motivation, self-image, self-efficacy, and task perception (Hanna et al., 2019a). Although not explicitly referring to identity theory, previous research has investigated various set of meanings – also referred to as components, dimensions, domains or indicators (e.g., Beijaard et al., 2000; Canrinus et al., 2012; Cheung, 2008; Schepens, Aelterman, & Vlerick, 2009). However, whereas different meanings of teacher identity have been distinguished, it is not clear to what extent they are related to and collectively represent the second-order construct teacher identity (Hanna et al., 2019b). In the present study, therefore, both first-order correlations and second-order factors of various meanings representing teacher identity were evaluated.

For assessing primary student teachers' professional identity, the Teacher Identity Measurement Scale (TIMS) was designed and validated. Following identity theory, teacher identity was finally decomposed in four relevant domains: motivation, self-image, self-efficacy, and task perception. Established methods for scale development were followed (e.g., Devon et al. 2007; Kline, 2011). In a first phase, the construct validity of the instrument was qualitatively examined. In phase 2, its second-order factor structure was tested among a sample of 211 students. In phase 3, this structure was cross-validated among a new independent sample of 419 student teachers.

METHOD

PARTICIPANTS AND PROCEDURE

This research involved data collection from two independent samples of primary student teachers. For the first data collection students were recruited from three primary teacher education institutions across the Netherlands. For the second data collection primary student teachers were recruited from four institutes, three of which are the same as in sample one. Managers of institutes were contacted in advance for permission to cooperate. All respondents – student teachers – that participated in this research provided informed consent. Ethical approval was granted by the Ethics Review Board of the Faculty of Social and

Behavioral Sciences. After reading and signing the informed consent, the measurement instrument was administered online during planned sessions at the institutions. The sessions were under the supervision of a teacher educator and a researcher and took on average 20 min.

SAMPLE 1

In May and June 2017, we conducted a survey among 209 first- and second-year primary student teachers. This is approximately 78% of all first- and second-year student teachers in the three institutions. Most students who did not completed the measurement instrument were ill or had overlapping appointments. The sample characteristics—academic year, gender, and educational background—are presented in Table 1. In general, this first sample appeared to be representative in terms of sex (see Geerdink & de Beer, 2013). However, the percentage of pre-university graduates was three times higher than the national average of 10% (see Educational Council, 2013). This high percentage is explained by the fact that one of the three institutions is only accessible for students with a pre-university educational background.

SAMPLE 2

In November and December 2017, we conducted a second survey research among 419 first year student teachers. This was almost 70% of all first-year students of the four institutes. As in sample 1, absence was mainly due to illness or double appointments. In Table 1 the characteristics of the second sample are shown. Equal to the national average percentages, most student teachers—73.5%—of this sample are female (see Geerdink & de Beer, 2013). In this second sample, the percentage of pre-university graduates was one and a half times higher than the national average of 10%, whereas the percentages of vocational graduates were almost two times lower than the national average of 40% (see Educational Council, 2013). A reason for these differences might be found in the increasing effort of institutions in that particular year to attract more students with a pre-university graduate educational background, while at the same time current governmental policies make teacher institution less easily accessible for those with a vocational educational background (cf. Snoek, van der Rijst, Versevel, Tigelaar, & van Driel, 2016).

TABLE 1. *Summary of samples' characteristics.*

	Sample 1 (absolute numbers and percentages)	Sample 2 (absolute numbers and percentages)	National average (percentages)
<i>Academic year</i>			
First	101 (48%)	409	
Second	108 (53%)		
<i>Sex</i>			
Men	36 (17.2%)	111 (26.5%)	18%
Women	173 (82.8%)	308 (73.5%)	82%
<i>Educational background</i>			
Pre-university education	89 (37.8%)	68 (16%)	10%
Higher prevocational education	90 (43.1%)	252 (60%)	50%
Vocational education	40 (19.1%)	99 (24%)	40%

