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Relations between student teachers' basic needs fulfillment and their teaching behavior

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HIGHLIGHTS

- Various relations are revealed between need fulfilment in student teachers and teacher behavior.
- A large degree of variance in behavior was found to be related to need fulfillment.
- More attention is needed for relations between the personal and the professional in teaching.
- Important implications for practices in teacher education are presented.

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ABSTRACT

This study examines the relation between fulfillment of the three basic psychological needs in 36 student teachers and their teaching behavior, based on Self-Determination Theory (Deci & Ryan, 2002) and the Model for Interpersonal Teacher Behavior (Wubbels, Den Brok, Van Tartwijk, & Levy, 2012). Data were collected through self-reports and students' scores of student teacher behavior. Strong correlations were found between fulfillment of the basic psychological needs and teaching behavior. The significance of the findings is that quantitative relations were established between the 'inner' side of teaching (student teachers' personal experiences) and the 'outer' side of observable teaching behavior.

1. Introduction

The literature on teaching and teacher education shows a growing interest in the motivational dimension in teachers. Researchers are increasingly aware that teacher behavior is not only influenced by cognitive aspects, such as theoretical insights or beliefs about education, but that non-cognitive factors, such as emotion and motivation, also play an important role (Day, 2004; Hargreaves, 1998; Schutz & Zembylas, 2009). The present study focuses on the relations between motivation and teaching behavior of 36 student teachers in a Dutch pre-service teacher education program, having their first teaching experiences during a 14 weeks period.

Central to recent insights about human motivation is *Self-Determination Theory* (SDT) (Deci & Ryan, 2000, 2002; Ryan & Deci, 2002). In SDT three basic psychological needs are distinguished, namely the need for competence, relatedness, and autonomy. In a previous study, Evelein, Korthagen, and Brekelmans (2008) demonstrated that the fulfillment of these three needs in student teachers has a significant impact on their teaching experiences. Their research has shown that need fulfillment appears to correlate positively with flow experiences, whereas thwarting of the three needs leads to fight, flight, and freeze tendencies. The purpose of the present study was to investigate the relation between need fulfillment in student teachers and their actual classroom behavior during their first teaching experiences. For this purpose, besides SDT, a second theoretical framework was used, namely *the Model for Interpersonal Teacher Behavior* (MITB) (Wubbels, Brekelmans, Den Brok, & Van Tartwijk, 2006; Wubbels, Den Brok, Tartwijk, & Levy, 2012). Instruments developed within these two frameworks were adapted and used among 36 post-graduate student teachers

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at a Dutch university.

With the help of these frameworks and instruments, the following research question was investigated:

What is the relationship between the fulfillment of basic psychological needs and interpersonal behavior of student teachers during their first teaching experiences in schools?

Our *first hypothesis* was that student teachers with a higher degree of fulfillment of the need for competence would show more leadership behavior in the classroom and would provide more structure. The *second hypothesis* was that more fulfillment of the need for relatedness would be associated with teaching behavior that is called 'proximity behavior' in MITB (Wubbels et al., 2006), i.e. behavior creating an experience of cooperation or closeness between teacher and students, in other words behavior through which the students experience their teacher as being 'close' and supportive. Our *third hypothesis* was that a higher fulfillment of the need for autonomy in student teachers would concur with giving their students more freedom, and with reduced controlling behavior in their classes.

Although there is a huge body of research on the relation between teacher beliefs and attitudes (the 'inner side' of teachers) and their actual behavior ('the outer side'), there is not much research on the relation between the inner aspect of their need fulfillment and their teaching behavior. Research on this relation in pre-service teachers is almost non-existent. In this respect, our the study fills in a gap in the body of knowledge on teaching and teacher education.

2. Theoretical framework

2.1. Self-Determination Theory

According to SDT, the fulfillment of the three basic psychological needs for competence, relatedness, and autonomy is essential to psychological health and growth, intrinsic motivation, well-being, optimal functioning, and self-actualization (Deci & Ryan, 2000; Ryan & Deci, 2002). The conceptualization of the need for *competence* within SDT is based on the notion of *effectance motivation* (Elliot, McGregor, & Trash, 2002), i.e. the idea that organisms are born with an urge of wanting to influence their environment and a tendency to try and be able to deal with the environment. This phenomenon can be recognized in student teachers as the wish to feel competent in managing their classrooms (Evelein, 2015). Situations in which the need for competence is thwarted produce a spectrum of effects generally directed towards compensation. Examples mentioned by Skinner and Edge (2002) are withdrawal from action, experiencing uncertainty or anxiety, and an orientation towards moving away from the situation.

The need for *relatedness* refers to the desire to be connected to, and experience caring for other people, and the feeling of belonging to a group or community (Baumeister & Leary, 1995; Ryan & Deci, 2002; Ryan, 1995). When this need of student teachers is fulfilled during their teaching, they experience contact and a positive connection with their students, and show behavior reinforcing contact and connection (Evelein, 2005). Skinner and Edge (2002, p. 308) point to a spectrum of reactions when the need for relatedness is thwarted, such as withdrawal, sadness, but also aching for contact and active connecting. Such reactions are directed towards improving adjustment, avoiding a further decrease of the need fulfillment, or compensation.

The need for *autonomy* points towards the longing of an organism to organize experiences and behavior and to act in harmony with the self-image (DeCharms, 1968; Deci & Ryan, 2000; Ryan, Kuhl, & Deci, 1997; Sheldon & Elliot, 1999). Autonomy refers to the need to express the authentic self, and to experience the self as the source of action (Ryan & Deci, 2002; Ryan, 1995; Skinner & Edge, 2002). If this need is fulfilled while teaching, student teachers experience that they can be authentic, have room for their own ideas and choices, and can develop accordingly (Evelein, 2005). Skinner and Edge (2002) mention several reaction patterns in situations when opposition or confrontation thwarts the need for autonomy, such as a self-protective orientation, a defensive attitude, and indignation. When the need for autonomy is put under heavy pressure, patterns such as resistance, a fighting attitude, and anger are to be expected.

