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Toward an Integrative and Fine-Grained Insight in Motivating and Demotivating Teaching Styles: The Merits of a Circumplex Approach

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Guided by Self-Determination Theory, we offer an integrative and fine-grained analysis of teachers' classroom motivating style (i.e., autonomy support, structure, control, and chaos) to resolve existing controversies in the literature, such as how these dimensions relate to each other and to educationally important student and teacher outcomes. Six independent samples of secondary school teachers ($N = 1332$; $M_{age} = 40.9$ years) and their students ($N = 1735$, $M_{age} = 14.6$ years) read 12 ecologically valid vignettes to rate four dimensions of teachers' motivating styles, using the Situations-in-School (SIS) questionnaire. Multidimensional scaling analyses of both the teacher and the student data indicated that motivating and demotivating teaching could best be graphically represented by a two-dimensional configuration that differed in terms of need support and directiveness. In addition, eight subareas (two subareas per motivating style) were identified along a circumplex model: participative and attuning, guiding and clarifying, demanding and domineering, and abandoning and awaiting. Correlations between these eight subareas and a variety of construct validation and outcome variables (e.g., student motivation, teacher burnout) followed an ordered sinusoid pattern. The discussion focuses on the conceptual implications and practical advantages of adopting a circumplex approach and sketches a number of important future research directions.

Educational Impact and Implications Statement

The present study suggests that rather than categorizing secondary school teachers as either motivating or demotivating, this approach reveals that an attuning and guiding approach relate to the most adaptive pattern of teacher and student outcomes, whereas an opposite pattern is found for a domineering and abandoning approach. This greater clarity allows teachers to gain a more precise insight into their own teaching style so that they adopt a more need-supportive style that benefits their students and themselves.

Keywords: autonomy support, multidimensional scaling, self-determination theory, structure, teaching styles

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Teachers play a major role in children's engagement, learning, and development more broadly (Wentzel, 2009). Especially critical in this process is teachers' motivating style, that is, the practices they rely on to foster children's motivation (Reeve, 2009; Wubbels, Brekelmans, den Brok, & van Tartwijk, 2006). A teacher's highly structured, highly autonomy-supportive motivating style is associated with various positive and educationally important student outcomes, such as motivation, engagement, learning, and well-being (Jang, Reeve, & Deci, 2010; Vansteenkiste et al., 2012), whereas a teacher's highly controlling motivating style is associated with a wide range of negative student outcomes (Assor, Kaplan, Kanat-Maymon, & Roth, 2005; Haerens, Vansteenkiste, Aelterman, & Van den Berghe, 2016). Experimentally based intervention research further shows that teachers can be successfully trained to adopt an autonomy-supportive (Aelterman, Vansteenkiste, Van den Berghe, De Meyer, & Haerens, 2014; Chatzisarantis

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& Hagger, 2009) and structuring (Cheon, Reeve, & Vansteenkiste, 2017) motivating style, to the benefit of both their students and themselves (Cheon, Reeve, Yu, & Jang, 2014; Reeve, 2016).

Although teachers generally hold the belief that an autonomy-supportive teaching style is beneficial for students' sustainable motivation, engagement, and learning (Aelterman, Vansteenkiste, Van Keer, & Haerens, 2016; De Meyer, Soenens, Aelterman, De Bourdeaudhuij, & Haerens, 2016; Reeve et al., 2014), they also fear that too much autonomy support might undermine structure and lead to demotivating chaos. At the same time, teachers sometimes express anxiety about providing too much structure, fearing that it might lead to demotivating control. In the present research, we adopt a Self-Determination Theory framework (SDT; Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013) to examine how the various dimensions of a teacher's classroom (de)motivating style (i.e., autonomy support, control, structure, and chaos; see Table 1)

Table 1
Conceptual Definitions of the Four Teaching Styles and Description of Eight Identified Teaching Approaches

Teaching style	Conceptual definition	Subarea	Description
Autonomy support	The teacher's instructional goal and interpersonal tone of ***understanding.*** The teacher seeks to maximally identify and nurture students' interests, preferences and feelings, so that students can volitionally engage themselves in classroom learning activities.	Participative	A ***participative*** teacher identifies students' personal interests by engaging in a dialogue with students and inviting them to provide input and suggestions. In addition, where possible, the teacher tries to offer (meaningful) choices in how students deal with learning activities and optimally follows their pace.
		Attuning	An ***attuning*** teacher nurtures students' personal interests by trying to find ways to make the exercises more interesting and enjoyable, accepting students' expressions of negative affect and trying to understand how students see things. The teacher allows students to work at their own pace and provides explanatory rationales that are meaningful in the eyes of students.
Structure	The teacher's instructional goal and interpersonal tone of ***guidance.*** Starting from the capabilities and abilities of students, the teacher provides strategies, help and assistance, so that students feel competent to master classroom learning activities.	Guiding	A ***guiding*** teacher nurtures students' progress by providing appropriate help and assistance as and when needed. The teacher goes through the steps that are necessary to complete a task, so that students can continue independently and, if necessary, can ask questions. Together with the students the teacher constructively reflects on mistakes, so that they see for themselves what can be improved and how they can improve.
		Clarifying	A ***clarifying*** teacher communicates expectations to students in a clear and transparent way. The teacher offers an overview of what students can expect from the lesson and monitors students' progress in meeting the communicated expectations.
Control	The teacher's instructional goal and interpersonal tone of ***pressure.*** The teacher insists that students think, feel, and behave in a prescribed way and imposes his/her own agenda and requirements on students, irrespective of what students think.	Demanding	A ***demanding*** teacher requires discipline from the students by using powerful and commanding language to make clear what students have to do. The teacher points students on their duties, tolerates no participation or contradiction, and threatens with sanctions if students don't comply.
		Domineering	A ***domineering*** teacher exerts power to students to make them comply with his/her requests. The teacher suppresses students by inducing feelings of guilt and shame. While a demanding teacher tries to change students' thoughts, feelings, and behaviors into something more acceptable to the teacher, a domineering approach is characterized by a 'personal attack' on students.
Chaos	The teacher's instructional goal and interpersonal tone of ***laissez faire.*** The teacher leaves students on their own, making it confusing for students to figure out what that they should do, how they should behave, and how they can develop their skills.	Abandoning	An ***abandoning*** teacher gives up on students. The teacher allows students to just do their own thing, because eventually students have to learn to take responsibility for their own behavior.
		Awaiting	An ***awaiting*** teacher offers a laissez-faire learning climate where the initiative fully lies with the students. The teacher tends to wait to see how things evolve, doesn't plan too much and rather let things take their course.