MEASUREMENT INSTRUMENT

Based on the outcome of the systematic review study (Hanna et al., 2019a), four of the six domains as identified, were ultimately included in the TIMS: motivation, self-image, self-efficacy, and task perception. For each domain items were selected from published and well-validated Likert-scale instruments applied in earlier research on teacher identity (see Appendix A in Hanna et al., 2019a). Two or three scales were selected to conceptualize the underlying theoretical construct of a particular domain of teacher identity to achieve good substantive coverage and to enable confirmatory factor analysis (cf. Little, 2013). In case no Dutch version of a measuring scale was available, items were translated into Dutch using the standard procedure of translation and back translation (cf. Sperber, 2004). If necessary, items were rephrased or adapted to the Dutch situation, or new items were added in order to measure certain aspects of teacher identity more accurately. We refer to Table 2 for an overview of the used scales and the modifications of these scales.

TABLE 2. *Overview of selected scales and modifications.*

Domains of teacher identity	Original instrument	Subscales	Modifications
Motivation (7-point Likert scale)	Dutch version of the FIT-Choice scale originally developed by Watt & Richardson (2007) and translated by Fokkens-Bruinsma & Canrinus (2012).	Intrinsic Career Value (5 items) Working With Children (3 items)	We added two items.
Self-Image (5-point Likert scale)	Teacher identity in physicians scale originally developed by Starr et al. (2006).	Global Teacher Identity (4 items) Belonging to a Community of Teachers (4 items)	We translated the items from the English language to Dutch language.
Self-efficacy (5-point Likert scale)	Dutch version of the teachers sense of self-efficacy scale originally developed by Tschannen-Moran & Woolfolk-Hoy (2001) and translated by Mainhard, Brekelmans, Wubbels, & den Brok (2008).	Efficacy for student engagement (4 items) Efficacy for instructional strategies (4 items) Efficacy for classroom management (4 items)	No modifications were made.
Task Perception (5-point Likert scale)	Dutch version of the Views on Education originally developed by Denessen (1999).	Perception on education (10 items) Perception on teaching (8 items)	We rephrased the items to a more first person perspective.

Motivation was measured by eight items from the Dutch translation of the FIT-CHOICE scale (Watt & Richardson, 2007; translated by Fokkens-Bruinsma & Canrinus, 2012). This measurement instrument is most frequently used in international research on professional development of teachers and is widely validated along large cohorts in comparison with other available instruments (Richardson & Watt, 2016). The scale consists of an initial question ‘State briefly your main reason/s for choosing to become a teacher’ followed by several statements to be rated on a 7-point Likert scale (1 = not important; 7 = extremely important). From this instrument two subscales were selected—‘intrinsic career value’ ($n = 3$) and ‘work with children’ ($n = 3$)—that cover most components of teacher motivation distinguished in quantitative studies into professional identity (Hanna et al., 2019a). The subscale ‘intrinsic career value’ covers the components ‘intrinsic interest value’ of Hong (2010) and ‘intrinsic

value identity' of Zhang et al. (2016). The subscale 'work with children' covers the component 'feeling intrinsic satisfaction' of Starr et al. (2006).

However, due to the relatively low reliability of the subscale 'intrinsic career value' in the Dutch context ($\alpha = 0.49$; see Fokkens-Bruinsma & Canninus, 2012) some items were rephrased. For example, a statement 'because I like teaching' was rephrased in 'because I like teaching on a primary school'. Furthermore, two statements were added to the intrinsic career value scale: 'because I like to teach primary school children' and 'because I like to have my own class'. Therefore, in the current study the 'intrinsic career value' subscale consist of five items.

Self-Image was measured by the Teacher Identity in Physicians Scale (Starr et al., 2006). This instrument emerged from our review as most reliable and most extensively validated compared to others (Hanna et al., 2019a). This instrument measures to what extent an individual perceives oneself as a teacher and consists of eight statements to be rated on a 5-point Likert scale (1 = strongly disagree; 5 = strongly agree). Two subscales were selected that cover components related to how and in what way individuals view and feel themselves as teachers: 'Global Teacher Identity' ($n = 4$) and 'Belonging to a Community of Teachers' ($n = 4$). Example statements concerning global teacher image and belonging to a community of teachers are respectively 'I see myself as a teacher' and 'I feel part of a community of teachers'. Because there was no Dutch version available, the statements were translated from English to Dutch by two authors of this manuscript. Both translations were compared by two other researchers until consensus was reached. Finally, the statements were back translated to English by a native English speaker and checked by all authors.