Skinner and Edge (2002) summarize the patterns caused by suppression of the basic psychological needs as *fight, flight, and freeze patterns*. Fight is the tendency to resist the circumstance; flight is the tendency of to withdraw from the situation; and freeze is the tendency to avoid action. In a study of 364 physical education teachers, Bartholomew, Ntoumanis, Cuevas, and Lonsdale (2014) reported that thwarting the need for autonomy, competence, and relatedness was correlated with these teachers' feelings of job pressure and burnout. In addition, thwarting of the need for competence appeared to predict somatic complaints.

When the basic psychological needs are fulfilled, there is adaptation, adjustment, growth, and optimal experience, such as the experience of *flow* (Csikszentmihalyi, 1990; Ryan & Deci, 2000). In this case there is an open contact with the environment, and the action tendencies are geared towards further fulfillment. Epstein (1990) emphasizes that such orientations are generally non-rational and are active in the human experiential system as wholes of affective experiences, images, associations, attitudes, and automatic processes.

2.2. SDT and education

Until now, research on the application of SDT to education has focused mainly on the need fulfillment of *students within schools*, i.e. children. The basic assumption underlying this research is that this fulfillment enhances students' intrinsic motivation and their sense of well-being (Niemiec, Ryan, & Deci, 2010). Fulfillment of the three basic needs also leads to more student engagement (Jang, Reeve, Ryan, & Kim, 2009). Tsai, Kunter, Lüdtke, Trautwein, and Ryan (2008) studied students' level of interest in their school subjects, and showed that this interest was promoted when their teachers were autonomy-supportive. In the context of physical education, Standage, Duda, and Ntoumanis (2006) found that perceived autonomy support was associated with greater effort and persistence in school students. Chirkov and Ryan (2001) found a positive relation with academic motivation. Reeve, Bolt, and Cai (1999) studied pre-service teacher behavior in one-to-one teaching situations within a laboratory setting. Autonomy-supportive teachers were more likely to ask for their students' wants, to respond to student-generated questions, and to support students' internal motivation and internalization. In a study of 420 seventh grade students in Israel, Kaplan and Assor (2012) showed that autonomy support led to more positive emotions in both the students and their teachers and reduced violence. In an overview of this strand of research, Niemiec and Ryan (2009) concluded that policy makers should be more aware of the importance of the need for autonomy.

Fewer studies have focused on need fulfillment in *teachers*. A study by Taylor, Ntoumanis, and Standage (2008) of 204 physical education teachers in the UK, has shown that need fulfillment in the teachers predicted the degree to which they tried to gain an understanding of their students and provide them with instrumental help and support. Roth, Assor, Kanat-Maymon, and Kaplan (2007) showed that Israeli teachers' self-reported autonomous motivation for teaching promoted their students' self-reported autonomous behavior as a result of these teachers' autonomy-

supportive behavior. This finding concurs with an earlier study by Pelletier, Séguin-Lévesque, and Legault (2002), who examined first- to twelfth-grade Canadian teachers. They found that when these teachers perceived pressure from above (e.g. as a result of an imposed curriculum or performance standards), the less autonomous they were in their teaching. This less autonomous orientation was shown to be correlated with more controlling teaching behavior. More fulfillment of the teachers' need for autonomy was associated with giving their students more freedom.

2.3. The Model for Interpersonal Teacher Behavior

A fruitful model for studying teacher behavior is the Model for Interpersonal Teacher Behavior (MITB), which is based on the work of Leary (1957). More than 40 years of research into this model has resulted in a solid foundation for studying teacher behavior (Wubbels et al., 2012). In the model, interpersonal teaching behavior is mapped on two independent dimensions, named the *influence dimension* and the *proximity dimension* (Wubbels et al., 2006). The first dimension characterizes interpersonal teacher behavior based on the extremes of dominance and submission, the second of cooperation versus opposition. Usually, the two dimensions are visualized in a diagram with eight sectors (Fig. 1).

Each sector is labeled with a specific term describing the interpersonal teacher behavior: leadership, helpful/friendly, understanding, giving students freedom, uncertain, dissatisfied, admonishing, and strict.

Teacher behavior as defined within the MITB has been studied in over 20 countries with the aid of the so-called *Questionnaire on Teacher Interaction* (QTI) (to be described in more detail in Section 3.3.), which has led to a vast knowledge base of teacher-student interpersonal behavior (Wubbels et al., 2012). This has made it possible to clarify relations between specific types of teacher behavior and cognitive and affective learning outcomes for various school subjects (Brekelmans, 1989; Wubbels et al., 2006). The sectors representing a high level of influence and proximity in particular have been shown to be positively related to learning outcomes.

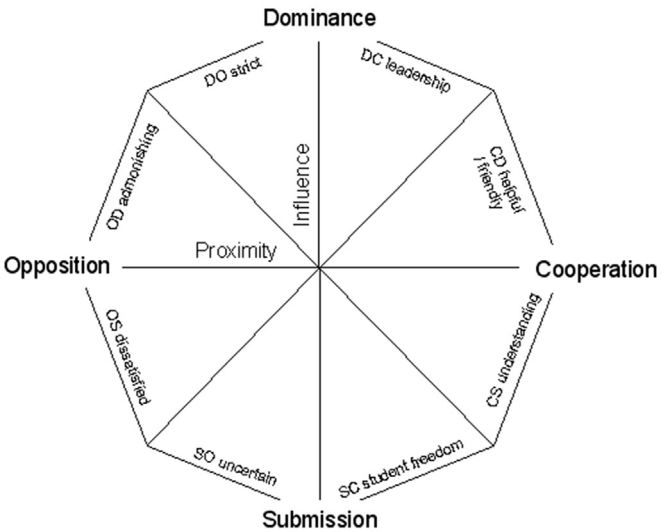

Fig. 1. The model for interpersonal teacher behavior.