are related to each other from a more integrative perspective, and we suggest that a finer-grained analysis of motivating style is necessary to make further progress in this area of research and practice. Specifically, we suggest that within each of these four broader teaching styles there is room for differentiation into more specific subareas, which can be ordered along a circular structure depicted in Figure 1. To illustrate, some aspects of autonomy support are likely to be closely related and complementary to structure (e.g., attuning to students' preferences), whereas other aspects of autonomy support lean closer to chaos (e.g., encouraging participation such that students take the lead in their learning). Similarly, we suggest that some aspects of structure are likely to be closely related and complementary to autonomy support (e.g., guiding students' progress), whereas other aspects of structure are closely related to control (e.g., clarifying expectations).

To gain such integrative and fine-grained insights in teachers' (de)motivating style, we adopted a circumplex approach. Specifically, we relied on multidimensional scaling analysis (Borg, Groenen, & Mair, 2013), a more descriptive analytical strategy that generates a visual insight in how different teaching styles (i.e., autonomy support, structure, control, chaos) and identified subareas relate to each other by situating them into a multidimensional structure based on their pattern of proximities or similarities. To test the validity of the obtained dimensional configuration, we examined whether a similar circumplex structure would emerge in six independent samples of secondary school teachers (total $N = 1332$) and students (total $N = 1735$), and whether the identified styles and finer-grained subareas would be associated in a systematic way with a wide range of adaptive and maladaptive aspects of both students' and teachers' functioning.

Teacher Autonomy Support and Control

At the heart of SDT is the postulation of three basic psychological needs, that is, the needs for autonomy (i.e., experiencing a sense of volition), competence (i.e., experiencing a sense of effectance), and relatedness (i.e., experiencing a sense of connection). Congruent with its presumed growth-promoting role of the psychological needs, abundant research has shown that the satisfaction of these needs relates to engagement, well-being, and development, whereas their frustration relates to disengagement, ill-being, and even psychopathology (Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013).

In light of the central role of these needs, dozens of studies have addressed the question of how teachers can nurture students' psychological needs. Historically, teachers' provision of autonomy support received most attention, with cross-sectional (e.g., Deci, Schwartz, Sheinman, & Ryan, 1981), longitudinal (e.g., Jang, Kim, & Reeve, 2016; Reeve, 2013), observational (e.g., Stroet, Opdenakker, & Minnaert, 2015), interventional (e.g., Cheon, Reeve, & Moon, 2012), and experimental studies (e.g., Mouratidis, Vansteenkiste, Sideridis, & Lens, 2011) all indicating that autonomy support fosters need satisfaction and brings multiple benefits, including more deep-level learning, engagement, and well-being.

When being autonomy-supportive, teachers adopt a curious, receptive, and open attitude, which allows them to better empathize with and nurture learners' emerging interests, values, and preferences (see Table 1). Several components of autonomy-supportive teaching have been identified, including taking students' perspective and welcoming their input (Jang, Reeve, & Halusic, 2016), offering choices (e.g., Patall, Cooper, & Wynn, 2010), providing a meaningful rationale (e.g., Assor, Kaplan, & Roth, 2002; Vansteenkiste et al., 2018), following students' pace (Reeve & Jang, 2006), using invitational language (e.g., Vansteenkiste, Simons, Lens, Sheldon, & Deci, 2004), nurturing inner motivational resources such as task interest (e.g., Tsai, Kunter, Lüdtke, Trautwein, & Ryan, 2008) and accepting expressions of negative affect (Reeve, 2009). In experimental studies (e.g., Reeve, Jang, Hardre, & Omura, 2002; Savard, Joussemet, Pelletier, & Mageau, 2013), these different components have typically been

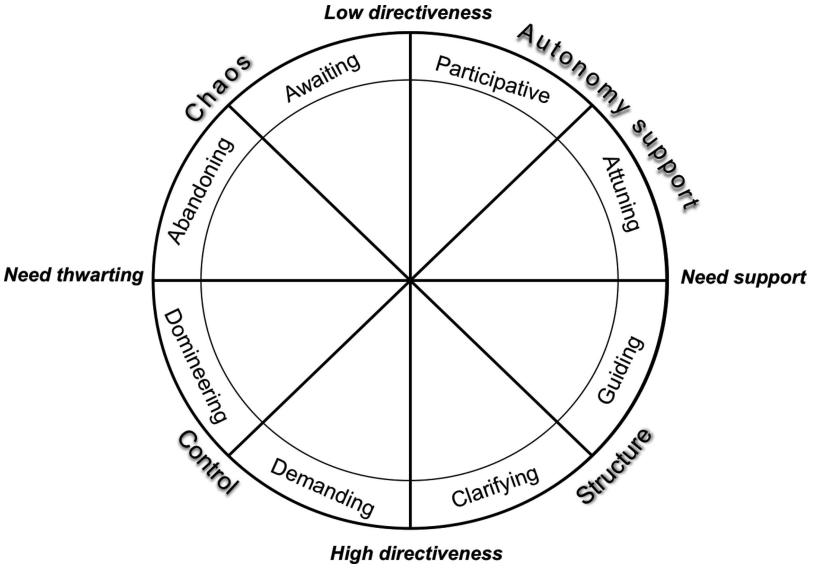

Figure 1. Graphical representation of the circumplex model.

studied in isolation or by using noncomprehensive composites (e.g., Jang et al., 2010; Patall, Dent, Oyer, & Wynn, 2013), with some studies emphasizing a *participative* approach (e.g., offer of choice) and others emphasizing an *attuning* approach (e.g., perspective taking; see Figure 1).