Self-efficacy was measured by the short version of the Teachers Sense of Self-efficacy Scale (Tschannen-Moran & Woolfolk-Hoy, 2001), which was translated into Dutch by Mainhard, Brekelmans, Wubbels, and den Brok (2008). The instrument is widely used and validated in research on professional development of teachers in different countries (Zee & Koomen, 2016). The instrument consists of 12 items to be scored on a 5-point Likert scale (1 = not at all ; 5 = very much) measuring the extent to which teachers believe in their capability to organize and execute daily teaching tasks (Bandura, 1997), divided over three subscales 'engagement' ($n = 4$), 'instructional strategies' ($n = 4$), and 'classroom management' ($n = 4$). Example items of these three subscales are respectively: 'How much can you do to help your students value learning?', 'To what extent can you use a variety of assessment strategies?', and 'How much can you do to control disruptive behavior in the classroom?'.

Task Perception was measured by items from the instrument Views on Education (Denessen, 1999). Items measure beliefs of individuals about teaching and education on a 5-point Likert scale (1 = totally disagree; 5 = totally agree). This instrument proved to be reliable and valid (Hanna et al., 2019a). Based on content analyses, the 50 statements were assigned to two subscales labelled 'perception of education' ('I find order and discipline important in my classroom') and 'perception of teaching' ('In addition to my teaching duties, I also have a task as an educator'). This division is similar to aspects of task perception distinguished by researchers (e.g., Biesta, 2013; Kelchtermans, 2009). For each part, Denessen presents statements that are more or likely about 'the way teachers define their job' and 'what they perceive as the purpose of education'. In this vein, the two most common task perceptions are covered, i.e., 'perception of education' and 'perception of teaching'.

Subsequently, a choice was made between items that were similar in terms of formulation and/or content. The item that best captured the teacher belief was included. This resulted in ten items measuring perception of education and eight items measuring perception of teaching. Finally, following Canrinus' suggestion (personal communication, November 16, 2016), the 18 statements were rephrased by using first person sentences due to her experiences in using the instruments among student teachers. On generally formulated questions such as 'Most important task of education is to teach student social skills' almost all students in her research responded totally agree, while an "I"-perspective formulation such as 'I consider my most important task to teach students social skills' provoked more pronounced discrimination in scoring patterns.

In a follow-up phase, the complete first version of the TIMS was presented to a group of experts in the field of teacher education to evaluate the content, length, and comprehensiveness of the instrument (cf. Devon et al., 2007). All experts reported that the selected four domains indeed collectively cover elemental sets of meanings concerning the professional identity of student teachers. One expert suggested to add the domain 'professional agency' often defined as "teacher's capacity to critically shape their responses to challenging situations" (Biesta & Tedder, 2006, p.11). Otherwise stated, the concept agency denotes the quality of engagement of teachers with others and their environment and is not considered as an identity-related characteristic (cf. Priestley, Biesta, & Robinson, 2013). Additionally, the concept of agency is rather intertwined with constructs such as motivation and self-efficacy (see also the questionnaire of Heikonen, Pietarinen, Pyhältö, Toom, & Soini, 2016). Therefore, in concordance with the results of the systematic review of quantitative

studies (Hanna et al., 2019a), agency was not included as a separate characteristic of teacher identity in TIMS.

In a subsequent phase four student teachers were requested by cognitive interviewing to talk out loud about their thoughts during reading and answering items (cf. Desimone & Le Floch 2004). The results revealed that most items were interpreted as intended. Only some items containing difficult words, such as interdisciplinary, were rephrased based on the feedback of the students.

Finally, 13 student teachers completed the TIMS online without supervision and were asked to report on their levels of concentration during the administration (cf. Hertzog, 2008). To keep respondents concentrated a progress bar was added for enabling respondents to track their own progress. All students were able to complete the TIMS without supervision in about 15 minutes. These steps resulted in a 7- and 5-point Likert scale instrument consisting of 46 items representing four domains of teacher identity.