3. Research method

3.1. Participants

Participants in the study were 36 student teachers from the post-graduate teacher education program at a Dutch university, and included 23 females and 13 males. At the time of our study, they were all teaching for the first time. They did so in different schools of secondary education, between 10 and 20 classes per week, with no mentor or coach attending. These 36 student teachers were recruited from two cohort groups of student teachers ($N = 46$), one pre-service ($N = 20$) and one in-service ($N = 26$). They participated voluntarily. They were asked to participate in a research study that would look into the experiences and feelings of student teachers while teaching on their own for the first time. They were promised anonymity in reporting the research results.

We checked whether the student teachers under study were representative of the regular population of student teachers at this university. We therefore compared the research group with a combination of two other groups of student teachers, namely all student teachers from the year before and the year after our study (114 in total). This comparison was made using the following characteristics: *program* (the number of pre-service versus in-service students), *discipline* (the distribution over teaching subjects), and *gender*. Two-tailed testing showed no significant differences (program: $\chi 2 = 2.73$, $p = 0.10$; subject: $\chi 2 = 3.68$, $p = 0.16$; gender: $\chi 2 = 0.004$, $p = 0.95$).

3.2. Procedure

The data collection took place during a period of 14 weeks, divided into three segments of two weeks each. This period was chosen for practical reasons, as it was the first regular period of student teaching in the teacher education program. Both during the 14-week period (i.e. at the level of individual lessons), and after it had ended (i.e. regarding the period as a whole), data were collected on the basis of self-reports, both concerning need fulfillment and teacher behavior. In order to also collect data among the students about their perceptions of the student teachers' teaching behavior, we asked students to fill in the *Questionnaire on Teacher Interaction* (QTI) at the end of the 14-week period.

3.3. Instrumentation

To determine the level of fulfillment of the basic psychological needs in student teachers, a questionnaire in Dutch was developed (*Basic Psychological Needs Questionnaire, BPNQ*), based on a questionnaire used by Sheldon, Elliot, Kim, and Kasser (2001). It consisted of three scales, one for measuring *competence,* one for *relatedness,* and one for *autonomy*. The student teachers scored the items on a five-point scale, ranging from 1 (applies not at all) to 5 (applies completely).

For each of the three scales, the scores on the individual items were averaged and divided by five, resulting in a final score between 0 and 1. A higher score represents a higher level of fulfillment of that particular basic need.

The validity of the three scales was supported by asking 15 teacher educators and researchers, and 10 student teachers not participating in the subsequent data collection, to group an initial set of 15 items into three categories, namely that of competence, relatedness, and autonomy. All but two items were assigned to the correct category. These two items were removed from the final set of items, which thus contains 13 items (see Table 1 for the items, translated from Dutch).

The three scales showed a strong internal consistency

(competence: $\alpha = 0.90$, relatedness: $\alpha = 0.80$, and autonomy: $\alpha = 0.82$; N = 417). Results of an exploratory factor analysis (principle component analysis, varimax rotation) also supported the three-factor structure of the questionnaire. All items loaded significantly on their target factor (>0.62). We found various cross loadings of items, but all of them were below 0.40. Correlations between the subscales were fairly high (competence–autonomy: r = 0.74; competence-relatedness: r = 0.63; relatedness–autonomy: r = 0.60), and somewhat stronger than reported in other research (e.g. Reis, Sheldon, Gable, Roscoe, & Ryan, 2000), although it is well-known that the three basic needs are interrelated.

Interpersonal teacher behavior in the classroom was measured with the aid of the *Questionnaire on Teacher Interaction* (QTI), which has eight subscales corresponding with the eight sectors of the Model for Interpersonal Teacher Behavior. The QTI can be used for self-scoring by teachers of their classroom behavior, which yields a so-called 'teacher image', but most importantly, it can be used by students in the schools to assess a teacher's classroom behavior. In the latter case, the scores of the students of one class are combined into one score, the 'student-image'. Students' scores on the QTI have been shown to be a valid and reliable means of mapping their teachers' behavior (Wubbels & Levy, 1991; Wubbels et al., 2006).

Table 2 shows one characteristic item for each subscale of the QTI, translated from Dutch. The total number of items is 77, which are scored on a five-point Likert-type scale.

Although the QTI has been designed for measuring teacher behavior over a period of time, we also collected data from the student teachers on their teaching behavior in separate lessons (the *lesson self-image*). As this required that the questionnaire could be filled in quickly, we developed a brief Dutch version of the QTI, named the *Questionnaire on Teacher Interaction in a Lesson (QTIL),* with 39 items. During the 14-week period, the student teachers were asked to fill in a combination of the BPNQ and the QTIL 18 times. Before the data collection period they had to select three different classes for which they would fill in this questionnaire after six individual lessons, namely two lessons during each of three two-week periods, which were spread over the entire 14-week period. The total number of questionnaires on individual lessons returned by the 36 participating student teachers was 417. On average, each student returned 11.5 of these questionnaires (varying from 2 to 19).

In line with previous research (Wubbels et al., 2006), the eight scales of the QTI showed good reliabilities (Cronbach's alphas) for the students' perceptions of the student teaching behavior (at the class level), and satisfactory to good reliabilities for the student teachers' self-perceptions, as shown in Table 3.

In sum, data were collected on the student teachers' interpersonal teaching behavior in three ways:

1. Through the average scores on the QTI given by students from each of a student teacher's classes, collected after the 14-week period (*student image*);
2. Through the self-image on the QTI of each student teacher regarding each of their selected classes for the entire period of 14 weeks, also measured after the 14-week period (*period self-image*);
3. Through the lesson self-image on the QTIL of each student teacher after individual lessons given during the 14-week period (*lesson self-image*).

