



## Research paper

# Profiles of teachers' need-support: How do autonomy support, structure, and involvement cohere and predict motivation and learning outcomes?

Lisette Hornstra <sup>a, 1</sup>, Kim Stroet <sup>b, \*, 1</sup>, Desirée Weijers <sup>c</sup>

<sup>a</sup> Department of Education, Utrecht University, Heidelberglaan 1, 3584, CS, Utrecht, the Netherlands

<sup>b</sup> Institute of Education and Child Studies, Leiden University, Wassenaarseweg 52, 2333, AK, Leiden, the Netherlands

<sup>c</sup> Kohnstamm Institute, University of Amsterdam, Roetersstraat 31, 1018, WB, Amsterdam, the Netherlands

## HIGHLIGHTS

- We identified profiles of need-supportive teaching using latent profile analyses.
- Student reports revealed three balanced profiles (low, moderate, and high need support).
- Unbalanced profiles were found based on student-specific teacher reports.
- Need-support was positively associated with student motivation and achievement.
- Need-support in one dimension cannot compensate for lack of support in another.

## ARTICLE INFO

## Article history:

Received 27 August 2019

Received in revised form

17 November 2020

Accepted 30 November 2020

Available online 22 December 2020

## Keywords:

Motivation

School achievement

Teacher-student interactions

Self-determination theory

Need-support

## ABSTRACT

According to Self-Determination Theory, need-supportive teaching fosters students' motivation. The present study examined the interplay between the three dimensions of need support: autonomy support, structure, and involvement. Using both student and teacher-reports ( $N = 287$  Grade 7 students), configurations of need support were examined with Latent Profile Analyses. Balanced profiles were identified based on student reports (low, moderate, or high need support), while unbalanced profiles were identified based on student-specific teacher-reports. Higher levels of need support were associated with more motivation and achievement, while high levels of teacher-reported structure and involvement could not compensate for a lack of teacher-reported autonomy support.

© 2020 The Author(s). Published by Elsevier Ltd. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

Student-teacher interactions affect students' motivation and learning. Self-Determination Theory (SDT; Deci & Ryan, 1985; Ryan & Deci, 2018) is a comprehensive framework that provides a theoretical base for classifying interactions in this regard. According to SDT, three fundamental human needs exist, for autonomy, competence, and relatedness. Teachers can support these needs through provision of autonomy support, structure, and

involvement (dimensions of need support) in their interactions with students and, thereby, foster motivation. Indeed, many studies indicate clear positive associations between teachers' need support and various aspects of students' motivation and school achievement. In most of these studies, separate analyses were conducted for each dimension or composite scores were used (see Stroet, Opendakker, & Minnaert, 2013 for a review). Thus far research into the interplay of the three dimensions—or profiles of teachers' need support—in fostering student motivation is scarce (see section 2.2 for exceptions), leaving unexplained how the three dimensions of need support are combined in practice and if high levels of support in one or two dimensions can compensate for a lack of support in another dimension.

For example, imagine what happens when a student does not

\* Corresponding author.

E-mail addresses: [t.e.hornstra@uu.nl](mailto:t.e.hornstra@uu.nl) (L. Hornstra), [k.f.a.stroet@fsw.leidenuniv.nl](mailto:k.f.a.stroet@fsw.leidenuniv.nl) (K. Stroet), [DWeijers@kohnstamm.uva.nl](mailto:DWeijers@kohnstamm.uva.nl) (D. Weijers).

<sup>1</sup> Lisette Hornstra and Kim Stroet share the first author position.

experience any warmth or affection (involvement) from her teacher, but does feel that her teacher gives her sufficient freedom in her thinking, provides relevant choices (autonomy support), and offers clear guidelines and explanations (structure). Firstly, do such unbalanced profiles of need support occur in practice? Or are the three needs so much intertwined that some sort of balance is automatically accomplished? Secondly, if unbalanced profiles do indeed occur, how would these be associated with motivation and learning? In the example, will the high levels of autonomy support and structure compensate for the lack of involvement, or not?

In the present study, we focus on two research questions. First, we examine naturally occurring profiles of teachers' need support in practice. In doing so, we examine need support from two perspectives: teacher-reports (per student) and student perceptions of teachers' need support. Second, we examine relationships between these naturally occurring profiles of teachers' need support and different aspects of students' motivation (autonomous motivation, controlled motivation, self-efficacy, behavioral engagement), as well as their school achievement.

## 2. Theoretical background

### 2.1. Self-Determination Theory, motivation, and school achievement

#### 2.1.1. Self-Determination Theory: teachers' need support

SDT is built on two core assumptions about human nature, that lie at the basis of SDT's view on what is motivation and on how people can be motivated (Deci & Ryan, 1985). The first of these assumptions is that people have an active tendency toward psychological growth and therefore strive to exercise and elaborate interests and to seek challenges. The second assumption is that people have a tendency towards integrating their experiences in a coherent sense of self and strive both towards being causal agents and towards internalizing the knowledge, customs, and values of relevant others that surround them.

Based on these two assumptions, SDT differentiates three fundamental psychological needs – autonomy, competence, and relatedness – and states that psychological growth can be fostered when the social context supports these basic needs (Ryan & Deci, 2018). Applied to the context of education, this means that it is important that teachers adopt a teaching style supportive of these three needs. First, students' need for autonomy refers to people's inherent desire to be causal agents and to experience volition in their actions. This need can be supported through autonomy-supportive teaching, which entails multiple components: providing students with relevant choice, fostering relevance, showing respect, and using informational rather than controlling language. By implementing these behaviors in their teaching style, teachers nurture students' interests and encourage that students are willing to engage in learning out of volition rather than feeling pressured to do so (Jang, Reeve, & Deci, 2010; Stroet, Opdenakker, & Minnaert, 2015). The need for competence refers to the need to feel effective and in control and to be able to stretch one's capabilities. Teachers can facilitate this need by providing structure, which entails the provision of clarity, guidance, encouragement, and feedback that is informational, not evaluative (Stroet et al., 2015). These behaviors help students to understand the expectations of their teachers and how they can effectively meet these expectations (Jang et al., 2010), without feeling pressured to perform. Students' need for relatedness refers to the desire to experience belongingness and feel connected to others (e.g., Baumeister & Leary, 1995; Ryan, 1995). Teachers can support this need by expressing involvement with their students by showing affection, interest, attuning to students' needs, and offering emotional support (Stroet et al., 2015).

#### 2.1.2. Motivation

Based on its two core assumptions, SDT further differentiates between autonomous versus controlled motivation (Ryan & Connell, 1989; Ryan & Deci, 2018). Autonomous motivation occurs when students engage in activities out of enjoyment or interest or because they personally value an activity, whereas controlled motivation occurs when students engage in activities because they feel pressure to do so by others or from within (e.g., guilt or shame) or for the sake of a reward or punishment (Ryan & Connell, 1989; Ryan & Deci, 2018; Vansteenkiste, Lens, & Deci, 2006). Autonomous motivation is considered more beneficial for (deep) learning and well-being than controlled motivation. In education, autonomous motivation has been linked to higher quality learning strategies (Grolnick & Ryan, 1987; Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004), the use of more effective learning strategies (Michou, Vansteenkiste, Mouratidis, & Lens, 2014), class participation (Green et al., 2012), and various aspects of students' psychological well-being (Black & Deci, 2000; Levesque, Zuehlke, Stanek, & Ryan, 2004). Providing students with autonomy support, structure, and involvement has been found to facilitate students' autonomous motivation and prevent controlled motivation. In addition, teachers' need support has been found to facilitate other aspects of motivation such as self-efficacy, behavioral engagement, and subsequent achievement outcomes (for a review, see Stroet et al., 2013). Self-efficacy concerns how well students think they will do in an upcoming task (Midgley et al., 2000) and is anticipated to be strongly associated, particularly with teachers' provision of structure. Engagement can be seen as an externalization of motivation; it can either be (1) behavioral, which refers to participation in learning activities as is manifested in for example persistence or attention, or (2) emotional, manifested in for example enthusiasm or enjoyment, or (3) cognitive which refers to a self-regulated approach to learning and use of meta-cognitive strategies (see Fredricks, Blumenfeld, & Paris, 2004; Skinner, Furrer, Marchand, & Kindermann, 2008). In the present study, we included only the behavioral component as this component is not so much represented in our other motivational outcomes.

### 2.2. Combining dimensions of need support

In SDT-literature (e.g., Deci & Ryan, 1985), the needs for autonomy, competence, and relatedness are considered interdependent: experienced satisfaction of one of the needs can boost (or even be a prerequisite to) experienced satisfaction of another need. In this regard, Deci and Ryan (1985) argue that feeling at least somewhat competent to do a task is a prerequisite to experiencing autonomy. For example, to a student who does not have a clue how to go about analyzing a text for her language class (i.e., a lack of structure), it will not matter much whether or not she receives choice in text topic or has opportunity to express personal viewpoints on this topic (elements of autonomy support). It could be anticipated that this student will not perceive autonomy support that is provided to her as such, and, accordingly, that there will not be any effects on motivation and achievement. Further, the SDT-notion that a sense of relatedness makes people more open to accept the other's viewpoints and not feel controlled by their suggestions is particularly relevant with regard to the dimension of involvement (Deci & Ryan, 1985). It could be anticipated that students who experience involvement from their teacher are therefore more likely to experience autonomy support also. In all, students' perceptions of need support in each dimension may be strongly intertwined and subsequently, profiles of need support are expected to be balanced (similar levels of experienced support in each dimension).