In contrast, when being controlling, teachers adopt a tunnel-view in which their own agenda and expectations get prioritized, which leads them to exert pressure on learners to act, think, or feel in specific ways (see Table 1). Teachers can exert such pressure in a variety of ways, with some strategies involving external control, such as threatening with sanctions; yelling, intimidating, and offering behaviorally contingent rewards (Bartholomew, Ntoumanis, Ryan, Bosch, & Thogersen-Ntoumani, 2011), and others involving more internal control, such as guilt-induction or shaming (Soenens & Vansteenkiste, 2010). The latter strategies may be more intrusive, manipulative, and *domineering* in nature because the student as a person is targeted, while the former may be more *demanding* in nature (see Figure 1), because the teacher uses behavior-focused pressuring strategies to force students to comply or to rectify their misbehavior.

Research has further increasingly indicated that the absence of teacher autonomy support does not denote the presence of teacher control (e.g., Haerens, Aelterman, Vansteenkiste, Soenens, & Van Petegem, 2015; Jang et al., 2016). For teachers to be perceived as controlling, they need to more directly suppress students' psychological needs and interfere with their volitional functioning. Congruent with a presumed dual process model, previous studies have found teacher control to be especially predictive of amotivation (e.g., De Meyer et al., 2014), oppositional defiance (Haerens et al., 2015), and disengagement (Jang et al., 2016), whereas teacher autonomy support simultaneously predicts students' positive adjustment and functioning. This relatively new research is important because it makes clear that autonomy support and control are two separate dimensions of teaching, rather than mere opposites falling along a single continuum.

Teacher Structure and Chaos

Whereas autonomy-supportive teaching is especially critical to foster autonomy need satisfaction, structure fosters students' competence (Skinner, Zimmer-Gembeck, & Connell, 1998). When providing structure, teachers adopt a process-oriented attitude, thereby trying to align activities and expectations with children's emerging skills while suggesting strategies and offering help, so that learners feel competent to master classroom learning activities (Vansteenkiste & Soenens, 2015; see Table 1). Like autonomy support, structure consists of several components, some of which are directly supportive of learners' competence and some of which are more indirectly relevant (Haerens et al., 2013; Mouratidis, Vansteenkiste, Michou, & Lens, 2013; Ryan & Deci, 2017). One key feature of structure involves communicating clear expectations and guidelines for desirable behavior (e.g., being cooperative) and undesirable behavior (e.g., not disturbing others while they are working), whereas a second involves providing step-by-step "how to" directions to attain those desired expectations (Jang et al., 2010; Vansteenkiste et al., 2012). The setting and monitoring of clear expectations and guidelines, which can be part of a *clarifying* approach (see Figure 1), is considered a precondition for learners to develop a sense of effectiveness. That is, when the learning objectives are unclear or learners are not informed about which steps are required to meet them, it will be more difficult for them successfully achieve these objectives. Moreover, such practices help learners to perceive the classroom environment as predictable and safe, which is indispensable to effective classroom management (Evertson & Weinstein, 2006; Gable, Hester, Rock, & Hughes, 2009).

Other components of structure include offering "how to" guidance and desired help during activities (Jang et al., 2010), adjusting tasks' difficulty levels in accordance with students' skills (Belmont, Skinner, Wellborn, & Connell, 1988), providing positive informational feedback during and after task completion (Koka & Hein, 2005; Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008), and expressing confidence in students' capabilities (Reeve, 2006). These *guiding* components of structure (see Figure 1) may more directly nurture learners' competence as the offer of tailored help and adjustment of task difficulty enables students to develop a sense of effectiveness, whereas the provision of positive feedback directly signals learners' effectiveness. Several studies have demonstrated that teacher structure, either perceived by students (Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009) or observed by external raters (Jang et al., 2010), brings multiple benefits, including greater competence and perceived control (Skinner et al., 1998), better self-regulated learning (Sierens et al., 2009), less depressive feelings (Mouratidis et al., 2013), and greater engagement (Jang et al., 2010), which are effects that can be largely accounted for by competence need satisfaction (Mouratidis et al., 2013). These benefits have also been shown in relation to corresponding constructs in the teaching literature, such as instructional scaffolding (van de Pol, Volman, & Beishuizen, 2010) and adaptive instruction (Aleven, McLaughlin, Glenn, & Koedinger, 2017).

Historically, compared with SDT investigations of teacher autonomy support, the notion of structure emerged more recently on researchers' agenda, with scholars focusing particularly on whether autonomy-supportive teaching is compatible with the provision of structure or at odds with it. The support of learners' autonomy is potentially compatible with the structuring of learners' behavior and school tasks, yet the way of doing so can vary, as structure can be introduced in an autonomy-supportive (e.g., by providing rationales) or in a controlling (e.g., by threatening students who do not follow teachers' guidelines) way. Consistent with such theorizing, past research has begun to suggest that autonomy support and structure can go hand in hand as exemplified in the obtained positive correlations between both styles (Jang et al., 2010; Vansteenkiste et al., 2012), and interaction effects in which the benefits of structure to students' self-regulated learning are more pronounced when structure is provided in an autonomy-supportive way (Curran, Hill, & Niemiec, 2013; Sierens et al., 2009).

The role of chaos has been largely neglected in the SDT literature (but see Skinner, Johnson, & Snyder, 2005 in the parenting domain). When being chaotic, teachers not only fail to successfully adjust their instruction to the developmental pace and growth potential of learners, but also actively interfere with their students' competence development (see Table 1). Although little is known about the specific features of a chaotic teaching style, like the other three styles, chaos also likely consists of various components. Teachers come across as chaotic when they adopt an *awaiting*

approach (see Figure 1), thereby being unclear or even contradictory about their requirements and expectations for learners. As a result, students may experience the learning environment as confusing, and may feel incapable and uncertain as to how to proceed. Chaos can also take the form of permissiveness (Baumrind, 2012) where teachers fail to stick to introduced guidelines and rules, thereby creating a laisser-faire climate. Finally, teachers may leave students to their own devices, presumably because teachers feel unable or have helplessly given up in the instructional effort to provide the required assistance. If students notice that their teacher has *abandoned* (see Figure 1) them, they may especially doubt their skills and even question themselves as a person.