The first two ways of data collection did not create a burden on the students or the student teachers, as it involved only one measurement moment. The students were told that giving feedback to the student teacher was an opportunity to help the student teacher learn and develop as a teacher. Filling in the BPNQ and QTIL many times after classes they had given, did require an effort from the student teachers. In return for their cooperation, we promised each of them an individual meeting with one of the researchers after the 14-week period, who would then explain to them the underlying structure of the study and give each individual feedback based on this framework and the data collection.

3.4. Data analysis

Using linear combinations of the eight scale scores, results of the QTI can be summarized in two *dimension scores* on the dimensions influence and proximity. These dimension scores were the basis of the analysis of relations between need fulfillment and teacher behavior, using standard techniques in SPSS, as explained below.

4. Findings

4.1. Basic statistical data

In Table 4, an overview is presented of the mean scores and standard deviations of the variables included in the analysis. Table 5 presents an overview of correlations between the variables.

4.2. The relation between need fulfillment and teaching behavior

For the analysis of the relations between need fulfillment and teaching behavior, we started with a canonical analysis of the correlations between scores on the influence and proximity dimension on the one hand, and fulfillment of the three basic

Table 1
Basic psychological needs questionnaire (BPNQ).

Need/Subscale	Items
Competence	During this lesson I felt…. - that I was successful in completing difficult tasks. - that I was taking on and mastering hard challenges. - very capable in what I did. - very skilled in teaching. - that I used my qualities successfully.
Relatedness	- a connection with the students. - a good relationship with the students. - a bonding with the students. - that the students liked me.
Autonomy	- that my choices were based on my true interests and values. - free to do things my own way. - that my choices expressed my true self. - that I felt free to make decisions which fit myself completely.

Table 2
Number of items, reliability, and typical item for the QTI subscales.

Subscale	Number of items	Typical item
Leadership	10	S/he is a good leader
Helpful/friendly	10	S/he is someone we can depend on
Understanding	10	If we have something to say s/he will listen
Giving student freedom	9	S/he gives us a lot of free time in class
Uncertain	9	S/he seems uncertain
Dissatisfied	11	S/he is suspicious
Admonishing	9	S/he gets angry
Strict	9	S/he is strict

Table 3
Reliabilities (Cronbach's α) of the instruments measuring interpersonal teacher behavior.

Scale	Student image of student teacher per class (N = 92)	Student teacher's self-image per period (N = 77)	Student teacher's self-image	
			Per lesson (N = 417)	Per class (N = 110)
Leadership	0.95	0.81	0.84	0.87
Helpful/friendly	0.95	0.76	0.77	0.82
Understanding	0.95	0.70	0.79	0.87
Giving students freedom	0.87	0.78	0.76	0.83
Uncertain	0.94	0.86	0.87	0.92
Dissatisfied	0.94	0.84	0.87	0.90
Admonishing	0.93	0.74	0.79	0.86
Strict	0.81	0.74	0.82	0.87

psychological needs on the other (Table 6). This means that the scores on the various variables (influence and proximity as dependent variables and the scores for competence, relatedness, and autonomy as independent variables) were analyzed in combination with each other. Next, we analyzed the combined variance in the scores on the two dimensions of interpersonal teaching behavior and need fulfillment.

For the student image, the period self-image, and the lesson self-image, the relations with need fulfillment were often strong. The combined variance is highest for the lesson self-image (43.5%) and lowest for the student image (23.4%).

4.3. More specific analyses

In a further exploration of the relations between both sets of variables, zero-order correlations were calculated (Table 7). These correlations were strongest between need fulfillment and lesson self-image. Both are aggregated scores of the same lessons. The correlations between need fulfillment and period self-image (which refers to all lessons in the 14-week period) were less strong, but in all cases significant, and with values of around 0.50, they were considerable.

Table 4
Mean scores (M) and standard deviations (SD) for the variables, at the level of student teacher per class.

Variable	M	SD	N
Interpersonal teaching behavior			
Student image – Influence	−0.02	0.32	92
Student image – Proximity	0.72	0.46	92
Period self-image – Influence	−0.08	0.39	77
Periode self-image – Proximity	0.80	0.40	77
Lesson self-image – Influence	0.15	0.47	110
Lesson self-image – Proximity	0.94	0.51	110
Basic need fulfillment			
Competence	0.57	0.15	110
Relatedness	0.61	0.14	110
Autonomy	0.57	0.16	110

Note: The dimension scores for interpersonal teaching behavior can vary between −2.60 and +2.60. Scores for need fulfillment can vary from 0.00 tot 1.00. The separate variables vary in skewness (−0.66 to 0.05) en kurtosis (−0.82 to 0.76) within acceptable boundaries for a normal distribution.

Table 5
Correlations between the two dimensions of interpersonal teaching behavior and between the degree of fulfillment of the three basic psychological needs.

Variable	1	2	N
Student image			92
1. Influence	–		
2. Proximity	0.40***	–	
Period self-image			77
1. Influence	–		
2. Proximity	0.16	–	
Lesson self-image			110
1. Influence	–		
2. Proximity	0.37***	–	
Need fulfillment			110
1. Competence	–	–	
2. Relatedness	0.62***	–	
3. Autonomy	0.83***	0.63***	

***p < 0.001. Note: The correlations for the three basic needs have been calculated at the level of student teacher per class.

The correlations between need fulfillment and the student image (also related to all lessons in the 14-week period) were weaker but still significant, with the exception of one of the six correlations. As expected, we found positive correlations in all cases. If we look at the overall pattern, the fulfillment of the need for competence appeared to have high correlations with both behavioral dimensions. The fulfillment of the need for relatedness showed the strongest relation with the proximity dimension, which seems not surprising.

In order to get more information on the unique contribution of fulfillment of each of the three basic psychological needs, multiple regression analyses were carried out with the influence or proximity dimension as the dependent variable and the three measures for need fulfillment as the independent variable. Table 8 presents an overview of the results.