DATA ANALYSIS

EXPLORING THE FACTOR STRUCTURE OF THE TIMS

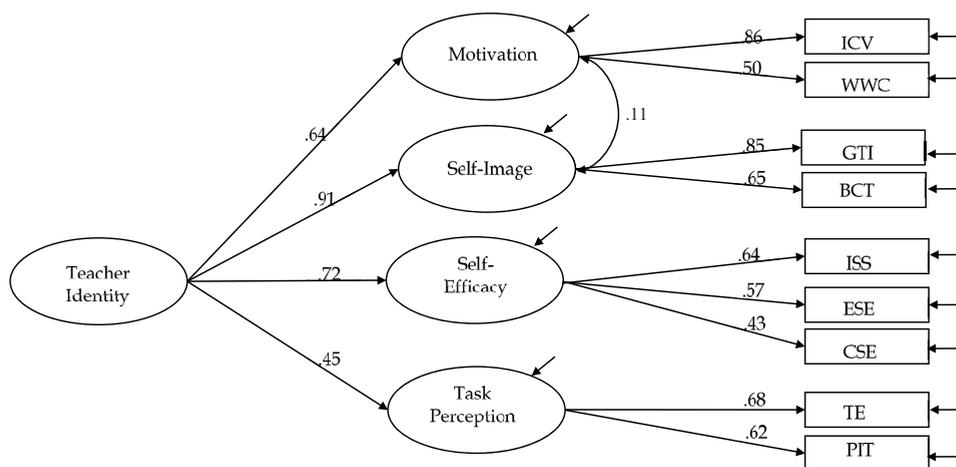
In the previous phase, motivation, self-esteem, self-efficacy, and task perception were identified domains of teacher identity (see Figure 1). To explore the construct validity of this model, we performed factor analysis using R version 1.1.453 (R Core Team, 2012) and the Lavaan package in version 0.5-20 (Rosseel, 2012).

We conducted confirmatory factor analysis on the variance-covariance matrix – which was obtained from the mean scores and corresponding standard deviations of each indicator – to confirm whether each indicator loaded significantly on the expected factors: motivation, self-image, self-efficacy, and task perception. The validity of the second-order model was subjected to the following three tests. First, a first-order correlated model was tested, where the four factors were correlated but not governed by the common latent factor teacher identity. This model functioned as our unrestricted model. Second, we explored the fit of a second-order model – i.e., restricted model, where the four factors represent the second-order factor teacher identity. This second-order model reflects the hypothesis that the underlying domains can be accounted by the overarching factor teacher identity. Third, we evaluated differences in fit and overall fit between the first-order correlated model and the second-order model. This comparison is possible because the second-order model is nested in the first-order correlated model (Little, 2013). Finally, to confirm the construct validity of the

second-order model, we cross-validated our final model in a new sample, following the same three steps.

Maximum likelihood (ML) was used as estimator and several fit indices were applied to evaluate the appropriateness of model fit: chi-square test, the Root Mean Square Error of Approximation (RMSEA) and Standardized Root Mean Square residual (SRMR), with values ≤ 0.05 reflecting a close fit, and ≤ 0.08 a satisfactory fit (Kline, 2011), and CFI, with values ≥ 0.95 indicating close fit, and values ≥ 0.90 indicating acceptable fit (Bentler, 2007; Little, 2013). The standardized factor loadings are interpreted using the following guidelines for the size of the effect: negligible $< 0.1 \leq$ small $< 0.3 \leq$ moderate $< 0.5 \leq$ large (Cohen, 1992). A chi-square difference test was used to compare the models. A non-significant result indicates that the unrestricted model does not fit to the data significantly better than the model with restricted model and, therefore, the restricted model, which is the more parsimonious, is preferred (Little, 2013).

FIGURE 1. Factor loadings for teacher identity.



All loadings are significant at $p < .001$.

RESULTS

DESCRIPTIVE STATISTICS

Table 3 displays the means, standard deviations, and correlations of the indicators for the first sample. On average, student teachers reported high levels of ‘work with children’ and low levels ‘belonging to a community of teachers’. Students’ perceived levels of ‘global teacher identity’ were positively correlated with self-efficacy indicators, suggesting that there might be a relation between students’ image as a teacher and their capability to organize and perform their daily teaching activities effectively. Furthermore, Table 3 presents the reliabilities of the subscales, which range from 0.66 to 0.92.