Present Research

Although substantial progress has been made to understand the effects of teacher-provided autonomy support, structure, and control, little is known about (a) how they are related to each other from an integrative perspective and (b) whether there is room for differentiation and refinement within each of these overarching styles. To achieve this double aim of integration and refinement, we relied on multidimensional scaling (MDS: Borg et al., 2013), which provides a graphical representation of (dis)similarities between different items (reflecting teaching practices) as distances between points in a geometrical space. Also, we developed a new vignette-based instrument, the Situations-in-School (SIS) Questionnaire, which presents respondents with authentic situations and depicts four different teacher reactions to each situation. These four reactions represent the key motivating styles studied herein, that is, teacher autonomy support, control, structure, and chaos. The specific aims of the present study were then to provide evidence for the SIS's internal validity (Aim 1), construct validity and reliability (Aim 2), and predictive validity (Aim 3), thereby pursuing five directional hypotheses. In addressing these aims, we controlled for teachers' social desirability response tendencies to rule out that any of the observed associations is driven by such a response tendency.

Aim 1: Internal Validity

Relying on MDS analyses, we aimed to identify the divergences and compatibilities between the four broad teaching styles (i.e., autonomy support, structure, control, and chaos). As can be noticed in Figure 1, the four teaching styles were hypothesized to be represented as a two-dimensional circumplex. As autonomy support and structure are considered motivating (i.e., need-supportive) teaching styles, we hypothesized that they would be related, and thus would be represented adjacent to one another within the geometrical representation. Similarly, we expected control and chaos to be related as both are considered demotivating (i.e., need thwarting) teaching styles. As such, a first dimension would reflect the degree to which teachers are need-supportive, relative to need thwarting. A second dimension would reflect the degree to which teachers are directive (see also Koestner, Powers, Milyavskaya, Carbonneau, & Hope, 2015). Because teachers are more directive when they either provide structure (e.g., setting expectations) or are controlling (e.g., demanding cooperation), these two styles were expected to be adjacent to one another. Similarly, because teachers are, relatively speaking, less directive when they adopt an autonomy-supportive (e.g., providing choice) or chaotic (e.g., leaving students on their own) style, these two styles were also expected to be adjacent. Moreover, based on the SDT-literature we expected that both autonomy support and control as well as structure and chaos to be represented as opposite from one another within the geometrical representation (Hypothesis 1a).

In light of a handful studies which indicated that teacher autonomy support (Assor et al., 2002; Patall et al., 2013), teacher control (De Meyer et al., 2016) and teacher structure (Haerens et al., 2013) can be deconstructed into subareas, we expected that there would be room for differentiation within each of these overarching styles (Hypothesis 1b). As can be noticed in Figure 1, autonomy support is likely to partition into a *participative* subarea including practices such as the offer of choice and the welcoming of students' input, which leave more room for students to take the lead, and a subarea involving practices where the teacher is *attuning* to students' interests, feelings, and wishes by providing a meaningful rationale, fostering task interest, or empathizing with negative affect. In such cases, teachers are more strongly taking the lead in comparison with the offer of choice, so that attuning practices are likely to be somewhat more directive than participative practices. Next, structure is likely to subdivide into *clarifying* practices such as the setting of expectations and monitoring, which are more directive preconditions for competence development, and *guiding* practices such as providing help, expressing confidence, and giving positive feedback, which are less directive and more directly supportive of learning's competence (e.g., Haerens et al., 2013). Further, control consists of a variety of directive strategies, with some being more intrusive and manipulative than others. Because *domineering* practices like shaming, guilt-induction, or personal attack come with more intense pressure and internal control, they are somewhat more directly thwarting of students' basic psychological needs, relative to *demanding* practices such as threatening with sanctions and offering behaviorally contingent rewards. Finally, chaos likely separates into an *awaiting* subarea including practices where the teacher is unclear about expectations and awaits how the situation evolves, which leave more room for students to take the lead, and an *abandoning* subarea involving practices such as leaving students to their own devices while help and assistance is called for, such that an abandoning approach is experienced as highly need thwarting.

In line with the assumptions underlying a circumplex model and testifying to the proposed differentiation within each of the overarching styles, we further expected that the each identified subareas would correlate most strongly with its two adjacent subareas and become decreasingly positive and even increasingly negative as one moves along the circle to more distant and eventually the opposing subarea (Hypothesis 2). Finally, we explored whether the obtained dimensional configuration would emerge both among teachers and students and we investigated the degree of stability across the obtained configurations in both groups.

Aim 2: Psychometric Properties and Construct Validation

We examined the psychometric properties of the scales by testing the reliabilities of the four teaching styles and identified subareas and their relation with commonly used teaching style measures in the literature (TASCQ, Belmont et al., 1988; PCT, Soenens, Sierens, Vansteenkiste, Dochy, & Goossens, 2012; TRS,

Reeve, Jang, Carrell, Jeon, & Barch, 2004). In terms of construct validity, we expected the four teaching styles and their respective subareas to correlate most strongly with the corresponding validation measures. Similar to the ordered pattern of correlations obtained among identified subareas themselves and apart from the hypothesized peak between a specific subarea and a corresponding validation measure, we hypothesized that correlations would become decreasingly positive and even negative as one gradually moves from one subarea to another along the circumplex model (Hypothesis 3). Next, we examined the degree of convergence in the identified areas across both informants (i.e., teachers and students). In light of past work indicating that perceptions of teachers and students—even within the same class—are idiosyncratic (e.g., Könings, Seidel, Brand-Gruwel, & van Merriënboer, 2014), we expected rather modest levels of convergence between teachers and students (e.g., Broekkamp, Van Hout-Wolters, Rijlaarsdam, & Van den Bergh, 2002; den Brok, Bergen, & Brekelmans, 2006; Taylor & Ntoumanis, 2007; Hypothesis 4a). In addition, substantial mean-level differences between teacher- and student-reports were expected, with teachers reporting to engage in more need-supportive and less need-thwarting teaching behaviors compared with what their students would perceive and report (Hypothesis 4b).