In all cases, there was a significant relation between the dimensions of interpersonal teaching behavior and the degree of fulfillment of the three basic needs. The amount of explained

Table 6
Combined variance in the scores on the two dimensions of interpersonal teaching behavior and need fulfillment.

	Comb. Var. (%)	Wilks Λ	Approx. F	df	p
Need fulfillment and student image	23.4	0.572	6.871	6/128	0.000
Need fulfillment and period self-image	33.8	0.411	9.903	6/106	0.000
Need fulfillment and lesson self-image	43.5	0.240	36.433	6/210	0.000

Note: Combined variance has been calculated with formula 6.4.21 (Finn, 1974, p. 191).

Table 7
Correlations between need fulfillment and interpersonal teaching behavior.

	Competence	Relatedness	Autonomy
Student image – Influence	0.37**	0.24**	0.05
Student image – Proximity	0.48***	0.48***	0.30*
Period self-image – Influence	0.57***	0.26*	0.45***
Period self-image – Proximity	0.49***	0.62***	0.47***
Lesson self-image – Influence	0.72***	0.51***	0.49***
Lesson self-image – Proximity	0.60***	0.68***	0.60***

*p < 0.05 **p < 0.01 ***p < 0.001.

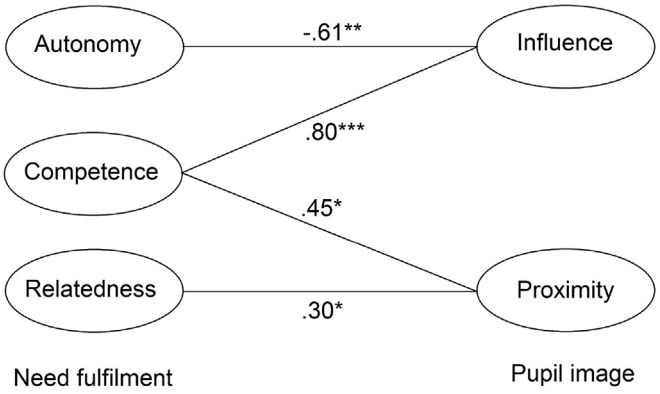

Fig. 2. The unique contribution of each of the three basic needs to both dimensions of interpersonal teacher behavior as measured in the student image, based on standardized regression coefficients (β) (*p < 0.05, **p < 0.01, ***p < 0.001).

variance in interpersonal teaching behavior was highest for the influence dimension in the lesson self-image (54.7%), and lowest (24.7%) in the influence dimension in the student image.

Figs. 2 and 3 show an image of the unique contribution of fulfillment of each of the three basic needs to both dimensions of interpersonal teacher behavior, based on standardized regression coefficients (β).

When all three measures for the level of need fulfillment were taken into account in a regression analysis with the two dimensions in the student image as dependent variables, two of these measures contributed significantly to the explained variance. For the influence dimension, variance was explained by fulfillment of the need for competence (β = 0.80, p = 0.000) and autonomy (β = −0.61, p = 0.001). For the proximity dimension, variance was explained by fulfillment of the need for competence (β = 0.45, p = 0.015) and relatedness (β = 0.30, p = 0.026). The explained variance was not significant in the other cases.

When all three measures of need fulfillment were used in combination in a regression analysis with the two self-image measures as dependent variables, there was a high degree of redundancy of the effects of need fulfillment (Fig. 3). In the case of the period self-image, the degree of fulfillment of the need for competence contributed significantly to the variance (β = 0.64, p = 0.002) in the influence dimension. For the proximity dimension, only fulfillment of the need for relatedness contributed significantly to the variance (β = 0.50, p = 0.001). The unique contributions of fulfillment of the other measures for need fulfillment were not significant. In the case of the lesson self-image, the degree of fulfillment of the need for competence also showed a significant contribution to the variance in the influence dimension (β = 0.93, p = 0.000), and a similar conclusion can be drawn for the contribution of fulfillment of the need for relatedness to the proximity dimension (β = 0.48, p = 0.000). In the case of the lesson self-image, fulfillment of the need for autonomy also contributed significantly to variance in the influence dimension (β = −0.39, p = 0.002). For the period self-image, this contribution was not significant (β = 0.02, p = 0.90).

Table 8
Results of multiple regression analyses, adjusted R2, and test of significance with the influence and proximity dimension as dependent, and fulfillment of the three needs as independent variables.

	Adjusted R2	F	df	p
Student image – Influence	0.247	8.449	3/65	0.000
Student image – Proximity	0.265	9.188	3/65	0.000
Period self-image – Influence	0.299	9.121	3/54	0.000
Period self-image – Proximity	0.370	12.182	3/54	0.000
Lesson self-image – Influence	0.547	44.960	3/106	0.000
Lesson self-image – Proximity	0.505	38.132	3/106	0.000

4.4. Interrelated influences

Interestingly, both for the student image and the lesson self-image, the significant contribution of fulfillment of the need for autonomy to the variance in the influence dimension was negative. When we combine the results of the regression analyses with the findings presented in Table 6, it becomes clear that the correlations between fulfillment of the need for autonomy and competence on the one hand, and the proximity dimension on the other, are to a large degree the result of an overlap of these two need variables with the need for relatedness. The correlation between both measures for autonomy and competence and the influence dimension seem the result of this overlap. Similarly, the correlations between relatedness and the influence dimension seem to a large degree a result of this overlap. Hence, although the zero-order correlations seem positive and significant for the student image, the lesson image, and the period self-image, the regression analyses reveal that this is a case of spurious correlation (Pawlowsky-Glahn & Buccianti, 2011). If we correct for the influence of the fulfillment of the need for competence on the influence dimension, this results in a negative effect of the autonomy variable on this influence dimension, both for the student image and for the lesson self-image. Hence, correlations found between fulfillment of the need for autonomy and the influence dimension can be explained by fulfillment of the need for competence, and are thus no real correlations.