CONFIRMATORY FACTOR ANALYSIS

Table 4 displays the fit indices for the two models. In these models, three factors of teacher identity had two indicators and one had three indicators. Analyses of these factors in isolation revealed that all standardized factor loadings range between moderate to large (0.36–0.78) and were statistically significant ($p < 0.01$).

FIRST-ORDER CORRELATED MODEL

The fit statistics of this model indicates a close fit with the data: $\chi^2(21, 209) = 26.788, p < 0.18$; CFI = 0.981; SRMR = 0.040; RMSEA = 0.036 (CI [90%] = 0.000–0.073). All correlations were positive and statistically significant, varying in strength from weak (0.14, $p < 0.05$)—to moderate (0.31, $p < 0.01$). These results suggest that the factors—motivation, self-image, self-efficacy, and task perception—might be governed by a second-order latent factor, i.e., teacher identity. To test this hypothesis a second-order factor model was tested.

SECOND-ORDER MODEL

The second-order model produced a $\chi^2(23, 209) = 31.537, p < 0.11$, and provided a close fit across all the fit criteria: CFI = 0.972; SRMR = 0.490; RMSEA = 0.042 (90% CI [0.000–0.076]). The second-order standardized loadings on teacher identity are 0.46 for motivation, 0.87 for self-image, 0.79 for self-efficacy, and 0.56 for task perception. All loadings were statistically significant ($p < 0.001$).

TABLE 3. Summary of means, standard deviations, and correlations.

First-order factor	Indicator	ICV	WWC	GTI	BCT	ISS	ESE	CSE	PE	PT
Motivation	Intrinsic career value (ICV)	1	.431**	.602**	.413**	.171*	.218**	.238**	.193**	.194**
	Work with children (WWC)	.505**	1	.364**	.168*	.154*	.178**	.151*	.155*	.146*
Self-Image	Global Teacher Identity (GTI)	.144*	.079	1	.550**	.301**	.289**	.322**	.205**	.204**
	Belonging to a Community of Teachers (BCT)	.205**	.005	.133*	1	.302**	.323**	.198**	.240**	.189*
Self-Efficacy	Instructional Strategies Self-Efficacy (ISS)	.237**	.142**	.297**	.117*	1	.395**	.291**	.139*	.122*
	Engagement Self-Efficacy (ESE)	.253**	.122*	.316**	.081	.572**	1	.158*	.193**	.113
	Classroom Self-Efficacy (CSE)	.126*	-.021	.248**	.086	.405**	.378**	1	.016	.070
Task Perception	Perception of education (PE)	.249**	.180**	.111*	.016	.264**	.231**	.075	1	.419**
	Perception of teaching (PT)	.224**	.200**	.095	.166**	.185**	.211**	.181**	.432**	1
Descriptive statistics Sample 1	Mean	6.12	6.32	3.21	3.19	3.56	3.68	3.59	3.78	3.92
	Standard deviation	0.60	0.81	0.37	0.38	0.51	0.49	0.65	0.44	0.34
	α	0.71	0.92	0.73	0.76	0.66	0.69	0.83	0.75	0.66
Descriptive statistics Sample 2	Mean	6.10	6.35	3.93	3.91	3.48	3.71	3.52	3.75	3.95
	Standard deviation	0.78	0.81	0.63	0.59	0.45	0.48	0.63	0.38	0.35
	α	0.72	0.89	0.62	0.73	0.64	0.65	0.79	0.73	0.64

Note. The correlations below the diagonal are for Sample 1 ($n = 211$); The correlations above the diagonal are for Sample 2 ($n = 419$).

* $p < .05$; ** $p < .001$.

TABLE 4. Summary of fit statistics for the factor model of Teacher Identity in the first sample.