Aim 3: Nomological Network and Predictive Validity

The final aim involved examining how the four broader teaching styles and eight identified subareas correlated with a range of external variables, including teaching motivation, burnout, and need-based experiences among teachers, as well as motivation, oppositional defiance, self-regulated learning, and rated teacher quality among students. In line with the proposed circumplex model, we again expected an ordered pattern of correlations. The need-supportive areas were expected to be positively correlated with adaptive outcomes and negatively with maladaptive outcomes, whereas an opposite pattern of correlations was expected for the need-thwarting subareas (Hypothesis 5).

Method

Participants and Procedure

Six independent samples of teachers ($N = 1332$) and/or students ($N = 1735$) in Flanders (Belgium) were used throughout the different phases of the study: four large convenience samples and two school specific samples.[1] The demographic characteristics of each sample appear in Table 2, and an overview of how the samples were used to address the aims of the study, along with the variables assessed in each sample, appears in Table 3. In each sample, participants completed the vignettes before construct and predictive validity measures were assessed. Sample 1 and Sample 2 participated by completing an online assessment that was either part of a large-scale study on the school's motivational climate ($N = 15$ schools) or was conducted in conjunction with an invited school-wide talk given by one of the first authors ($N = 9$ schools). For Sample 3, school principals were contacted by e-mail to ask permission for their teachers to cooperate in the study. Teachers were asked to fill out an online questionnaire twice with an interval of at least two weeks. Test–retest reliability analyses were based on T1 and T2 data of 89 teachers, whereas the T2 data were used in the MDS analyses. Sample 4 constituted a school specific sample of 729 students who completed an online questionnaire during the last month of the school year. Sample 5 comprised 56 teachers and their 1006 students of one large secondary school, who filled out a questionnaire online. Data from the teachers were linked to the data of their students, so that the convergence between both informants could be examined. Sample 6 involved secondary school teachers from eight different schools who followed the same online assessment procedure as used with Samples 1 and 2.

In each sample, an informed consent form explaining the purposes of the study preceded the Internet survey. Participation was voluntary and confidential and participants could drop out at any time for any reason. With respect to the student samples, a passive parental consent method was used by distributing a letter to students' parents explaining the purposes of the study and providing a method to retract permission. All parents gave permission for their child to participate in the study.

Teacher Measures

Teacher's teaching style. Rather than making use of generic items (e.g., "I give my students a lot of choices regarding schoolwork"; Belmont et al., 1988), we made use of a vignette-based instrument, entitled the Situations-in-School (SIS) Questionnaire. Vignettes have the advantage of being embedded in more authentic situations, and thus likely carry high (ecological) validity (Evans et al., 2015; Taylor & Ntoumanis, 2007). The Situations-in-School (SIS) Questionnaire was developed in collaboration with SDT experts and extensively pilot tested with an additional sample of 339 teachers (35.0% men; $M_{age} = 43.2 \pm 10.7$ years) from six secondary schools in Flanders (Belgium). The SIS consists of a pool of 12 vignettes of situations (see online supplemental material) representing a wide range of situations that could be grouped in different ways. First, the timing of the event differed across the vignettes, occurring either before, during or at the end of a lesson. Second, the type of event also differed, with some vignettes depicting a problem that required the teacher to intervene and remedy the situation (e.g., "At a difficult point in the lesson students begin to complain. In response, you . . ."), and other situations depicting a nonproblematic situation in which the teacher takes a more proactive role (e.g., "You are thinking about classroom rules. So you . . ."). Finally, the content also differed across vignettes, with some vignettes involving the provision of learning content (e.g., "It is time for students to practice what they have learned. You . . .") and others involving the introduction or monitoring of guidelines or a code of conduct (e.g., "A couple of students have been rude and disruptive. To cope, you . . ."). For each of the 12 vignettes participants were provided with four different teaching behaviors that correspond to an autonomy-supportive, controlling, structuring and chaotic style. Using a 7-point Likert scale ranging from 1 (*does not describe me at all*) to 7 (*does describe me extremely well*), teachers were asked to

[1] All data files and syntaxes for the present study are available on Open Science Framework Storage: Aelterman, N. (2018, April 11). Situations-in-School Questionnaire. Retrievable from osf.io/e6d9n.

Table 2
Demographic Characteristics of the Participants in the Six Samples

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5		Sample 6
Target group	Teachers	Teachers	Teachers	Students	Teachers	Students	Teachers
N	448	253	89	729	56	1006	486
Sex							
Male	35.0%	34.4%	46.1%	42.1%	40.7%	46.7%	39.7%
Female	65.0%	65.6%	53.9%	57.9%	59.3%	53.3%	60.3%
Age							
Range	22–61	22–61	24–61	11–20	22–59	11–19	21–65
Mean	40.18	41.26	43.08	14.93	40.26	14.18	39.80
SD	10.99	10.47	10.32	1.89	10.72	1.73	10.25
Teaching experience							
Range	0–53	0–40	0–38	—	NN	—	0–39
Mean	15.25	14.50	15.51	—	NN	—	14.65
SD	10.95	10.68	10.58	—	NN	—	9.65
Education							
Bachelor's degree	64.5%	70.0%	47.2%	—	NN	—	59.9%
Master's degree	35.5%	30.0%	38.4%	—	NN	—	33.7%
Other			18.0%	—	NN	—	6.4%
Educational track							
Academic	—	—	—	57.2%	—	89.5%	—
Technical	—	—	—	33.9%	—	10.5%	—
Vocational	—	—	—	8.9%	—	0.0%	—

indicate to the degree to which each of these four behaviors described their own style.

Social desirability. The Marlowe-Crowne Social Desirability Scale (MC-SDS; Crowne & Marlowe, 1960) was used to assess the extent to which teachers were concerned with social approval. The original 33-item questionnaire was created to measure social desirability bias, which is considered one of the most common biases affecting survey research. In the present study, teachers were asked to fill out an adapted short version of the scale consisting of 10 items (e.g., "I never hesitate to help someone in trouble," "If I made a mistake, I'm always willing to admit it") with a true–false response scale (Fischer & Fick, 1993). A high correlation between scores on the MC-SDS and another measure suggests that the latter is measuring a respondent's desire to answer in socially desirable ways, whereas a low correlation suggests that the measure is relatively free of social desirability bias. Internal consistency of the scale was rather poor with Cronbach's alpha = .56, though still consistent with past findings using this scale (Fischer & Fick, 1993).