For profiles based on teacher-reported need support the same argumentation does not necessarily hold. It could well be that

teacher profiles are more unbalanced. Previous studies have suggested that although SDT conceptualizes autonomy support and structure as complementary dimensions, in practice, many teachers see autonomy support and structure as opposite ends of the same continuum (e.g., Hornstra, Mansfield, Van der Veen, Peetsma, & Volman, 2015; Jang, Reeve, & Deci, 2010; Reeve, 2009; Vansteenkiste et al., 2012). An explorative study on teacher beliefs (Hornstra et al., 2015), for example, suggested that some teachers considered autonomy support and structure as opposite dimensions. Especially with at-risk students, who are from a less affluent background or have a lower ability level, teachers expressed a need to offer structure by providing these students less autonomy compared to other students (see also Pelletier, Séguin-Lévesque, & Legault, 2002). Hence, when looking at teacher-reported need support, it could be that high levels of autonomy support may be associated with lower levels of structure and vice versa. Regarding involvement, it is unclear whether teachers consider involvement as independent, complementary, or opposite to autonomy support and structure.

### 2.2.1. Prior research on naturally occurring profiles

Prior studies that include several dimensions of need support provide interesting suggestions regarding our first research question into naturally occurring profiles, while important gaps remain as well. Studies on student-perceived need support typically reported strong positive associations between the three dimensions. Most studies found correlations between the three dimensions ranging from  $r = .50$  to  $r = .81$  (Domen, Hornstra, Weijers, Van der Veen, & Peetsma, 2019; Hospel & Galand, 2016; Lietaert, Roorda, Laevers, Verschueren, & De Fraine, 2015; Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009; Skinner & Belmont, 1993). In one longitudinal study, weaker, yet still substantial correlations ( $r = .32 - r = .50$ ), were obtained between autonomy support and involvement at each wave (Schuitema, Peetsma, & Van de Veen, 2016). Studies examining naturally occurring profiles of need support are scarce. We found two prior studies examining profiles of student-perceived need support. In secondary education, Vansteenkiste et al. (2012) examined profiles of autonomy support and one aspect of structure (clear expectations), and found four naturally occurring profiles: (1) high autonomy support and high structure, (2) low autonomy support – low structure, (3) high autonomy support – average structure, and (4) moderately high autonomy support and moderately low structure. Interestingly, no naturally occurring combinations were found of high autonomy support and low structure, or vice versa, suggesting that autonomy support and structure are perceived by students in a somewhat balanced manner. In higher education, Leenknecht, Wijnia, Loyens, and Rikers (2017) identified three profiles based on student reports that were even more balanced: overall low, overall moderate, and overall high need support.

Relying on another source of data, namely teacher-reported need support, associations of varying strength were found. In a study on teacher-reported need support per class (Van den Berghe et al., 2014), positive correlations between the three dimensions were shown ( $r = .37$  to  $r = .46$ ), although they appeared to be weaker than for student-perceived need support. For student-specific ratings of teacher-reported need support, findings are mixed. The aforementioned study by Skinner and Belmont (1993) reported positive correlations between the dimensions of need support ( $r = .27$  to  $.65$ ). Leflot, van Lier, Onghena, and Colpin (2010) also reported strong positive correlations of  $r = .51$  to  $r = .71$  between the three dimensions of need support, while some other studies reported weaker or non-significant correlations between involvement and the other two dimensions, and even found

negative correlations between autonomy support and structure ( $r = -.26$  and  $r = -.25$ ) (Domen et al., 2019; Hornstra, Bakx, Mathijssen, & Denissen, 2020). Finally, in one study relying on observations of teachers' need support (Haerens et al., 2013), a negative correlation of  $r = -.30$  between observations of autonomy support and structure was found as well as non-significant correlations of both dimensions with involvement. Although these negative correlations between autonomy support and structure are in conflict with findings of many of the other studies presented above, they are not completely at odds with previous literature. That is, prior research suggests that many teachers consider autonomy support and structure to be opposite dimensions (e.g., Hornstra et al., 2015; Jang, Reeve, & Deci, 2010; Reeve, 2009; Vansteenkiste et al., 2012).

In all, these findings suggest that teachers who offer high (or low or moderate) levels of support for one of the needs, also are likely to offer high (or low or moderate) levels of support for the other two needs. Interestingly, this seems the case particularly when need support is measured via student perceptions; for teacher-reported and observed need support associations are weaker or, in one case, even negative. We will now proceed with arguing why from a more theoretical perspective, it makes sense to distinguish student-perceptions and teacher reports.

Thus far, most SDT-research has relied on student perceptions of need support (Stroet et al., 2013), as these measures are closest to how students experience student-teacher interactions psychologically and, hence, to how these interactions affect their motivation (Deci, 1975). However, using alternative measures such as teacher perceptions or observations is of relevance as well as these have the advantage of being more proximate to what teachers actually do (or perceive to do) in their interactions and therefore (amongst others) provide valuable input for classroom interventions. Moreover, behaviors expressed by the teacher with the aim of supporting their students' need, may not necessarily be received by each student accordingly. Also, how students perceive the interactions will probably depend on the teachers' behaviors, but may also be shaped by student factors such as past experiences with the teacher or students' self-esteem. Therefore, considering both the student and the teacher perspective helps to gain a more complete understanding of teachers' need support. Relying on teacher-reports, we may answer questions such as: is a teacher who decides to provide a specific student with autonomy support, also more likely to express involvement, or are these two dimensions independent?

In addition, prior research (see Stroet et al., 2013, for a review) states that need-supportive teaching is a dyadic construct expressed through the interactions between teachers and students. As teachers typically interact not only with the class as a whole, but also with individual students, it seems likely that they – consciously or unconsciously – differentiate in their need support between different students and are for example more autonomy-supportive to some than to others. Studies using student perceptions of need support as well as student-specific teacher perceptions indicate that there is indeed much more variation in perceptions of need support within classes than between classes (ICCs < 0.42) (Bieg, Backes, & Mittag, 2011; Danielsen, Wiium, Wilhelmsen, & Wold, 2010; Domen et al., 2019; Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015; Hornstra et al., 2020; Hospel & Galand, 2016). Assessing teacher perceptions of need support for each student individually may therefore provide a more accurate measure of need support than class-level measures. Based on the premise of the universality of needs (Chen et al., 2015) and prior research indicating the positive effects of need-supportive teaching (Stroet et al., 2013), it can be assumed that higher levels of need support are beneficial for all students.

### 2.2.2. Prior research on associations of naturally occurring profiles of teachers' need support with motivation and achievement

A small body of SDT-studies examined how different combinations of the dimensions of need support predicted student motivation and engagement, yielding information that is of relevance to our second research question into associations of different profiles of teachers' need support with student motivation and school achievement. These studies have examined whether different dimensions of need support have additive and/or combined effects on student outcomes (Hospel & Galand, 2016). Additive effects refer to main effects of the three dimensions that cumulate in predicting student outcomes. Hence, in case of additive effects, each dimension of need support contributes to student outcomes, irrespective of the level of support regarding the other dimensions. Combined (or interaction) effects suggest that the effect of support for one dimension depends on the level of support in the other dimensions. That is, support for one dimension could strengthen the effect of support for the other dimensions, or alternatively, support for one dimension might compensate a lack of support in other dimensions. For example, there would be a combined effect if a high level of relatedness boosts the effect of autonomy support and structure, or alternatively, would compensate for a lack of autonomy or structure.

Studies that examined the interplay between autonomy support and structure found support for both additive and combined effects. Jang et al. (2010) found additive effects in predicting observed engagement, although for self-reported engagement only autonomy support appeared a significant predictor. In a large-scale study, Hospel and Galand (2016) found additive effects of both autonomy support and structure (i.e., for both dimensions they found main effects) on student engagement and combined effect (i.e., an interaction effect between both dimensions). Sierens et al. (2009) found additive effects of structure, but their findings also indicated that structure only had an effect on students' self-regulated learning when levels of autonomy support were moderate to high (combined effect). Noels (2003) only found additive effects of perceived autonomy and perceived competence, which can be fostered through structure. Finally, in their study on profiles of need support, Vansteenkiste et al. (2012) found the most positive associations with student motivation and learning outcomes for students who perceived high levels of both autonomy and structure, and the least adaptive outcomes for students who perceived the low levels of autonomy support and structure.

In all, previous research on the interplay between autonomy support and structure suggests main and additive effects of each dimension of need support on a variety of student outcomes. Moreover, several studies (Hospel & Galand, 2016; Sierens et al., 2009) indicate that in addition there are combined effects of autonomy support and structure, suggesting that experienced support in one dimension can boost experienced support in another dimension. However, these studies all focused on student-perceptions of need support, whereas for teacher-reported need support associations may be different. Also, it is unclear how involvement may add to or interact with autonomy support and structure as the aforementioned studies focused only on the interplay of autonomy support and structure.

### 2.3. Present study

In the present study we aimed to enhance understanding of how teachers combine autonomy support, structure, and involvement in their classrooms, and, secondly of how these different combinations relate to students' motivation and achievement outcomes. The study was conducted among students in the first year of secondary school who attended the prevocational track ("vmbo"). The

prevocational track is the lowest track of the three main tracks in Dutch secondary education and is attended by approximately 56% of secondary school students in the Netherlands (Ministry of Education, Culture, and Science, 2014). The first year of secondary school is a critical moment in students' educational career as the quality of motivation starts to decline substantially for many students (e.g., Opdenakker et al., 2012).