Model ^a	χ^2 (df)	CFI	SRMR	RMSEA (90% CI)	Model comparison	χ^2_{Δ}	Δ RMSEA	Δ CFI	Δ SRMR
Model 1	26,788 (21)	.981	.040	.036 (.000-.073)	-	-	-	-	-
First-order correlated factor structure: Motivation, Self-Image, Self-Efficacy, and Objectives									
Model 2	31,537 (23)	.972	.049	.042 (.000-.076)	2 vs. 1	4,749 (2)	-.006	-.009	-.009
Second-order factor structure: Teacher Identity; Motivation, Self- Image, Self-Efficacy, and Objectives									

Note. χ^2 = chi-square; df = degrees of freedom; RMSEA = root mean squared error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index.

n = 209; 101 vs. 108.

* *p* < .001.

TABLE 5. Summary of fit statistics for the factor model of Teacher Identity in the second sample.

Model ^a	χ^2 (df)	CFI	SRMR	RMSEA (90% CI)	Model comparison	χ^2	Δ RMSEA	Δ CFI	Δ SRMR
Model 1	50.539 (21)	.961	.041	.058 (.038-.079)	-	-	-	-	-
First-order correlated factor structure: Motivation, Self-Image, Self-Efficacy, and Objectives									
Model 2	54.377 (23)*	.959	.042	.057 (.000-.076)	-	-	-	-	-
Second-order factor structure: Teacher Identity; Motivation, Self- Image, Self-Efficacy, and Objectives									
Model 3	53.002 (22)*	.959	.042	.058 (.038-.079)	3 vs 1	3.537 (1)	0	0.002	0.001
Second-order factor structure: Teacher Identity; Motivation, Self- Image, Self-Efficacy, and Objectives + Correlation									

Note. χ^2 = chi-square; df = degrees of freedom; RMSEA = root mean squared error of approximation; SRMR = standardized root mean square residual; CFI = comparative fit index.

n = 419.

* *p* < .001.

The chi-square difference test between the models was not significant ($\Delta\chi^2 = 4.75$, $\Delta df = 2$, $p < 0.09$). This result suggests that the first-order correlated model does not fit to the data significantly better than second-order model. This result indicates that it is feasible to accept the second-order model as a better representation of teacher identity (cf. Kline, 2011).

CROSS-VALIDATING THE SECOND-ORDER FACTOR STRUCTURE OF THE TIMS

To verify the second-order factor structure of the teacher identity instrument obtained from the steps before, a CFA was performed on a second independent sample. Table 3 shows the means, standard deviations, and correlations of the indicators for this sample and Table 5 displays the fit indices for the models of this second sample. Moreover, Table 3 presents the reliability of the subscales, which range from 0.62 to 0.89.

FIRST-ORDER CORRELATED MODEL

The first-order model produced similar fit statistics as in the first sample: $\chi^2(21, 419) = 50.530$, $p < 0.01$; CFI = 0.961; SRMR = 0.041; RMSEA = 0.058 (90% CI [0.038–0.079]). All correlations were positive and statistically significant, varying in strength from weak to strong.

SECOND-ORDER MODEL

The output resulted in the following fit statistics: $\chi^2(23, 419) = 54.377$, $p < 0.001$; CFI = 0.959; SRMR = 0.042; RMSEA = 0.057 (CI[90%] = 0.038–0.077). However, although the CFA converged, it showed an estimated correlation between self-image first-order factor and teacher identity second-order factor with a value > 1 (1.046) – i.e. Heywood case (Kline, 2011). Examination of the models' modification indices (19.20) and identity theory (e.g., Burke & Stets, 2009) suggested that the Heywood case can be resolved by adding a correlation between motivation and self-image. The addition of a correlation between these two first-order factors resulted in similar fit statistics: $\chi^2(22, 419) = 53.002$, $p < 0.001$; CFI = 0.959; RMSEA = 0.058 (CI[90%] = 0.038–0.078), SRMR = 0.042.

To clarify if the first-order correlated model and second-order model are statistically similar, we evaluated the chi-square difference. The chi-square difference test between the models was not significant ($\Delta\chi^2 = 2.47$, $\Delta df = 1$, $p < 0.12$). This result suggests that the first-order correlated model does not fit to the data significantly better than second-order model. Therefore, we accepted the second-order model as a better representation of teacher identity.