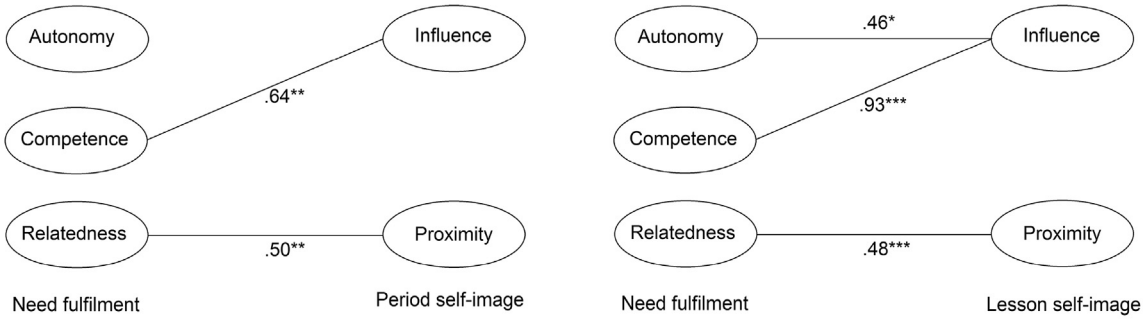

Fig. 3. The unique contribution of each of the three basic needs to both dimensions of interpersonal teacher behavior as measured in the period self-image and lesson self-image, based on standardized regression coefficients (β) (*p < 0.05, **p < 0.01, ***p < 0.001).

4.5. Teacher autonomy and giving students freedom

In a study on relations between fulfillment of the need for autonomy in experienced teachers and their teaching behavior, Pelletier et al. (2002) found a relation with giving students more freedom. We investigated whether our data show a similar relation. Regression analyses were carried out with the scores on the QTI subscales 'giving student freedom' and 'leadership' in the student image as dependent variables and autonomy and competence as independent variables. Fig. 4 shows the results.

Fig. 4 supports the above explanation for some of the findings of this study. When studying the effects of the fulfillment of the needs for competence and autonomy on students' perception of the degree of freedom they get, fulfillment of the need for autonomy has a positive effect. When we look at the effect of the degree of fulfillment of the needs for competence and autonomy on students' perception of their teacher's leadership, the unique contribution of the autonomy variable is negative. This is further evidence for the conclusion that fulfillment of the need for autonomy is related to giving more freedom to students, at least in the case of student teachers with less leadership behavior.

4.6. Summary of the main findings

Summarizing the above findings, significant relations were found between the degree of fulfillment of the three basic psychological needs in student teachers and their interpersonal teaching behavior. Strongest is the relation between the three basic needs and the lesson self-image. However, also significant is the relation between fulfillment of the three basic needs and the student image. Further exploration of the two sets of variables (referring to need fulfillment and teaching behavior respectively) showed significant correlations between the degree of fulfillment of the need for competence and both the influence and proximity dimension in the student teachers' interpersonal teaching behavior. These relations were found for the lesson self-image, the period self-image, and the student image. The highest correlation was found between the level of fulfillment of the need for competence and the influence dimension, in particular with the QTI subscale of leadership behavior, which concurred with our first hypothesis.

For the need for relatedness, significant correlations were found with both behavioral dimensions, most strongly for the proximity dimension, which confirmed the second hypothesis. In general, fulfillment of the need for autonomy is associated with both the influence and the proximity dimension in the student teachers' behavior, in all three images (the lesson self-image, period self-image, and student image). The only exception is the non-significant correlation between fulfillment of the need for autonomy and the influence dimension in the student image. Higher fulfillment of the need for autonomy was correlated with giving students more freedom and less leadership behavior, which concurred with our third and final hypothesis.

The regression analysis involving all three basic needs and both behavioral dimensions showed that there is a strong redundancy in the relations between the three needs on the one hand, and the student teachers' behavior on the other. In the student image and in both self-images, the level of fulfillment of the need for competence offers a unique and considerable contribution to the variance in the influence dimension. Fulfillment of the need for relatedness shows a unique and considerable contribution to the variance in the proximity dimension.

5. Discussion

5.1. Contribution to the body of knowledge

Our study showed strong relations between student teachers' basic need fulfillment and their teaching behavior. Although other studies have been carried out in this area (Pelletier et al., 2002; Roth et al., 2007; Taylor et al., 2008), the research generally focuses on relations between specific needs (in particular the need for autonomy) and particular types of teacher behavior, and is restricted to in-service teachers. The present study thus fills a blank in the research, as it takes a broader perspective, grounded in all three basic psychological needs distinguished within SDT and a rather comprehensive model of teacher behavior, and also focuses on

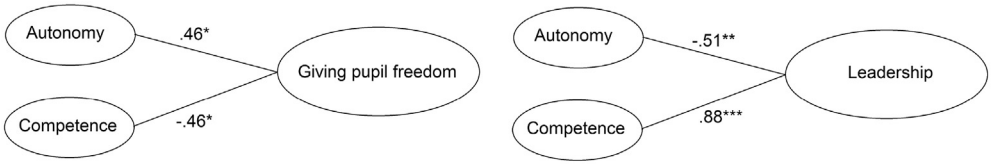

Fig. 4. The relation between the level of fulfillment of the needs for autonomy and competence (independent variables) and scores on the subscales 'giving student freedom' and 'leadership' in the student image of interpersonal teacher behavior (dependent variables). The numbers are standardized regression coefficients (*p < 0.05, **p < 0.01, ***p < 0.001).

student teachers. The study is in line with the growing attention to the influence of teachers' motivation on their behavior and development (e.g. Day & Gu, 2009; Schieb & Karabenick, 2011). Viewed from a broader perspective, it concurs with the increasing attention to the relation between teachers' personal and professional development (Bukor, 2015; Day, 2004).