We examined need support profiles measured via both student-perceptions and student-specific teacher-reports. This latter type of measure has not been used often in SDT-research (see van Lier, Onghena, & Colpin, 2010; and Skinner & Belmont, 1993 for exceptions), but is of relevance as teachers may differentiate between students in their provision of need support.

Based on prior literature, several expectations were formulated. First, we expected to find balanced profiles for student-perceived need support (e.g., a profile with high experienced support in each dimension, a profile with low experienced support in each dimension, and possibly one or more profiles with moderate support). For teacher-reported need support, we expected both balanced and unbalanced profiles of need support. Also, the correspondence between teacher and student profiles was examined. Given the relatively low correlations between teacher and student perceptions of need support (e.g., Skinner & Belmont, 1993), only modest correspondence was expected.

Second, we anticipated more favourable student outcomes (higher levels of autonomous motivation, self-efficacy, behavioral engagement, and achievement, and lower levels of controlled motivation) for profiles characterized by higher levels of need support. Because not much prior research is available, we did not formulate expectations about whether there would be additive effects (main effects) of need support only, or also combined effects (interaction effects).

To answer our research questions, we applied a person-centered approach. With the exception of Vansteenkiste et al. (2012) and Leenknicht et al. (2017), all of the aforementioned prior studies used variable-centered techniques to examine the associations between need support and student outcomes. In contrast, person-centered techniques examine relationships at the level of the individual, and group individuals with similar patterns into a profile. As such, latent profile analyses (Vermunt & Magidson, 2002) were used in the current study because with these analyses, naturally occurring profiles of need support can be identified and be related to student motivation and achievement outcomes.

## 3. Method

### 3.1. Sample and procedure

A sample of 287 students from twelve classes from two schools in the Netherlands participated in this study. The students were in the first year of secondary school, which corresponds to Grade 7, and they attended the prevocational track of secondary education. Their mean age was 12.4 years ( $SD = 0.65$ ). Over half of the sample (55.0%) were female, and 11.1% of the participants were from a non-western minority background.

The study took place approximately two months after the start of the school year. Prior to the start of the study, parents received passive informed consent letters. Four parents did not allow their children to participate. Questionnaires were administered during Dutch, English, or math class. Some classes participated more than once (they participated in multiple subject domains). More specifically, three classes participated in all three subjects, three classes participated in two subjects, and six classes only participated in one subject. This brought the total number of observations to 514 observations nested in 21 classes. Hence, some classes were taught by



multiple teachers (one per subject domain), while some teachers taught multiple classes. As such, the data had a cross-classified structure (Fielding & Goldstein, 2006). In section 3.3 (Data analyses), we discuss how we dealt with this data structure.

### 3.2. Instruments

#### 3.2.1. Student-perceptions of need support

The scales on *autonomy support* and *structure* were based on the teacher version of the Teacher as Social Context Questionnaire (TASC) (original questionnaire developed by Belmont, Skinner, Wellborn, & Connell, 1988, Dutch translation by Sierens et al., 2009). The scale *autonomy support* consisted of eight items (e.g., ‘My English teacher gives me a lot of choices about how to do my schoolwork’). The subscale *structure* consisted of eight items as well (e.g., ‘My math teacher shows me how to solve problems independently’). *Involvement* was measured by a scale developed by Peetsma, Wagenaar, and De Kat (2001), consisting of seven items (‘If I’m unhappy, I can talk about it with my Dutch teacher’). All items were assessed on a 5-point Likert scale ranging from completely not applicable to me (1) to completely applicable to me (5). Cronbach  $\alpha$ 's were 0.75 for autonomy support, 0.70 for structure, and 0.90 for involvement.

#### 3.2.2. Teacher-reported need support

For each individual student, teachers rated the degree to which they provided that student with autonomy, structure, and involvement. All items were measured on a 5-point Likert scale ranging from completely not applicable to this student (1) to completely applicable to this student (5). The scales on *autonomy support* and *structure* were based on the teacher version of the TASC (Belmont et al., 1988; Sierens et al., 2009). Shortened scales were used to limit the time investment of the teacher, as they rated each student individually. Based on results from a prior (unpublished) study in which all items were filled out, items with the highest factor loadings were selected, while taking content coverage into account. A pilot test with these shortened scales yielded satisfactory results (see also (Domen et al., 2019)). Both shortened scales consisted of four items (e.g., autonomy support: ‘I let this student make a lot of decisions regarding schoolwork.’; structure: ‘I am very clear about my expectations with this student’). *Involvement* was measured with the teacher-student relationship scale (Koomen, Verschueren, & Pianta, 2007). The scale on involvement was not shortened as the original scale only contained five items (e.g., ‘I share a warm relationship with this student’). Cronbach  $\alpha$ 's were 0.90 for autonomy support, 0.63 for structure, and 0.87 for involvement.

#### 3.2.3. Student motivation

The self-regulation questionnaire academic (SRQ-A) (Ryan & Connell, 1989) was administered to assess students’ autonomous and controlled motivation for Dutch, English, or math. The SRQ-A assesses the extent to which students’ school-related behaviors are autonomously regulated. It consists of sixteen items that are answered on a five-point scale ranging from completely not applicable to me (1) to completely applicable to me (5). In line with previous studies (e.g., Vansteenkiste, Lens, De Witte, De Witte, & Deci, 2004; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009), factor analyses revealed two subscales. The first scale was *autonomous motivation*, consisting of eight items from the subscales intrinsic and identified regulation (e.g., ‘Why do you try to do well in English? Because I enjoy doing my school work for English well.’). This subscale had a reliability of  $\alpha = 0.85$ . The second scale was *controlled motivation*, consisting of eight items from the

subscales introjected and external regulation (e.g., ‘Why do you try to do well in math? Because I might get a reward if I do well in math.’). This subscale had a reliability of  $\alpha = 0.70$ .

#### 3.2.4. Self-efficacy

Self-efficacy for each subject was measured by a scale from the ‘Patterns of Adaptive Learning Survey’ (PALS) (Midgley et al., 2000). The scale consisted of six items (e.g., ‘I can do even the hardest work in English if I try.’) that were answered on a five-point scale ranging from completely not applicable to me (1) to completely applicable to me (5). Cronbach’s  $\alpha = 0.84$ .

#### 3.2.5. Behavioural engagement

Behavioural engagement for each subject was assessed by students’ self-reported effort investment by a scale from Roede (1989). The scale consisted of six items (e.g., ‘I work hard during math class’) that are answered on a five-point scale ranging from completely not applicable to me (1) to completely applicable to me (5). Cronbach’s  $\alpha = 0.81$ .

#### 3.2.6. School achievement

Students reported their average course grade for Dutch, English, and/or mathematics. Self-reported grades in academic subject domains are considered to reflect actual grades with reasonable accuracy (Kuncel, Crede, & Thomas, 2005). The grades can range from 1 to 10, with 10 representing the highest grade.

### 3.3. Data analyses

The analyses were performed with Mplus (Muthén & Muthén, 2012). To examine which naturally occurring profiles of teacher-provided need support and student-perceived need support could be distinguished, two separate latent profile analyses (LPA) (Vermunt & Magidson, 2002) were conducted. LPA has several advantages compared to traditional cluster techniques, mainly because it is model-based and therefore, model fit of solutions with different numbers of clusters can be compared. Moreover, with LPA, it is possible to take classification inaccuracy into account. The data had a cross-classified structure with students nested in both classes and teachers (Fielding & Goldstein, 2006). However, the number of teachers/classes was too small to accurately correct for the cross-classified structure. We considered two alternative options: (1) to aggregate scores for each student (i.e., to aggregate the need support and motivation scores for math, Dutch, and English; or (2) to use only one observation per student. Given the domain-specificity of motivational constructs (Bong, 2001; Green, Martin, & Marsh, 2007; Hornstra, Van der Veen, & Peetsma, 2016), and the fact that aggregating would mean aggregating over teachers as well, the first option did not seem conducive. The second option would mean that we would not use almost half the observations in our data, and therefore also seemed undesirable. Therefore, we included multiple measurements per student even though the measurements were not fully independent. We performed the LPA analyses, while correcting for the nested structure of the data (students nested in classes) by estimating cluster-robust standard errors (i.e., the ‘sandwich estimator’, McNeish, Stapleton, & Silverman, 2017). This method, however, did not take into account the non-independence of the data due to students participating in multiples domains. To ensure that the findings were not affected by this non-independence, similar analyses were therefore performed with only one observation per student to check if the findings were robust. Except for minor variations, this was indeed found to be the case. Therefore, only the findings for the analyses with all observations included are reported. In addition, for students

participating more than once, the correspondence in profile membership across domains was examined and reported.