Construct validation measures. For construct validation purposes, teachers filled out the Teacher as Social Context Questionnaire—Teacher version (TASCQ; Belmont et al., 1988), the Psychologically Controlling Teaching Questionnaire (PCT; Soenens et al., 2012), and the Teaching Rating Scale (TRS; Reeve et al., 2004).

The three composite TASCQ subscales were used to measure various components of teachers' provision of autonomy support (12 items; e.g., "I try to give a lot of choices about how to do the exercise to my students"), structure (15 items; e.g., "I talk with my students about my expectations for them"), and involvement (14 items; "I find it easy to like my students"). Items were rated on a 5-point Likert scale ranging between 1 (*completely disagree*) and 5 (*completely agree*). Internal consistencies were satisfactory with Cronbach's alpha of .65, .79, and .81 for autonomy support, structure, and involvement, respectively. Controlling teaching was measured with the 7-item scale for psychologically controlling teaching (α = .65, e.g., "I'm less friendly to my students if they do not see things my way"). Items were rated on a 5-point Likert scale ranging between 1 (*completely disagree*) and 5 (*completely agree*). Finally, teachers also filled out the 20-item TRS, which was previously used to observe teachers' autonomy support, structure, control and chaos in a study by Reeve and colleagues (2004), and for the purposes of the present study was adjusted to a self-report format. Specifically, the original bipolar items (e.g., with 1 = *controlling* and 7 = *autonomy-supportive*) of the rating sheet were decoupled as to obtain separate items for each of the four teaching styles to be rated by teachers on a 7-point Likert scale ranging between 1 (*does not describe me at all*) to 7 (*does describe me extremely well*). Cronbach's alphas were satisfactory for autonomy support (5 items; α = .75, e.g., "I explain to students the reasons for procedures and requests," "I acknowledge and accept negative feelings and irritation"), structure (5 items; α = .63, e.g., "I communicate clear expectations," "I provide helpful feedback"), and control (5 items; α = .67; "I insist that students have to do what they have to do," "I use commanding language"), but low for chaos (5 items; α = .44, e.g., "I expect that students solve their problems by themselves," "I await and see what my students are capable of").

Predictive validity measures. For predictive validity purposes, teachers reported on their motivation to teach, feelings of burnout, and need-based experiences at school. To measure teachers' motivation to teach we relied on an adapted version of the well-established Self-Regulation Questionnaire—Academic (Ryan & Connell, 1989). The validity of the questionnaire has previously been demonstrated in terms of theoretically anticipated associations with teachers' teaching style and burnout (Soenens et al., 2012; Van den Berghe et al., 2014). The

Table 3
Overview of the Use of the Six Samples to Address the Three Study Aims

Aim	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5		Sample 6
	Teachers (N = 448)	Teachers (N = 253)	Teachers (N = 89)	Students (N = 729)	Teachers (N = 56)	Students (N = 1006)	Teachers (N = 486)
Aim 1: Internal validity							
Multidimensional scaling SIS12	X	X	X	X	X	X	
Multidimensional scaling SIS15							X
Intercorrelations	X	X	X	X	X	X	X
Aim 2: Psychometric properties							
Reliability	X	X	X	X	X	X	X
Test–retest reliability			X				
Social desirability tendency	X	X					
Construct validity							
Autonomy support (TASCQ)	X						
Autonomy support (TRS)		X					
Structure (TASCQ)	X						
Structure (TRS)		X					
Psychological control (PCT)	X						
Control (TRS)		X					
Chaos (TRS)		X					
Involvement (TASCQ)	X						
Aim 3: Predictive validity							
Teacher variables							
Motivation to teach	X	X			X		X
Burnout	X	X			X		X
Need-based experiences		X			X		X
Student variables							
Motivation to study				X		X	
Oppositional defiance				X		X	
Self-regulated learning				X			
Rated teacher quality				X		X	

Note. SIS12 = Situations-in-School Questionnaire with 12 vignettes; SIS15 = Situation-in-School Questionnaire with 15 vignettes; TASCQ = Teacher as Social Context Questionnaire; PCT = Psychologically Controlling Teaching; TRS = Teacher Rating Scale.

scale uses the stem "I am motivated to teach well because . . ." followed by 16 items representing four subscales: intrinsic motivation (4 items, α = .90; e.g., "I enjoy teaching"), identified regulation (4 items, α = .79; e.g., "it is an important life goal"), introjected regulation (4 items, α = .72; e.g., "I would feel bad about myself if I do not"), external regulation (4 items, α = .71; e.g., "others force me to do so"). Items were rated on a 5-point Likert scale ranging between 1 (*completely disagree*) and 5 (*completely agree*). For the purposes of the present study, we computed composite scores for autonomous (α = .89) and controlled (α = .80) motivation by averaging the subschales of intrinsic and identified, and introjected and externe regulation, respectively.

Further, participants completed two subscales of the Dutch version (Soenens et al., 2012) of the Maslach Burnout Inventory—Educators Survey (MBI-ES; Kokkinos, 2006; Maslach & Jackson, 1986), a validated questionnaire on burnout in teachers. The Emotional exhaustion subscale (9 items, α = .91) measures feelings of tiredness at work (e.g., "I feel emotionally drained from my work"), and the Depersonalization subscale (5 items, α = .69) reflects teachers' impersonal response to students ("I do not really care what happens to some students"). All items were rated on a 5-point Likert scale ranging from 1 (*not at all*) to 5 (*totally*).

Finally, teachers' need-based experiences were measured with an adapted version of the Basic Psychological Need Satisfaction Need Frustration Scale (BPNSNF; Chen et al., 2015). This 24-item scale has been validated in four samples from diverse cultural backgrounds (i.e., China, US, Peru, and Belgium; Chen et al., 2015) and assesses each need with eight items of which four items tap into need satisfaction and four items into need frustration. For the purposes of the present study, this general need-based scale was slightly adjusted by adding the stem "At school" and by slightly rewording some of the items to better reflect the specific context of teaching. Internal consistency was good for both need satisfaction (12 items, α = .86) and need frustration (12 items, α = .86).