As we have collected data about all three basic psychological needs and about each of the eight subscales of the QTI, which correspond with particular forms of teacher behavior, we could also do further analyses of a large number of specific relations between these data sets. At least one of these is worth mentioning here: we found that fulfillment of the need for competence is associated with more leadership behavior. This finding concurs with SDT, as the experience of competence is related to a feeling of having a grip on, effective behavior, and successful functioning (Deci & Ryan, 2000; Elliot et al., 2002; Ryan & Deci, 2002), being able to use one's skills effectively (Levesque, Zuehlke, Stanek, & Ryan, 2004), and a feeling of control (Patrick, Skinner, & Conell, 1993).

5.2. Limitations

Our study took place in the natural context of student teaching, which implies a high degree of ecological validity. On the other hand, it is possible that certain aspects of the approach had an influence on the processes the student teachers were going through or on their self-reports, such as the recurring use of questionnaires with a high number of items, and the application of the QTIL directly after a class. The use of questionnaires could have made the student teachers more aware of their need fulfillment and perhaps of associated ideals, and Korthagen (2004) states that this type of reflection influences teacher development.

The 14-week period was chosen for practical reasons, as this was the first regular period of student teaching. It is uncertain whether a longer period of data collection would have shown other phenomena, for instance patterns of change or fluctuations. The level of fulfillment of the basic needs will probably change after a longer period of time, especially when teachers are more experienced. For interpersonal teacher behavior, such long-term changes are well-known (Brekelmans, Wubbels, & Van Tartwijk, 2006), and future longitudinal and cross-sectional studies could focus on relations between these 'inner' and 'outer' sides of teacher development.

Although we measured the student teachers' self-image of their teaching behavior not only after the 14-weeks period, but also after specific lessons, we did not measure the student image of this behavior at the level of specific lessons. In a practical sense this seemed to be complicated, as it would have put a heavy burden on the students, but it could have deepened our understanding of the relation between need fulfillment in student teachers and their teaching behavior. If we look at the literature in this field, such a focus seems almost non-existent, although it would be very important in strengthening our knowledge about learning to teach and could help improve teacher education.

The research group was shown to be fairly representative of the regular population of student teachers at this particular university. However, we should be careful in generalizing the findings to student teachers in other countries and settings. Therefore, we hope that our study will be an incentive to other researchers internationally to carry out similar studies in other contexts.

5.3. Further research

Further research could also include more data about the student teachers, for example their own ideal teaching behavior. Years of research on the QTI have shown that correlations between teachers' 'ideal image' on the QTI and student scores on the QTI may be significantly different (Wubbels, Brekelmans, & Hooymayers, 1992). One explanation is that, although behavior is grounded in people's beliefs and attitudes (Ajzen, 1991), teachers are not always able to enact their ideal way of teaching. Moreover, they are not always aware of such differences between their ideal and their actual behavior, and their students often have a more adequate perception of teachers' actual behavior than the teachers themselves (Wubbels et al., 1992). Further research could shed more light on this intriguing topic, and relations with need fulfillment, which seems highly relevant to teacher education.

An interesting topic for further research into teacher development could be that psychological research has shown the influence of global patterns in need fulfillment on need fulfillment in specific situations (Reeve et al., 1999; Reis et al., 2000). Vallerand and Ratelle (2002) suggest that the opposite is also true, and that there may thus be a reciprocal influence. Hence, interesting questions are how similarities and differences between ideal and actual teaching behavior are associated with the level of need fulfillment and how global need fulfillment is related to need fulfillment in teaching, and to actual teaching behavior.

It would be interesting and important for practices in teacher education to study the outcomes of interventions aimed at improving the degree of need fulfillment. For example, as shown by Zwart, Attema-Noordewier, and Korthagen (2015), the *core reflection approach* (Korthagen, Kim, & Greene, 2013) can positively impact need fulfillment in teachers and through this, their teaching behavior. This type of reflection is aimed at raising teachers' awareness of their personal qualities and ideals and at overcoming inner obstacles. A related and more general topic for further research is how more attention to the connection between the personal and professional dimension in teaching (Bukor, 2015; Day, 2004) may contribute to need fulfillment in teachers, their teaching behavior, and developmental processes in teachers.

Another interesting topic for further research emerges from our findings regarding the influence on teacher behavior of fulfillment of the need for autonomy. In this respect we found a rather complex situation, as regression analyses showed that the zero-order correlations were spurious. An explanation could be that a higher degree of fulfillment of the need for autonomy is associated with giving more freedom to students, while student teachers may not yet be sufficiently competent to combine this with giving structure. This is a well-known and crucial issue in teacher education (Jang, Reeve, & Deci, 2010).

5.4. Final remarks

This study provides evidence that need fulfillment in student teachers (part of the 'inner' side of teaching) is related to their teaching behavior (the 'outer' side of teaching). The present study in particular has revealed relations between fulfillment of the needs for competence and relatedness and teacher behavior with a high level of influence and proximity, and we know from research based on the MITB that such teacher behavior is positively correlated with learning outcomes (Wubbels et al., 2006). Hence, there is evidence of a connection between need fulfillment and effective teacher behavior. Based on findings from SDT, we believe there is reason to assume a reciprocal influence between need fulfillment and teacher behavior. However, in this study we did not investigate causal relations, and, fundamentally, the mechanisms underlying the quantitative relations can not be revealed within the chosen research approach, which limits a deeper insight into the phenomena under study (cf. Bhaskar, 2008). Still, we may observe that in teacher education the development of effective teacher behavior already receives much attention, whereas the present study shows that support of teachers' need fulfillment could offer an important

contribution to their professional development.

Finally, we wish to emphasize that we have studied only a small part of the non-cognitive factors influencing teachers and their behavior. The cognitive and non-cognitive sources of teacher behavior are much more complex and interrelated (Korthagen, in press; Crothers, Hughes, & Morine, 2008). For example, self-efficacy beliefs influence motivation and vice versa (Bandura, Adams, & Beyer, 1977). Moreover, even the area of teacher motivation can be studied from various perspectives, and the SDT offers only one such perspective. A fundamental critique may also be that until now, SDT does not have much to offer in terms of revealing underlying mechanisms or providing concrete guidelines for influencing need fulfillment in education. As we believe that such guidelines are highly important, in particular for practices in teacher education, we discuss some practical ideas in the next section.