In the LPAs, models from one up to nine profiles were estimated and then compared based on the following criteria and considerations: (1) the AIC, BIC, and SA-BIC were considered as fit criteria, with models with smaller values preferred over models with larger values (Vermunt & Magidson, 2002); (2) models with higher classification accuracies were preferred indicated by higher entropy values (e.g., Pastor, Barron, Miller, & Davis, 2007) and by high average latent profile probabilities for the most likely profile membership; (3) with regard to parsimony, solutions with fewer profiles were preferred over solutions with more profiles, especially if additional profiles were only small variations of profiles found in previous solutions (4) profiles with very few cases (e.g., <5% of the cases); were not considered; (5) the interpretability of the solutions was considered. As a next step, multilevel LPAs (MPLA) were performed to examine whether the probability that a student belongs to a specific attributional profile varied significantly across classes (Henry & Muthén, 2010; Mäkikangas et al., 2018). Furthermore, cross-tabulations with Chi-square tests were conducted to examine the correspondence between student and teacher profiles and the correspondence in profile membership across domains.

To examine the second research question on how the profiles are associated with motivation and achievement, a three-step Bolck-Croon-Hagenaars (BCH) method was used (Asparouhov & Muthen, 2015). Although it is possible to use a one-step model and include distal outcomes in the latent profile model, this can lead to undesirable shifts in the latent classes, because the latent classes are determined not only by its indicators but also by the distal outcomes. As an alternative, researchers have used three-step approaches in which they first estimated the latent profiles, then assigned respondents to their most likely profile, and then estimated differences between these groups in distal outcomes, for example by a MANOVA analyses. However, this approach can lead to underestimations of the strength of the relationships between the latent profiles and distal outcomes (Bakk, Tekkle, & Vermunt, 2013). With a three-step approach with a BCH bias correction method (Bolck, Croon, & Hagenaars, 2004), these biases are prevented (Bakk et al., 2015). We therefore used the three-step BCH method as described by Asparouhov and Muthen (2015) to examine if different need support profiles were associated with motivation and achievement. Wald-tests were used to test whether the differences were significant. Again, we corrected for the nested structure of the data by estimating cluster-robust standard errors.

#### 4. Results

##### 4.1. Descriptive statistics and correlations

Table 1 displays the descriptive statistics of the dimensions of teacher-reported need support, student-perceived need support, motivational outcomes, and school achievement. Table 1 also shows the intraclass correlations (ICCs), which indicates the degree of variance situated at the class level. For all variables, the ICCs are below .29, indicating that most variance is situated at the individual level. Table 2 displays the correlations between the variables. The three dimensions of need support as perceived by students are positively correlated ( $r = .56 - r = .68$ ). For teacher-reported need support, a different pattern emerges with a non-significant correlation ( $r = .02$ ) between structure and involvement, a negative correlation between autonomy support and structure ( $r = -.43$ ), and a positive correlation between autonomy support and involvement ( $r = .37$ ). As for the intercorrelations between teacher

**Table 1**  
Descriptive statistics

	M	SD	Min	Max	ICC
Teacher ratings of need-support					
Autonomy-support	3.05	0.83	1.00	5.00	.18
Structure	3.71	0.45	2.30	5.00	.29
Involvement	3.51	0.70	1.00	5.00	.24
Student perceptions of need-support					
Autonomy-support	3.68	0.59	1.80	5.00	.17
Structure	3.54	0.53	1.60	5.00	.11
Involvement	3.52	0.78	1.00	5.00	.20
Motivational outcomes and achievement					
Autonomous motivation	3.55	0.79	1.00	5.00	.10
Controlled motivation	2.87	0.59	1.00	5.00	.01
Self-efficacy	3.48	0.65	1.50	5.00	.01
Behavioural engagement	3.39	0.70	1.00	5.00	.06
Achievement	6.99	1.11	4.00	9.50	.07

and student reports of need support, teacher-reported autonomy support and involvement both correlated positively with student perceptions on all three dimensions ( $r = .10$  to  $r = .21$ ). Teacher-reported structure however was not correlated with student perceptions of need support.

##### 4.2. Student profiles of teachers' need support

Table 3 displays the fit statistics of the latent profile analyses for student perceptions of need support. The results indicate that – up to the solution with six profiles – solutions with more profiles had better fit (smaller AIC, BIC, SA-BIC values) compared to models with fewer profiles. However, solutions with five or more profiles included very small groups (<5%). Solutions with more than three profiles only included minor variations of the first three profiles. In all, the three-profile solution was considered the best representation of students' need support profiles. The three-profile solution had very high average latent class probabilities (>0.88) for the most likely latent class membership (see Table 4), indicating that with the three-profile solution, profile membership can be estimated with a high degree of accuracy.

Fig. 1 displays the configuration of the three profiles. The profiles were balanced, suggesting that the three dimensions of need support as perceived by students are interdependent. That is, a higher level of support in one dimension is associated with higher levels of support in the other dimensions. Profile 1 consists of students who perceived relatively low levels of need support in all dimensions. This profile is referred to as 'low need support' and 21% of students are placed in this profile. Most students (64%) are in Profile 2, with moderate support in all three dimension. This profile is referred to as 'moderate need support'. The third profile consists of 14% of the students and is characterized by high support for all three needs and therefore referred to as 'high need support'. The results of the Multilevel LPA indicated that the size of the latent profiles varied between classes (Profile 1 versus 3:  $z = 0.61, p = .619$ ; Profile 2 versus 3:  $z = 3.158, p = .006$ ). That is, some profiles were more common in some classes than in other classes.

##### 4.3. Teacher profiles of teachers' need support

A three-profile solution was considered the best representation of teachers' need support profiles. The fit statistics reported in Table 5 suggest that solutions with more teacher profiles had better fit than models with fewer profiles. However, solutions with five or more profiles included very small groups (<5%) and solutions with more than three profiles only included minor variations of the first three profiles. Moreover, the solution with four profiles was

**Table 2**  
Correlations between teacher (T) and student (S) ratings of need-support of motivation outcomes and school achievement.

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. T_Autonomy-support	1.00										
2. T_Structure	-.43**	1.00									
3. T_Involvement	.37**	.02	1.00								
4. S_Autonomy-support	.19**	-.06	.12**	1.00							
5. S_Structure	.17**	-.08	.10**	.68**	1.00						
6. S_Involvement	.21**	-.06	.21**	.56**	.60**	1.00					
7. Autonomous motivation	.27**	-.12**	.19**	.50**	.50**	.53**	1.00				
8. Controlled motivation	-.05	.03	.04	-.04	.01	.10*	.16**	1.00			
9. Self-efficacy	.29**	-.09	.15**	.35**	.32**	.38**	.64**	.07	1.00		
10. Behavioural engagement	.26**	-.14**	.14**	.42**	.42**	.47**	.72**	.13**	.60**	1.00	
11. School achievement	.34**	-.26**	.17**	.14**	.19**	.17**	.28**	-.05	.36**	.32**	1.00

\* p<.05 level (2-tailed); \*\*<.01 level (2-tailed).

**Table 3**  
Latent profile solutions for student profiles of need-support

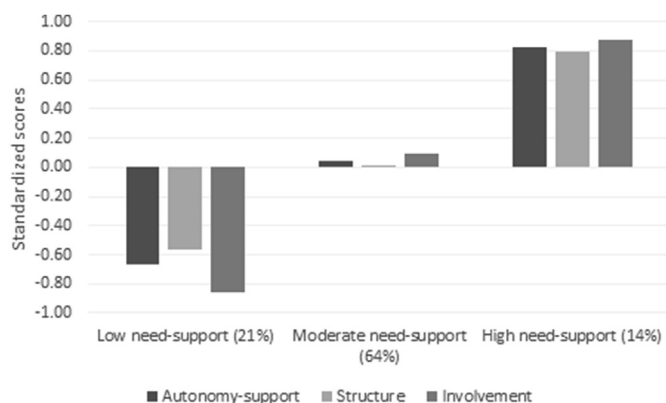
K	AIC	BIC	SA-BIC	Entropy	% per cluster
1	2789.450	2814.604	2795.560	1.000	100
2	2491.221	2533.145	2501.405	0.662	49/51
<b>3</b>	<b>2339.507</b>	<b>2398.200</b>	<b>2353.765</b>	<b>0.780</b>	<b>22/64/14</b>
4	2246.319	2321.781	2264.650	0.785	5/45/40/10
5	2224.592	2316.824	2246.996	0.819	5/36/2/45/11
6	2207.269	2316.270	2233.747	0.831	1/6/2/38/11/43
7	2192.429	2318.200	2222.981	0.853	1/5/2/39/5/10/42
8	2187.424	2329.964	2222.049	0.865	1/10/2/39/41/0/5/1
9	2181.433	2340.743	2220.132	0.786	1/21/4/1/2/32/9/0/30

**Table 5**  
Latent profile solutions for teacher profiles of need-support

K	AIC	BIC	SA-BIC	Entropy	% per cluster
1	2780.908	2805.888	2786.845	1.000	100
2	2648.654	2690.287	2658.548	0.659	40/60
<b>3</b>	<b>2604.542</b>	<b>2662.829</b>	<b>2618.395</b>	<b>0.740</b>	<b>36/58/6</b>
4	2587.384	2662.324	2605.195	0.694	25/35/35/5
5	2562.230	2653.823	2583.999	0.740	22/33/4/35/6
6	2518.773	2627.019	2544.499	0.868	6/40/7/34/10/4
7	2502.374	2627.273	2532.058	0.820	14/7/4/21/10/6/39
8	2489.679	2631.232	2523.321	0.845	8/0/11/22/38/10/6/4
9	2442.188	2600.394	2479.788	0.948	16/4/20/21/14/7/3/13/3

**Table 4**  
Average latent class probabilities for the most likely latent class membership for student profiles of need-support.