Student Measures

Perceptions of teachers' teaching style. To measure students' perceptions of their teacher's teaching style, the 12 vignettes of the teacher-based SIS were slightly adapted so that they tapped the degree to which students perceived each of the four behaviors as describing their teacher's teaching style. Students rated each teaching style in an internally consistent way: autonomy support (α = .85), structure (α = .86), control (α = .82), and chaos (α = .80).

Predictive validity measures. As a proximal measure of how students had experienced the school year with their head teacher, students were asked to indicate to what extent they (a) would recommend their teacher to others (Recommended; 2 items, α =

.80, e.g., "I would recommend my head teacher to other students"), (b) would like to be taught by their teacher again next school year (Continued education; 3 items, $\alpha = .90$, e.g., "I would like to be taught by my head teacher again next year"), (c) found the lessons by their head teacher clear and easy to follow (Clarity; 2 items, $\alpha = .79$), and (d) would rate their head teacher as an excellent teacher (1 item). Also, a composite score for rated teacher quality was calculated ($\alpha = .92$).

Students' motivation to study for the subject taught by their head teacher was assessed with the adapted version of the Academic Self-Regulation Questionnaire (SRQ-A; Ryan & Connell, 1989; Vansteenkiste, Sierens, Soenens, Luyckx, & Lens, 2009). This 20-item scale contains four items per regulation. Internal consistencies, as indexed by Cronbach's alpha, were satisfactory: intrinsic motivation, $\alpha = .91$, for example, "because I enjoy studying for this subject"; identified regulation, $\alpha = .81$, for example, "because it's important to me to study for this subject"; introjected regulation, $\alpha = .76$, for example, "because I'll feel guilty if I do not study for this subject"; external regulation, $\alpha = .75$, for example, "because that's what I'm supposed to do"; and amotivation, $\alpha = .87$ (e.g., "Honestly, I do not know why I study for this subject"). Similar to previous research (Vansteenkiste et al., 2009) and the measure for teachers' motivation to teach, we created composite scores for autonomous ($\alpha = .91$) and controlled ($\alpha = .79$) motivation.

Students' oppositional defiance was measured with a recently developed and validated scale (Haerens et al., 2015; Vansteenkiste, Soenens, Van Petegem, & Duriez, 2014) that was adjusted to the education context. The scale assesses students' tendencies to reject the teacher's authority and contains four items, including "I do exactly the opposite of what my class teacher expects me to do for this subject" and "I completely ignore what my class teacher asks me to do with respect to my schoolwork." Internal consistency of this scale was good with Cronbach's alpha = .82.

Finally, to assess students' self-regulated learning, five subscales of the Dutch Children's Perceived use of Self-Regulated Learning Inventory (CP-SRLI; Vandevelde, Van Keer, & Rosseel, 2013) were used. Specifically, students were asked to fill out to what degree they relied on Surface learning strategies (four items, $\alpha = .64$, e.g., "I read or recall everything again and again until I know it by heart"), Deep-level learning strategies (nine items, $\alpha = .74$, e.g., "I try to repeat the new material in my own words"), Planning (six items, $\alpha = .76$, e.g., "Before I start my schoolwork, I decide what to do first and what later"), Monitoring (seven items, $\alpha = .71$, e.g., "During my schoolwork, I ask myself: 'Is it working well in this way?'"), and Persistence (six items, $\alpha = .86$, e.g., "Even if I would rather do other things, I make myself start my schoolwork") when doing their schoolwork for the subject taught by their head teacher by means of a 5-point Likert scale from 1 (*never*) to 5 (*always*).

Plan of Analysis

To address the study aims, we always used the maximum amount of data available. Because different measures were collected across samples, the number of participants involved varied across the aims and hypotheses in question. In addition, in teacher samples, all analyses were controlled for social desirability response tendencies.

With respect to Aim 1 (internal validity), we examined the dimensional structure of the SIS items by relying on multidimensional scaling (MDS; Borg et al., 2013). MDS provides a graphical representation of (dis)similarities between items as distances between points in a geometrical space, with high correlations (or small dissimilarities) between items being represented by small distances between points in the geometrical space. Euclidean distances[2] between the standardized item responses were used as a dissimilarity measure (which correspond to Pearson correlations between the items). We used the PROXSCAL MDS procedure of SPSS to compute the configuration with nonmetrical MDS. This procedure was performed twice to obtain a teacher-specific (using data from Samples 1, 2, 3, and 5) and student-specific (using data from Samples 4 and 5) configuration, and to examine whether the data could best be graphically represented by a two-dimensional configuration in both samples. To investigate the stability of the dimensional structure across teachers and students, we subjected the sample-specific configurations to generalized procrustes analysis (GPA; Borg et al., 2013; Commandeur, 1991). GPA reflects, rotates, shifts, dilates, or shrinks configurations from different samples in such a way that they correspond as closely as possible, without affecting the relative distances between items within each configuration. Further, GPA computes a centroid configuration representing the average configuration across the teacher and student samples. Next, we inspected whether we could identify the four broader teaching styles (Hypothesis 1a) and whether there was room for refinement within each of them (Hypothesis 1b). Finally, through correlational analyses, we examined the pattern of correlates between the identified subareas (Hypothesis 2).

With respect to Aim 2 (construct validity), we explored the psychometric properties of the SIS by (a) calculating internal consistencies of the identified areas across all samples, and (b) investigating the test–retest reliability of the items by means of Pearson correlations between T1 and T2 data of teachers in Sample 3. Construct validity was tested by investigating whether the identified areas meaningfully correlated with construct validation measures, including the TASCQ (Sample 1), PCT (Sample 1), and TRS (Sample 2; Hypothesis 3). Further, we examined to what degree there was significant convergence between teacher- and student-reports of the SIS relying on data from Sample 5 (Hypothesis 4a). Given the hierarchical structure of the data in Sample 5, with 1006 students being nested within 56 teachers, we relied on multilevel regression analyses in MLwiN 2.27 (Rasbash, Steele, Browne, & Goldstein, 2014). Intraclass correlation coefficients (ICCs) were calculated to examine whether there was significant between-class (i.e., between-teacher) variance in the broader teaching styles and identified subareas. Associations between student- and teacher reports were examined in distinct regression models for the broader teaching styles, as well as for the identified subareas, thereby regressing teacher-reports (i.e., independent variable) onto student-reports (i.e., dependent variable). In each model, the other teaching styles or subareas were respectively controlled for. Finally, to examine mean-level differences between teachers and students, MANOVA was conducted (Hypothesis 4b).