6. Implications for practice

Our study raises the question of *how* need fulfillment can be supported in student teachers. Concerning *the need for competence*, we believe the following strategies may be helpful:

- Stimulating student teachers to work on concrete learning goals that can be achieved with relatively small and clear steps, each with a high chance of success (Deci & Ryan, 2000, 2002). This requires careful coaching, as student teachers sometimes overestimate or underestimate their own success chances.
- Placement of student teachers into relatively safe classes that at the same time give them some degree of challenge, so that they can feel competent. Such a challenge could, for example, be to give a lesson stimulating a certain level of student interaction.
- Paying much attention to the positive aspects of student teachers' behavior and professional growth (Fredrickson, 2009), for example through feedback on what goes well, and on the student teachers' personal qualities and competencies.

Concerning *the need for relatedness*, one may think of the following strategies:

- Helping student teachers focus on and practice with building positive relationships with students, giving attention to personal interactions with individual students, and supporting student teachers not to lose sight of individual students within the sometimes overwhelming image of whole classes. For example, student teachers can be stimulated to include exercises in their lessons during which the students work in pairs, with the student teacher walking around and making personal contact with the students.
- Helping student teachers become more aware of opportunities to improve the social-emotional climate in the classroom (Deci & Ryan, 1985; Skinner & Belmont, 1993), and to use approaches promoting a positive group feeling. Many such approaches have been described by Kagan (1994) and Sharan (1994), and student teachers can be asked to use some of these approaches in their lessons.

Concerning *the need for autonomy*, we consider the following approaches fruitful:

- Offering student teachers choices within the teacher education program and in their student teaching (Deci & Ryan, 1985; Levesque et al., 2004; Patrick et al., 1993; Ryan, 1995). Hence, basic questions within a teacher education program are: who decides about the what and how of the learning, and can more of these decisions be made by the student teachers themselves?
- Putting less pressure on student teachers regarding requirements coming from their teacher educators, the schools, supervisors, and mentors (Pelletier et al., 2002), and giving the student teachers a feeling of being able to find their own paths (Deci & Ryan, 2000, 2002).
- Giving attention to student teachers' personal goals, ideals, and values, and providing freedom for self-chosen activities building on this (Sheldon & Kasser, 2001).

With an eye to the fulfillment of all three basic psychological needs, it seems important to avoid placing student teachers into problematic classes too soon. A strategy of gradualness could be fruitful, i.e. an approach in which the level of complexity of practices and assignments is gradually being increased (Korthagen et al., 2001). Of course, this is not easy to realize in short teacher education programs or in situations in which the student already has a paid job as a teacher. Still, we believe that promoting in student teachers more awareness of their need fulfillment could have a positive effect on their development (cf. Epstein, 1998a, 1998b; Peterson & Seligman, 2004). In this respect, the BPNQ could also be a useful instrument in teacher education, perhaps in combination with the QTIL. Student teachers could compare and discuss their scores on these instruments and relate them to their teaching experiences. In addition, observing video recordings of student teachers' own lessons may be a fruitful means of deepening their understanding of the link between their need fulfillment and their classroom behavior.

We have already mentioned *core reflection* as a specific approach aimed at enhancing need fulfillment. Based on positive psychology (Seligman & Csikszentmihalyi, 2000; Fredrickson, 2009), core reflection focuses on (student) teachers' personal qualities, ideals and values, and puts much attention on success experiences and the positive aspects already present in their behavior. In addition, it helps them to become aware of and to overcome inner obstacles to building on such positive resources. Various studies have demonstrated that core reflection effectively promotes teacher development (for an overview of this strand of research, see Korthagen, Kim, & Greene, 2013). Grounded in this approach, Evelein and Korthagen (2015) developed a number of specific activities for student teachers aimed at the fulfillment of the three basic psychological needs, but research studies on the outcomes of these activities have not yet been conducted.

In conclusion, the findings of this study may lead to a plea for finding a balance in teacher education and professional development between an emphasis on need fulfillment and behavioral aspects in teacher development and on their connection. In line with this, we believe policy makers could be more aware of such connections, in particular of the possibly negative influences of emphasis put on standards and accountability systems meant to promote effective behavior. Such an emphasis may reduce need fulfillment in teachers, especially fulfillment of the need for autonomy (cf. Pelletier et al., 2002). This may even be counterproductive to the aim of enhancing effective teacher behavior.

7. Conclusion

The focus of this study concurs with the growing attention to the connection between the personal and the professional aspects in teaching (e.g. Bukor, 2015; Day & Gu, 2009), as it deepens our understanding of the relation between the personal aspect of need fulfillment in student teachers and their professional behavior. Our findings provide evidence that the experience of need fulfillment is not only a personal feeling of the student teacher, but is also

associated with teaching behavior that students can and do actually perceive, as the scores on the QTI have shown. From previous research it is known that such student scores on the QTI concur with the scores of trained observers (Wubbels et al., 2006).

Contrary to previous studies in this area, we adapted a broad perspective, including all basic psychological needs and a comprehensive model of teacher behavior, which enabled us to analyze various complex relations between motivational aspects in teachers and their behavior, the latter both from the teachers' and their students' perspectives. Effect sizes for the correlations between the degree of fulfillment of the basic psychological needs and student teachers' classroom behavior were large: 25% of the variance in the perception of students (the student image), and even 50% of the variance in the lesson perceptions of the student teachers (the lesson self-image) is explained by the degree of fulfillment of the three basic needs. As such in-depth studies into relations between fulfillment of the three basic psychological needs in student teachers and their actual behavior (as observed by their students) seem non-existent, the present study offers a unique and important contribution to the research on the application of SDT to education, and shows important directions for strengthening teacher education.

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