	1	2	3
1	<b>.88</b>	.12	.00
2	.06	<b>.91</b>	.03
3	.00	.09	<b>.91</b>



**Fig. 1.** Student profiles of need-support (standardized scores).

discarded because it had a lower entropy value compared to the three-profile solution. Table 6 indicates that with the three-profile solution, profile membership can be estimated with a high degree of accuracy (average latent class probabilities > .85).

The configuration of the three profiles is displayed in Fig. 2. Around one third of students (36%) are placed in Profile 1 based on the ratings of need support by their teacher. This profile consists of students whose teacher provides them with relatively low levels of autonomy support, moderate structure, and low involvement. This

profile is referred to as 'low need support'. Profile 2 consists of students whose teacher provides them with high levels of autonomy support, moderate structure, and moderate involvement. Because there is at least moderate support for each need, this profile is referred to as 'moderate need support'. A majority of students could be classified in this profile (58%). The third profile consists of students whose teachers provide them with low levels of autonomy support, high structure, and high involvement. This profile is referred to as 'dominant teaching'. Only 6% of the students were classified in this profile. The results of the Multilevel LPA indicate that the size of the latent profiles did not vary between classes (p values > .05). This indicates that the likelihood of students being in one of the three teacher profiles of teachers' need support did not significantly depend on the class students were in.

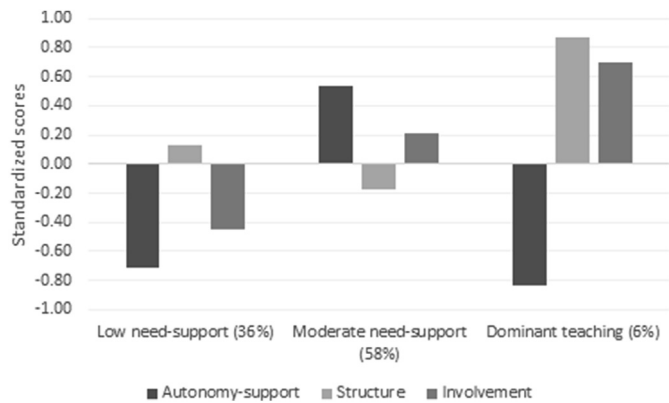
4.4. Associations between student and teacher profiles and across domains

A cross-tabulation indicated significant coherence in students' membership of the student and teacher profiles,  $\chi^2(4) = 21.12, p < .001$ . The corresponding effect size for the association between student and teacher clusters was small, Cramers's  $V = 0.10$ . Students who were in the low need support teacher profile were somewhat more likely to be clustered in the low need support student profile, while students in the moderate need support teacher profile were somewhat less likely to be in the low need support student profile. Also, students in the dominant need support teacher profile were somewhat more likely to be in the low need support student profile.

In addition, for students who participated in multiple subject domains, it was examined if there was correspondence between the profiles they were clustered in across domains (N ranging from 76 to 121 students). For the student profiles, all three cross-tabulations indicated a significant association ( $p < .05$ ), and the findings suggested that students were more likely to be in similar profiles for multiple domains. Cramer's  $V$  ranged from 0.19 to 0.20,

**Table 6**  
Average latent class probabilities for the most likely latent class membership for teacher profiles of need-support.

	1	2	3
1	.85	0.12	.04
2	.09	.91	.01
3	.10	.05	.85



**Fig. 2.** Teacher profiles of need-support (standardized scores).

suggesting medium effect sizes. For the teacher profiles, only one out of three cross-tabulations was significant ( $p < .05$ ; Cramer's  $V = 0.16$ ), indicating less correspondence in profile membership across domains for the teacher profiles.

4.5. Associations between profiles of teachers' need support and student motivation and achievement

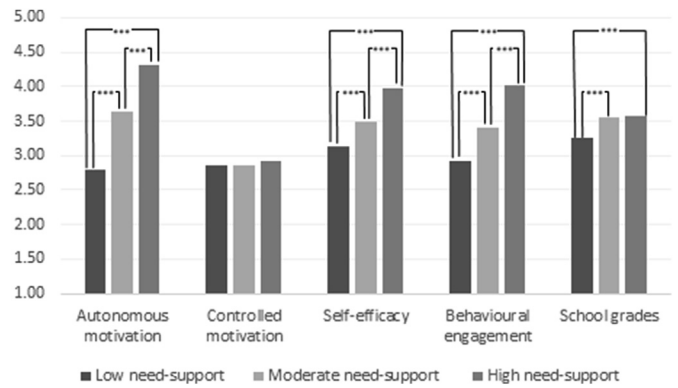
The results presented in Table 7 and Fig. 3 indicate the mean scores of motivational outcomes and school achievement for the three student profiles of need support. Profiles characterized by higher levels of experienced need support were significantly associated with more favourable motivation outcomes in terms of autonomous motivation, self-efficacy, and behavioural engagement. The three profiles did not significantly differ in controlled motivation. Additionally, students in the moderate and high need support profiles reported higher school achievement. Table 7 also reports the effect sizes (Cohen's  $d$ ) for the significant differences and indicates small to medium differences in achievement and medium to large differences in motivational outcomes.

The mean scores of motivational outcomes and achievement for the three teacher-reported profiles of need support are reported in Table 8 and displayed in Fig. 4. Similar to the student profiles, no significant differences were found between the three profiles in controlled motivation. For the other outcomes however, it was

**Table 7**  
Motivational outcomes and school achievement per need-support profile (student reports)

	Low need-support		Moderate need-support		High need-support		Cohen's $d$		
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	low versus moderate	low versus high	moderate versus high
Autonomous motivation	2.78	0.06	3.65	0.06	4.31	0.10	0.98	2.06	0.68
Controlled motivation	2.86	0.05	2.86	0.03	2.91	0.13	—	—	—
Self-efficacy	3.13	0.06	3.49	0.04	3.97	0.11	0.53	1.06	0.57
Behavioural engagement	2.93	0.07	3.41	0.05	4.02	0.12	0.58	1.23	0.63
Achievement	6.53	0.20	7.09	0.10	7.16	0.14	0.29	0.37	—

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$



**Fig. 3.** Motivational outcomes and school achievement per need-support profile (student perceptions). Note. For presentation purposes, school achievement was transformed to a similar scale (1-5) as the other variables.

found that students in the moderate need support profile had more favourable scores on autonomous motivation, self-efficacy, behavioural engagement, and school achievement than students in either the low need support or dominant teacher profiles, whereas the low and dominant profile did not significantly differ from each other in any of the outcomes. The effect sizes (Cohen's  $d$ ) for the significant differences indicate small to medium differences in achievement and medium to large differences in motivational outcomes. The differences between the low and moderate need support profile were small to medium and the differences between the moderate and dominant profile ranged from small (controlled motivation) to large (achievement), see Table 8.

5. Discussion

In the present study, we examined naturally occurring profiles of teachers' need support and their associations with student motivation and school achievement. Thereby we considered not only the three separate dimensions of teachers' need support, i.e., autonomy support, structure, and involvement, but also their interplay. While SDT's three needs are assumed to be interdependent in their effects on students (Deci, 1975) and insight in their interplay is of the utmost importance for translating SDT to educational practice, thus far, research has been scarce. To assess teachers' need support, we employed a person-centered approach and assessed teachers' need support per student both as perceived by the student and by the teacher.

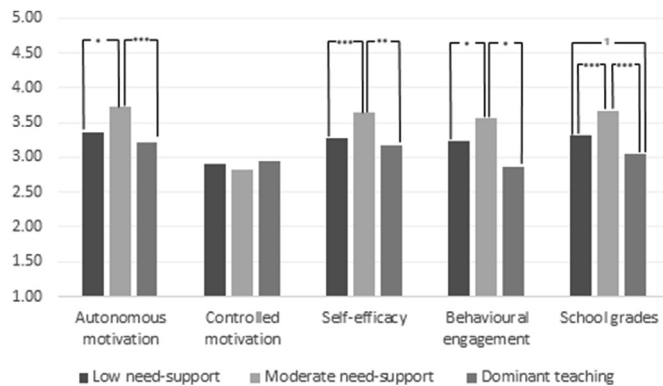
In summary, firstly, our findings indicated balanced profiles for student-perceived need support, i.e., students typically reported similar levels of support for each of the three dimensions. This finding is in line with expectations based on prior research and suggests interdependence of the respective dimensions, i.e., high support for one need can boost the perception of support for the



**Table 8**  
Motivational outcomes and school achievement per need-support profile (teacher reports)

	Low need-support		Moderate need-support		Dominant teaching		Cohen's <i>d</i>		
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	low versus moderate	low versus dominant	moderate versus dominant
Autonomous motivation	3.36	0.13	3.73	0.09	3.21	0.17	0.22	–	0.40
Controlled motivation	2.91	0.07	2.83	0.04	2.94	0.09	–	–	0.18
Self-efficacy	3.27	0.07	3.64	0.06	3.18	0.16	0.37	–	0.48
Behavioural engagement	3.24	0.11	3.56	0.07	2.87	0.26	0.24	–	0.52
School achievement	6.64	0.11	7.34	0.11	6.11	0.22	0.41	–	0.77

\*\*\*  $p < 0.001$ , \*\*  $p < 0.01$ , \*  $p < 0.05$ , †  $p < 0.10$



**Fig. 4.** Motivational outcomes and school achievement per need-support profile (teacher perceptions). Note. For presentation purposes, school achievement was transformed to a similar scale (1–5) as the other variables.

other needs, or likewise, when students do not experience support for one need, this may translate to perceiving less support for the other dimensions.