All factor loadings were statistically significant ($p < 0.001$). Figure 1 shows that the standardized factor loadings ranged from 0.45 to 0.91, for the second-order factor, which can

be considered moderate to large. The strongest relation appears to be between self-image and teacher identity and motivation and teacher identity. The interpretation of a loading would be that with a one standard deviation increase in teacher identity motivation increases 0.64 standard deviation, self-image 0.91 standard deviation, self-efficacy 0.72 standard deviation, and task perception 0.45 standard deviation. Based on Little's (2013) equation for converting covariances to correlations, our calculations suggest that the implied correlation between self-image and motivation can be considered small ($r = 0.11$). When it comes to the first-order factors the standardized loadings ranged from 0.43 to 0.86, which all are large effect size. There, the strongest relation seems to be between 'intrinsic career value' and motivation.

Table 6 displays the correlation between the four first-order factors and their reliabilities. All correlations were positive and statistically significant, varying in strength from weak, e.g., between self-efficacy and task perception, to strong between motivation and self-image, supporting the convergent validity of this instrument for teacher identity. The first-order factors representing teacher identity showed acceptable to high reliability – between 0.84 and 0.74.

TABLE 6. *Inter-factor correlations among the four sets of meanings of Teacher Identity.*

	Motivation	Self-Image	Self-Efficacy	Task Perception
Motivation	1			
Self-Image	.52**	1		
Self-Efficacy	.31**	.45**	1	
Task Perception	.24**	.28**	.17*	1
α	.84	.81	.74	.74
Mean	6.20	3.92	3.57	3.85
SD	0.67	0.54	0.37	0.31

Note. * $p < .05$, ** $p < .001$.

DISCUSSION

The first objective of this study was to design and validate the Teacher Identity Measurement Scale (TIMS, see appendix A) for primary student teachers. Based on a systematic review (Hanna et al., 2019a) domains of teacher identity were identified. To design and validate the instrument different established qualitative approaches were followed – expert validation, cognitive interviews, and a small pilot. Finally, to assess the psychometric quality of the instrument several analysis, including confirmatory factor analysis, were performed, involving 645 primary student teachers.

Results provide support for the capability of the TIMS to obtain reliable and valid information about the teacher identity of primary student teachers. Specifically, the qualitative results suggest that content of TIMS is understandable, meaningful, and doable for primary student teachers, and quantitative results indicate that the four domains—motivation, self-image, self-efficacy, and task perception—are separate yet related factors teacher identity.

The second aim of this study was to contribute to the literature about teacher identity from a theoretical and empirical point of view. Conceptualizing teacher identity is complex and challenging (cf. Beauchamp & Thomas, 2009; Henry, 2016). In the past, researchers—and for good reason—justified the dynamic and multifaceted complexity of the construct as a reason that qualitative assessment of teacher identity is more suitable than quantitative measurements (cf. Kelchtermans, 2009; Nias, 2002).

In this study identity theory (e.g., Burke & Stets, 2009) is used to conceptualize the complex nature of teacher identity by focusing on domains—sets of meanings—that together represent the overarching second-order construct. In order to identify relevant domains of teacher identity a previously published systematic review was used (Hanna et al., 2019a). This resulted in six domains of teacher identity of which four were finally included in the TIMS: motivation, self-image, self-efficacy, and task perception. The relevance of these domains is not only reflected in this validation study, but also in the general literature. Different studies reported links between teacher identity and motivation (cf. Bilim, 2014; Watt & Richardson, 2007; Zhang et al., 2016), self-image (cf. Nias, 2002; Olsen, 2008; Starr et al., 2006), self-efficacy (cf. Canrinus et al., 2012; Pendergast, Garvis, & Keogh, 2011; Zee, Koomen, & de Jong, 2018), and task perception (cf. Lamote & Engels, 2010; Nevgi & Löfström, 2015). These findings are also in line with the frequently mentioned self-understanding model of Kelchtermans (1994, 2009), which also distinguishes motivation, self-image, and task perception as components of teacher identity.

This study provides an empirical approximation of how motivation, self-image, self-efficacy, and task perception are determinants of teacher identity, both separately and collectively. Because of these findings, a second-order model consisting of the four domains of teacher identity can be used as a conceptual framework for studying the development of teacher identity as well as the mediating and moderating relation with other constructs such as resilience and professional identity tensions.

LIMITATIONS

Even though we followed established methods for scale development (e.g., Devon et al., 2007; Kline, 2011), some limitations should be addressed before the application of the TIMS. First, the selection of domains was solely based on most frequently used set of meanings by researchers in quantitative studies. While this approach, from an identity theory perspective, seems legitimate, it can be argued that the included domains should also have been substantiated from qualitative studies to verify the comprehensiveness of our conceptualization of teacher identity. A comparison of the four domains in TIMS with conceptualizations in qualitative research, such as the self-understanding model (Kelchtermans, 2009), reveals that certain domains are sometimes part of the construct of teacher identity and sometimes not. This suggests that further substantiation from qualitative research does not necessarily provide substantive guidance in determining the comprehensiveness of the construct teacher identity. Nevertheless, there will undoubtedly be other domains worth investigating, such as resilience (Bobek, 2002) or future time perspective (Peetsma, 2000).

Second, our study was predominantly aimed at investigating the construct validity of the TIMS (cf. Devon et al., 2007). Ideally, the development of such an instrument should also involve criterion validity – e.g., convergent and discriminant validity. For example, a future study could examine the relation between professional identity of students teachers and their study success or their quality of teaching. Although we have cross-validated the factor structure of the TIMS, more evidence is needed to further confirm the construct validity of the instrument and the applicability for further research and teacher education.

Finally, it must be emphasized that both samples largely consisted of female primary student teachers, reflecting the unequal gender distribution in primary teacher education institutions and primary schools in the Netherlands (CBS, Statline, 2018). This might limit the generalizability and applicability of the TIMS to populations in other countries. It is therefore important to replicate the findings of this research in various and more heterogeneous samples.

IMPLICATIONS FOR FUTURE RESEARCH AND PRACTICE

For researchers and practitioners in the field of teacher education the TIMS might be a useful instrument. Researchers can use the instrument for gathering data on differences between primary student teachers and discovering longitudinal patterns in the development of

professional identity among primary (student) teachers. The TIMS may also be relevant for investigating differences between teacher education institutions, and the evaluation of their support in the development of teacher identity. Furthermore, future studies might concentrate on exploring the relation between professional identity of primary student teachers' and professional identity tensions (Pillen, den Brok, & Beijaard, 2013). Whereas several researchers (cf. Smagorinsky, Cook, Moore, Jackson, & Fry, 2004) have suggested this relation, it has not yet been examined explicitly (Hanna et al., 2019b). Examining these relations may result in a better understanding of which professional identity tensions might occur during the process of becoming a teacher (van der Wal, Oolbekkink-Marchand, Schaap, & Meijer, 2019). Additionally, the TIMS might also be applied in other research areas such as that of student-teacher relationships and teacher well-being. Two interesting questions in these areas could be which and how specific teacher identity profiles influence the quality of student-teacher relationships and well-being (Roorda, Jak, Zee, Oort, & Koomen, 2017).

Primary teacher education institutions might apply the TIMS to modify their program content and services to student teachers' need concerning the development of their teacher identity. By doing so, teacher education institutions might be better equipped to student teachers' needs which could increase their enthusiasm for the profession (Nias, 2002). Teacher educators can also use the TIMS as a pedagogical vehicle for discussing student teachers' professional development as a part of a course focused upon teacher identity. For example, teacher educators can discuss the different domains of teacher identity to localize strengths and points of improvement in students teachers' professional identity. Student teachers can also work independently with TIMS. For example, student teachers can use the domains of teacher identity to more consciously monitor their own development and evaluate their own professional development.

CONCLUSION

The TIMS is specifically designed for primary student teachers. Teacher identity, conceptualized from an identity theory perspective, includes four underlying domains: motivation, self-image, self-efficacy, and task perception. The instrument, which is psychometric valid, can be used for research and educational objectives, by researchers and practitioners. Using the TIMS can be used to better understand the development of primary student teachers professional identity and can help teacher training institutions to support and strengthen the professional identity of their students.