Notably, for teacher-reported need support, our results showed a different picture: these profiles appeared unbalanced. Three profiles were distinguished: (1) a low need support profile characterized by low levels of autonomy support and involvement and moderate structure; (2) a moderate profile characterized by high levels of autonomy support yet moderate structure and involvement; and (3) a dominant teaching profile characterized by low autonomy support with high structure and involvement. Based on prior research, we had anticipated that profiles for teacher-reported need support might be unbalanced, amongst others because teachers seem to consider autonomy support and structure as the opposite ends of the same continuum (e.g., Hornstra et al., 2015; Jang, Reeve, & Deci, 2010; Reeve, 2009; Vansteenkiste et al., 2012).

In addition, as expected, findings suggested only modest correspondence between the student and teacher profiles. This suggests that teachers and students do not perceive their interactions in the same way, although there is some correspondence.

Finally, we found teachers' need support to be positively associated with student motivation and achievement. As we found only balanced profiles for student-perceived need support, we could not disentangle the unique effects of each dimension and therefore not establish whether the effects of need support on student outcomes were additive or combined. As such, the teacher-reported profiles provided more information on how the needs interact in predicting student outcomes. The finding that the profile with at least moderate support in each dimension yielded the most beneficial student outcomes suggests that higher overall levels of need support are associated with more favourable student outcomes. In addition, the finding that the two profiles that were low in autonomy

support – even when combined with high levels of structure and involvement (i.e., 'dominant teaching') – were both associated with equally unfavourable student outcomes, indicates that high levels of support in the other two dimensions cannot compensate for a lack of autonomy support.

### 5.1. Implications for research and practice

Our findings generate several relevant implications for research and practice. First, the balanced profiles for student-perceived need support suggest the three dimensions of need support could be (much) more intertwined than has typically been accorded for. This is supported by the lack of compensation effects we found for profiles of teacher-reported need support. In this light, the question emerges how the findings of the many studies focusing on only one dimension of need support should be interpreted. Based on our findings, it could even be anticipated that in such studies the level of perceived support for the measured dimension is indicative of the level of support for all three dimensions. Implications are far-reaching. Amongst others, for interventions focusing on one or two dimensions of need support it could be that effectiveness varies between contexts, with interventions being more effective when the other dimension(s) of need support being apparent already. Future research is necessary to sort this out.

Second, for teacher-reported need support, the unbalanced profiles we found imply that while balanced need support appears most beneficial for students, teachers do not necessarily report to offer balanced support. On the contrary, the teachers themselves often indicated to combine high structure with low autonomy and vice versa, which has also been suggested in prior studies (Hornstra et al., 2015; Jang, Reeve, & Deci, 2010; Reeve, 2009; Vansteenkiste et al., 2012). A possible explanation is that teachers tend to confuse structure with control, thereby offering structure in rather controlling ways without supporting students' need for autonomy. This has been found especially for students who lag behind, are perceived to be unmotivated, or students from less affluent backgrounds (e.g., Reeve, 2009; Pelletier et al., 2002). Alternatively, there also seem to be teachers who report relatively high levels of autonomy but who seem hesitant in providing structure. It may be that those teachers are afraid to come across as controlling. Educational interventions would benefit from taking consideration of such dis-optimal processes.

Third, whereas previous studies on combinations of dimensions of need support mostly focused on autonomy support and structure (e.g., Hospel & Galand, 2016; Sierens et al., 2009), the findings of the present study provide insight in the role of involvement. We found that when students perceived a high degree of autonomy support and structure, they typically also perceived higher levels of teacher involvement. The profiles that were distinguished based on teacher-reports suggest, however, that involvement is rather independent on the other two dimensions. That is, teachers who reported a high level of involvement with their students did not

necessarily also provide high levels of structure or autonomy or vice versa.

Fourth, while there was only modest correspondence between the teacher and student ratings of need support, both types of measures were predictive of student outcomes. The difference in findings between student and teacher measures of need support illustrates the added value of combining different measures in future research in order to obtain a more accurate and complete picture of teacher-student interactions in classrooms. Combining both types of measures revealed some interesting patterns, although these findings were beyond the scope of our research questions. That is, correlations showed that teacher-reported autonomy support and involvement were positively associated with student perceptions on all three dimensions, yet, teacher-reported structure did not facilitate students' perceptions of need support. As discussed above, this may come about as many teachers appear to offer structure in rather controlling ways without supporting students' need for autonomy. These findings indicate that teachers may especially benefit from interventions explicitly focusing on how to provide structure in autonomy- and relatedness-supportive ways.

Finally, while SDT proposes that an optimal teaching style is characterized by high levels of support in all three dimensions (e.g., Ryan & Deci, 2000), our findings reveal that such an optimal teaching style is not often found in practice. When looking at student-perceptions of need support, most students perceived moderate levels of support for each dimension, while only a small proportion perceived high levels of need support for all three dimensions. Moreover, teacher-reports of need support revealed that such an optimal profile with high levels of support for all three dimensions did not seem to occur. Even the most optimal profile based on teacher-reports (relatively high autonomy support, moderate structure and involvement) was only found for over half of the students. These findings demonstrate that there is substantial room for improvement when it comes to teachers' need support, thereby considering that the dimensions of need support do not occur in isolation but are interdependent.

### 5.2. Recommendations for future research

The present study demonstrated that different combinations of teachers' need support can be identified by adopting a person-oriented approach. To gain understanding of why teachers adopt a certain teaching style, future research is necessary to examine possible antecedents of different profiles of teachers' need support. It would, for example, be interesting to examine the role of teachers' beliefs, knowledge, experience, and background as well as school characteristics. Moreover, given the large difference in need support between students in the same class (as is apparent from the relatively low ICCs), also the role of student characteristics as predictors of teachers' need support needs to be examined. Prior studies (e.g., Hornstra et al., 2020; Hornstra et al., 2015; Pelletier et al., 2002; Reeve, 2009) have suggested that certain student characteristics, such as ability level, motivation, and demographic characteristics, can evoke higher or lower levels of autonomy support. Moreover, while prior research suggests that high levels of need support are beneficial for all students (e.g., Stroet et al., 2013), research on adaptive teaching or differentiation states that students benefit from a personalized approach (Deunk, Smale-Jacobse, de Boer, Doolaard, & Bosker, 2018). More research is needed to examine if and how differentiation in teachers' need support can be conducive for students' motivation and learning outcomes. It may be that teachers could use different types of need-supportive strategies to satisfy the needs of different students.

In addition, it is recommended to study the generalizability of

the findings beyond this the context of this study. Our study focused on the first year of secondary education and included three core academic domains. Our study population mostly consisted of students in the lower tracks of secondary education. It could be that students in this age group are not yet able to distinguish between different aspects of need support, resulting in balanced need support profiles based on student perceptions. Similar studies with older students may yield different findings, although in the one study in higher education we are aware of, balanced profiles were found as well (Leenknecht et al., 2017). Further research could aim to examine whether the profiles that were obtained in this study were specific to this context and examine if similar profiles of need support can be found in other contexts.

Further, it would be of interest to gain a more fine-grained understanding of the mechanisms underlying our findings. Why is it that students perceive their teachers' need support as relatively balanced? In section 2, we offered some possible explanations. For example, feeling (somewhat) competent to do a task may be a prerequisite to experiencing autonomy and feeling related may make people more open to accept the other's viewpoints and not feel controlled by their suggestions. In future research, it would be of relevance to examine validity of these proposed mechanisms, for example via experimental manipulations varying each dimension systematically, and by student interviews. In interviews, students could, for example, be asked where their psychological responses to teacher-student interactions stem from. Additionally, a more fine-grained examination of profiles of need support would be of interest in this light, taking into consideration not only support per dimension (i.e., autonomy support, structure, and involvement), but also per element (e.g., offering choice).

Additionally, given the low correspondence between student and teacher perceptions, it would be of interest to examine in more depth how these are related, to gain understanding of how need support as perceived by teachers relates to how students perceive and respond to student-teacher interactions psychologically. Next to comparing teacher and student reports, it would also be of interest to combine these measures with classroom observations and video-stimulated recall, to gain a better understanding of how actual classroom practices with respect to each of the three dimensions are perceived and responded to by students and teachers. Such an approach could help shed light on what makes educational SDT-interventions effective as well.

### 5.3. Limitations

Several limitations of the present study are worth noting. First, given the cross-sectional nature of the data, the direction of causality cannot be established. Longitudinal research could help to unravel the direction of causality in the relation between profiles of need support and students' motivation and achievement. In addition, the data was collected early in the school year. Longitudinal research may also give more insight into the stability of need support profiles over time, and for example show if different profiles emerge later on in the school year when students and teachers have gotten to know each other better. Second, a teacher's teaching style may be a combination of more general behaviours displayed toward all their students and student-specific behaviours expressed toward specific students. By correcting for the nested structure of the data, we took the hierarchical nature of the data (students clustered in classes/teachers) into account. Yet, given the relatively small number of classes participating in this study, the present study did not explicitly distinguish between class-general and student-specific aspects of teachers' need support. Further research with a larger sample at the classroom level could take a multilevel approach and distinguish between profiles of need

support at both the class-general and student-specific level. Moreover, the data contained multiple measurements per student as the data had a cross-classified structure with students nested in classes as well as in teachers who taught multiple classes. Thereby the data violated the assumption of independence. Additional analyses suggested that the findings did not substantially differ if the data were analysed with one observation per student, supporting the robustness of the findings. However, with a larger number of classes and teachers, a cross-classified approach (Fielding & Goldstein, 2006) can be used to accurately account for the non-independence of the data, which can provide more insight into how variance in student-perceived and teacher-perceived need support is distributed across teachers, classes, students, and specific pairings of teachers and students. Prior research using such an approach (Mainhard, Oudman, Hornstra, Bosker, & Goetz, 2018) suggests that within-class variations in interpersonal teacher behaviours may be largely due to specific student-teacher pairings. This might also be the case for need-supportive teaching. Third, to reduce the time investment of the teachers who rated the three dimensions of need support for each student, we used shortened scales for autonomy support and structure. We tried to ensure content coverage, but nevertheless, the complete scales may cover the constructs more completely. Fourth, in the present study, we only focused on the three dimensions of need support. We did not assess need thwarting (control, neglect, and chaos as opposites of autonomy support, structure, and involvement). Prior research (e.g., Bartholomew, Ntoumanis, Ryan, & Thøgersen-Ntoumani, 2011; Haerens et al., 2015) suggests that a lack of need support does not necessarily imply that students' need are thwarted. Examining naturally occurring profiles of dimensions of need support and need thwarting may provide an even more complete understanding of the interactions between teachers and students. Despite these limitations, our study demonstrates the value of using a person-centered approach to increase our understanding of the complex interplay between different aspects of need support as well as the added value of incorporating different types of measures simultaneously.

#### 5.4. Conclusions

The present study was among the first to examine profiles of teachers' need support. By adopting a person-oriented approach and assessing teachers' need support from two different perspectives, we were able to advance research on teachers' need support. In doing so, this study increases understanding of how different dimensions of need support are combined in practice and provides new insights regarding the complex interplay between different dimensions of need support in relation to student outcomes. The present study has shown that dimensions of need support do not occur in isolation but are interdependent. An integrative approach – taking into account all three dimensions – is therefore recommended for future research and educational practice.

#### Acknowledgements

This work was supported by the National Scientific Organization of The Netherlands (NWO) [grant number NWO-PROO 405-15-514].

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tate.2020.103257>.

#### References

- Asparouhov, T., & Muthen, B. (2015). *Auxiliary variables in mixture modeling: Using the BCH method in Mplus to estimate a distal outcome model and an arbitrary second model*. Retrieved from Version 2. <http://www.statmodel.com/examples/webnotes/webnote21.pdf>.
- Bakk, Z., Tekle, F. B., & Vermunt, J. K. (2013). Estimating the association between latent class membership and external variables using bias-adjusted three-step approaches. *Sociological Methodology*, 43, 272–311. <https://doi.org/10.1177/0081175012470644>
- Bartholomew, K. J., Ntoumanis, N., Ryan, R. M., & Thøgersen-Ntoumani, C. (2011). Psychological need thwarting in the sport context: Assessing the darker side of athletic experience. *Journal of Sport & Exercise Psychology*, 33, 75–102. <https://doi.org/10.1123/jsep.33.1.75>
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117, 497–529. <https://doi.org/10.1037/0033-2909.117.3.497>
- Belmont, M., Skinner, E., Wellborn, J., & Connell, J. (1988). *Teacher as social context: A measure of student perceptions of teacher provision of involvement, structure, and autonomy support* (tech. Rep (Vol. 102). Rochester, NY: University of Rochester.
- Bieg, S., Backes, S., & Mittag, W. (2011). The role of intrinsic motivation for teaching, teachers' care and autonomy support in students' self-determined. *Journal for Educational Research Online*, 3, 122–140.
- Black, A. E., & Deci, E. L. (2000). The effects of instructors' autonomy support and students' autonomous motivation on learning organic chemistry: A self-determination theory perspective. *Science Education*, 84, 740–756. [https://doi.org/10.1002/1098-237X\(200011\)84:6<740::AID-SCE4>3.0.CO;2-3](https://doi.org/10.1002/1098-237X(200011)84:6<740::AID-SCE4>3.0.CO;2-3)
- Bolck, A., Croon, M., & Hagenaars, J. (2004). Estimating latent structure models with categorical variables: One-step versus three-step estimators. *Political Analysis*, 12, 3–27. <https://doi.org/10.1093/pan/12.3.3>
- Bong, M. (2001). Between- and within-domain relations of academic motivation among middle and high school students: Self-efficacy, task-value, and achievement goals. *Journal of Educational Psychology*, 93, 23–34. <https://doi.org/10.1037/0022-0663.93.1.23>
- Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., et al. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion*, 39, 216–236. <https://doi.org/10.1007/s11031-014-9450-1>
- Danielsen, A. G., Wiium, N., Wilhelmsen, B. U., & Wold, B. (2010). Perceived support provided by teachers and classmates and students' self-reported academic initiative. *Journal of School Psychology*, 48, 247–267. <https://doi.org/10.1016/j.jsp.2010.02.002>
- Deci, E. L. (1975). *Intrinsic motivation*. New York, NY: Plenum.
- Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behaviour*. New York: Plenum.
- Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation practices: A systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educational Research Review*, 24, 31–54. <https://doi.org/10.1016/j.edurev.2018.02.002>
- Domen, J., Hornstra, L., Weijers, D., Van der Veen, I., & Peetsma, T. (2019). Differentiated need support by teachers: Student-specific provision of autonomy and structure and relations with student motivation. *British Journal of Educational Psychology*. <https://doi.org/10.1111/bjep.12302>
- Fielding, A., & Goldstein, H. (2006). *Cross-classified and multiple membership structures in multilevel models: An introduction and review* (Vol. 791). Retrieved from: <http://dera.ioe.ac.uk/6469/1/RR791.pdf>.
- Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74, 59–109. <https://doi.org/10.3102/00346543074001059>
- Green, J., Liem, G. A. D., Martin, A. J., Colmar, S., Marsh, H. W., & McInerney, D. (2012). Academic motivation, self-concept, engagement, and performance in high school: Key processes from a longitudinal perspective. *Journal of Adolescence*, 35, 1111–1122. <https://doi.org/10.1016/j.adolescence.2012.02.016>
- Green, J., Martin, A. J., & Marsh, H. W. (2007). Motivation and engagement in English, mathematics and science high school subjects: Towards an understanding of multidimensional domain specificity. *Learning and Individual Differences*, 17, 269–279. <https://doi.org/10.1016/j.lindif.2006.12.003>
- Grolnick, W. S., & Ryan, R. M. (1987). Autonomy in children's learning: An experimental and individual difference investigation. *Journal of Personality and Social Psychology*, 52, 890–898. <https://doi.org/10.1037/0022-3514.52.5.890>
- Haerens, L., Aelterman, N., Van den Berghe, L., De Meyer, J., Soenens, B., & Vansteenkiste, M. (2013). Observing physical education teachers' need-supportive interactions in classroom settings. *Journal of Sport & Exercise Psychology*, 35, 3–17. <https://doi.org/10.1123/jsep.35.1.3>
- Haerens, L., Aelterman, N., Vansteenkiste, M., Soenens, B., & Van Petegem, S. (2015). Do perceived autonomy-supportive and controlling teaching relate to physical education students' motivational experiences through unique pathways? Distinguishing between the bright and dark side of motivation. *Psychology of Sport and Exercise*, 16, 26–36. <https://doi.org/10.1016/j.psychsport.2014.08.013>
- Henry, K. L., & Muthén, B. (2010). Multilevel Latent Class Analysis: An application of adolescent smoking typologies with individual and contextual predictors. *Structural Equation Modeling: A Multidisciplinary Journal*, 17, 193–215. <https://doi.org/10.1080/10705511003659342>



- Hospel, V., & Galand, B. (2016). Are both classroom autonomy support and structure equally important for students' engagement? A multilevel analysis. *Learning and Instruction, 41*, 1–10. <https://doi.org/10.1016/j.learninstruc.2015.09.001>
- Hornstra, L., Mansfield, C., Van der Veen, I., Peetsma, T., & Volman, M. (2015). Motivational teacher strategies: The role of beliefs and contextual factors. *Learning Environment Research, 18*, 363–392. <https://doi.org/10.1007/s10984-015-9189-y>
- Hornstra, L., Bakx, A., Mathijssen, S., & Denissen, J. J. A. (2020). Motivating gifted and non-gifted students in regular primary schools: A self-determination perspective. *Learning and Individual Differences, 80*. <https://doi.org/10.1016/j.lindif.2020.101871>
- Hornstra, L., Van der Veen, I., & Peetsma, T. (2016). Domain-specificity of motivation: A longitudinal study in upper primary school. *Learning and Individual Differences, 51*, 167–178. <https://doi.org/10.1016/j.lindif.2016.08.012>
- Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: it's not autonomy support or structure, but autonomy support and structure. *Journal of Educational Psychology, 102*, 588–600. <https://doi.org/10.1037/a0019682>
- Koomen, H. M. Y., Verschuere, K., & Pianta, R. C. (2007). Leerling-leraar relatie vragenlijst. Handleiding [Student–Teacher relationship questionnaire. Manual]. Houten: Bohn Stafleu Van Loghum.
- Kuncel, N. R., Crede, M., & Thomas, L. L. (2005). The validity of self-reported grade point averages, class ranks, and test scores: A meta-analysis and review of the literature. *Review of Educational Research, 75*, 63–82. <https://doi.org/10.3102/00346543075001063>
- Leenknecht, M. J. M., Wijnia, L., Loyens, S. M. M., & Rikers, R. M. J. P. (2017). Need-supportive teaching in higher education: Configurations of autonomy support, structure, and involvement. *Teaching and Teacher Education, 68*, 134–142.
- Leflot, G., van Lier, P. A., Onghena, P., & Colpin, H. (2010). The role of teacher behavior management in the development of disruptive behaviors: An intervention study with the good behavior game. *Journal of Abnormal Child Psychology, 38*, 869–882. <https://doi.org/10.1002/icd.672>
- Levesque, C., Zuehlke, A. N., Stanek, L. R., & Ryan, R. M. (2004). Autonomy and competence in German and American university students: A comparative study based on self-determination theory. *Journal of Educational Psychology, 96*, 68–84. <https://doi.org/10.1037/0022-0663.96.1.68>
- Liettaert, S., Roorda, D., Laevers, F., Verschuere, K., & De Fraine, B. (2015). The gender gap in student engagement: The role of teachers' autonomy support, structure, and involvement. *British Journal of Educational Psychology, 85*, 498–518. <https://doi.org/10.1111/bjep.12095>
- Mäkikangas, A., Tolvanen, A., Aunola, K., Feldt, T., Mauno, S., & Kinnunen, U. (2018). Multilevel latent profile analysis with covariates: Identifying job characteristics profiles in hierarchical data as an example. *Organizational Research Methods, 21*(4), 931–954. <https://doi.org/10.1177/1094428118760690>
- Mainhard, T., Oudman, S., Hornstra, L., Bosker, R. J., & Goetz, T. (2018). Student emotions in class: The relative importance of teachers and their interpersonal relations with students. *Learning and Instruction, 53*, 109–119. <https://doi.org/10.1016/j.learninstruc.2017.07.011>
- McNeish, D., Stapleton, L. M., & Silverman, R. D. (2017). On the unnecessary ubiquity of hierarchical linear modeling. *Psychological Methods, 22*, 114–140. <https://doi.org/10.1037/met000007>
- Michou, A., Vansteenkiste, M., Mouratidis, A., & Lens, W. (2014). Enriching the hierarchical model of achievement motivation: Autonomous and controlling reasons underlying achievement goals. *British Journal of Educational Psychology, 84*, 650–666. <https://doi.org/10.1111/bjep.12055>
- Midgley, C., Maehr, M. L., Hruda, L. Z., Anderman, E., Anderman, L., Freeman, K. E., ... Urdan, T. (2000). *Manual for the patterns of adaptive learning scales*. Ann Arbor: University of Michigan.
- Ministry of Education Culture, and Science. (2014). Kerncijfers 2009-2013: Onderwijs, Cultuur, en Wetenschap [Core figures 2009-2013: Education, culture and science]. The Hague: Ministry of Education, Culture and Science.
- Muthén, B., & Muthén, L. (2012). *Mplus version 7: User's guide*. Los Angeles, CA: Muthén & Muthén.
- Noels, K. A. (2003). Learning Spanish as a second language: Learners' orientations and perceptions of their teachers' communication style. *Language Learning, 53*, 97–136. <https://doi.org/10.1111/1467-9922.53225>
- Opdenakker, M.-C., Maulana, R., & den Brok, P. (2012). Teacher–student interpersonal relationships and academic motivation within one school year: Developmental changes and linkage. *School Effectiveness and School Improvement, 23*, 95–119. <https://doi.org/10.1080/09243453.2011.619198>
- Pastor, D. A., Barron, K. E., Miller, B. J., & Davis, S. L. (2007). A latent profile analysis of college students' achievement goal orientation. *Contemporary Educational Psychology, 32*, 8–47. <https://doi.org/10.1016/j.cedpsych.2006.10.003>
- Peetsma, T., Wagenaar, E., & De Kat, E. (2001). School motivation, future time perspective and well-being of high school students in segregated and integrated schools in The Netherlands and the role of ethnic self-description. In J. K. Koppen, I. Lunt, & C. Wulf (Eds.), *Education in europe: Cultures, values, institutions in transition* (pp. 54–74). Münster: Waxmann.
- Pelletier, L. G., Séguin-Lévesque, C., & Legault, L. (2002). Pressure from above and pressure from below as determinants of teachers' motivation and teaching behaviors. *Journal of Educational Psychology, 94*, 186–196. <https://doi.org/10.1037/0022-0663.94.1.186>
- Reeve, J. (2009). Why teachers adopt a controlling motivating style toward students and how they can become more autonomy-supportive. *Educational Psychologist, 44*, 159–175.
- Roede, E. (1989). *Explaining student investment: An investigation of high school students' retrospective causal accounts of their investment in school*. University of Amsterdam (Doctoral dissertation).
- Ryan, R. M. (1995). Psychological needs and the facilitation of integrative processes. *Journal of Personality, 63*, 397–427. <https://doi.org/10.1111/j.1467-6494.1995.tb00501.x>
- Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology, 57*, 749–761. <https://doi.org/10.1037/0022-3514.57.5.749>
- Ryan, R. M., & Deci, E. L. (2000b). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25*, 54–67. <https://doi.org/10.1006/ceps.1999.1020>
- Ryan, R. M., & Deci, E. L. (2018). *Self-Determination Theory. Basic psychological needs in motivation, development, and wellness*. New York: Guilford Publications.
- Schuitema, J., Peetsma, T., & van der Veen, I. (2016). Longitudinal relations between perceived autonomy and social support from teachers and students' self-regulated learning and achievement. *Learning and Individual Differences, 49*, 32–45. <https://doi.org/10.1016/j.lindif.2016.05.006>
- Sierens, E., Vansteenkiste, M., Goossens, L., Soenens, B., & Dochy, F. (2009). The synergistic relationship of perceived autonomy support and structure in the prediction of self-regulated learning. *British Journal of Educational Psychology, 79*, 57–68. <https://doi.org/10.1348/000709908x304398>
- Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effects of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*, 571–581. <https://doi.org/10.1037/0022-0663.85.4.571>
- Skinner, E., Furrer, C., Marchand, G., & Kindermann, T. (2008). Engagement and disaffection in the classroom: Part of a larger motivational dynamic? *Journal of Educational Psychology, 100*(4), 765–781. <https://doi.org/10.1037/a0012840>
- Stroet, K., Opdenakker, M.-C., & Minnaert, A. (2013). Effects of need supportive teaching on early adolescents' motivation and engagement: A review of the literature. *Educational Research Review, 9*, 65–87. <https://doi.org/10.1016/j.edurev.2012.11.003>
- Stroet, K., Opdenakker, M.-C., & Minnaert, A. (2015). What motivates early adolescents for school? A longitudinal analysis of associations between observed teaching and motivation. *Contemporary Educational Psychology, 42*, 129–140. <https://doi.org/10.1016/j.cedpsych.2015.06.002>
- Van den Bergh, L., Soenens, B., Aelterman, N., Cardon, G., Tallir, I. B., & Haerens, L. (2014). Within-person profiles of teachers' motivation to teach: Associations with need satisfaction at work, need-supportive teaching, and burnout. *Psychology of Sport and Exercise, 15*, 407–417. <https://doi.org/10.1016/j.psychsport.2014.04.001>
- Vansteenkiste, M., Lens, W., De Witte, S., De Witte, H., & Deci, E. L. (2004a). The "why" and "why not" of job search behaviour: Their relation to searching, unemployment experience, and well-being. *European Journal of Social Psychology, 34*(3), 345–363. <https://doi.org/10.1002/ejsp.202>
- Vansteenkiste, M., Lens, W., & Deci, E. L. (2006). Intrinsic versus extrinsic goal contents in Self-Determination Theory: Another look at the quality of academic motivation. *Educational Psychologist, 41*, 19–31. [https://doi.org/10.1207/s15326985ep4101\\_4](https://doi.org/10.1207/s15326985ep4101_4)
- Vansteenkiste, M., Sierens, E., Goossens, L., Soenens, B., Dochy, F., Mouratidis, A., et al. (2012). Identifying configurations of perceived teacher autonomy support and structure: Associations with self-regulated learning, motivation and problem behavior. *Learning and Instruction, 22*, 431–439. <https://doi.org/10.1016/j.learninstruc.2012.04.002>
- Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of Educational Psychology, 101*(3), 671–688. <https://doi.org/10.1037/a0015083>
- Vansteenkiste, M., Simons, J., Lens, W., Sheldon, K. M., & Deci, E. L. (2004b). Motivating learning, performance, and persistence: The synergistic effects of intrinsic goal contents and autonomy-supportive contexts. *Journal of Personality and Social Psychology, 87*, 246–260. <https://doi.org/10.1037/0022-3514.87.2.246>
- Vermunt, J. K., & Magidson, J. (2002). Latent class cluster analysis. In J. A. Hagenaars, & A. L. McCutcheon (Eds.), *Applied latent class analysis* (pp. 89–106). Cambridge, UK: Cambridge University Press.