[2] Euclidian distances where used as association measures, rather than the more common Pearson correlations, because a MDS analysis can only work with non-negative (dis)similarity measures.

As for Aim 3 (predictive validity), the predictive validity was determined by evaluating the magnitudes and the pattern of correlations of the identified areas in the dimensional configuration with teacher outcomes (e.g., motivation to teach, Samples 1, 2, and 5) and with student outcomes (e.g., rated teacher quality; Samples 4 and 5), respectively (Hypothesis 5). As to rule out that any observed association with teacher outcomes was driven by social desirability, partial correlations controlling for such a response tendency were calculated among the identified areas and teacher outcomes.

Results

Aim 1: Internal Validity

Dimensionality. We examined a one- up to a six-dimensional configuration produced by the nonmetric MDS analyses for the teacher and student data separately. In both data sets, the normalized raw stress and the scree test of each configuration clearly pointed to a two-dimensional representation, as was a priori expected (Hypothesis 1a). As for teacher data, the normalized raw stress declined from .064 over .013, .007, .005, .004, to .003 for a one-dimensional up to a six-dimensional solution, respectively. With respect to student data, the normalized raw stress declined from .047 over .010, .006, .004, .003, to .002 for a one-dimensional up to a six-dimensional solution, respectively.

Robustness. To compare the robustness of the two-dimensional configuration between teacher and student samples, we applied GPA to the sample-specific configurations. Only 2% of the squared distances was lost by representing the two sample-specific configurations by a single centroid configuration. This clearly indicates that the coordinates of the individual SIS items are highly comparable between the teacher and student samples, and that the centroid configuration provides a very good and highly similar representation of the internal structure for both samples. Figure 2a and 2b shows the two-dimensional representation of the SIS among teachers and students, respectively.

Interpretation of the dimensional structure. An MDS configuration can be interpreted in two ways, that is, at the dimensional and at the regional levels. A dimensional interpretation interprets the dimensions looking at the coordinates of the items on the dimensions, whereas a regional interpretation looks for bounded regions within the geometrical representation each containing qualitatively different type of items. In the centroid two-dimensional structure of the SIS items, the first dimension (i.e., *x* axis) can be interpreted as need thwarting versus need support, with the control and chaos items having negative coordinates and the autonomy support and structure items having positive coordinates on this dimension. To illustrate, the two right-most items in Figure 2a and 2b refer to need support ("adjust," "foster enjoyment"), whereas the two left-most items both refer to need thwart (i.e., "ignore," "indifference").

The second dimension (i.e., *y* axis) can be interpreted in terms of the level of teacher directiveness, with the control and structure items having positive coordinates and the autonomy support and chaos items having negative coordinates on this dimension. To illustrate, the two lower-most items in Figure 2a and 2b both refer to high directiveness ("push compliance," "insist firmly"), whereas the two upper-most items both refer to low directiveness (i.e., "wing it," "offer choice"). Moreover, as expected based on the SDT-literature, a 45 degree rotation of the two axes resulted in a dimension with autonomy support positioned most distant from control (i.e., *x* axis), and structure positioned most distant from chaos, thereby confirming Hypothesis 1a.

In addition to the dimensional interpretation, the interpretation of the different regions was consistent with our theorizing. Specifically, four broader quadrants could be distinguished, with the autonomy support items being situated in the upper right quadrant (e.g., "interest taking"), the structure items in the lower right quadrant (e.g., "set expectations"), the control items in the lower left quadrant (e.g., "exert power"), and the chaos items in the upper left quadrant (e.g., "wing it"). Providing evidence for Hypothesis 1b, a closer inspection of the position of each item in the circumplex structure and its content revealed that each quadrant fell into two meaningful subareas. Specifically, autonomy support items involving inviting students' input and providing choice, which we labeled as a *participative approach*, clustered together (see empty dots), whereas items referring to nurturing students' personal interests and preferences, fostering enjoyment, and offering a meaningful rationale cluster together in a subarea which we labeled as an *attuning approach* (see black dots). With regard to structure, items including offering help and adjusting the learning material were labeled as a *guiding approach* (see empty triangles) and items including communicating clear expectations and monitoring whether students live up to these expectations were labeled as a *clarifying approach* (see black triangles). Control items involving highlighting students' duties and responsibility and using (threats of) sanctions were labeled as a *demanding approach* (see empty squares), whereas items involving intensively pressuring students by means of harsh controlling strategies, such as shaming, guilt-induction, or exerting power, were labeled as a *domineering approach* (see black squares). Finally, the two subareas of chaos were labeled as an *abandoning approach*, including items referring to indifference and ignoring student activity when an action from the teacher is actually called for (see empty diamonds), and an *awaiting approach* including items referring to waiting to see how the situation evolves and letting things unfold for themselves (see black diamonds). Moreover, we observed that these eight subareas were ordered in a circular way (i.e., circumplex structure), with an attuning approach being more related to a guiding approach and a participative approach being more related to an awaiting approach, an abandoning approach being more related to a domineering approach, and a demanding approach being more related to a clarifying approach.

Further testifying to the visually inspected differentiation between adjacent subareas, confirmatory factor analyses (CFA) were performed in Mplus Version 8.0 (Muthén & Muthén, 1998–2017). Robust maximum likelihood estimation (MLR) was used to obtain parameter estimates with standard errors and a chi-square test statistic that are robust to non-normality. First, a four-factor model was tested with the 48 items as indicators of their respective overarching styles (e.g., 12 items loading on autonomy support). The fit of this model was unsatisfactory both among teachers, $\chi^2(1074) = 3733.73$, $p < .001$, CFI = .73, TLI = .73, RMSEA = .05, SRMR = .08, with loadings from .20 to .67, and among students, $\chi^2(1074) = 6525.69$, $p < .001$, CFI = .76, TLI = .75, RMSEA = .05, SRMR = .09, with loadings ranging from .24 to .73. Second, an 8-factor model

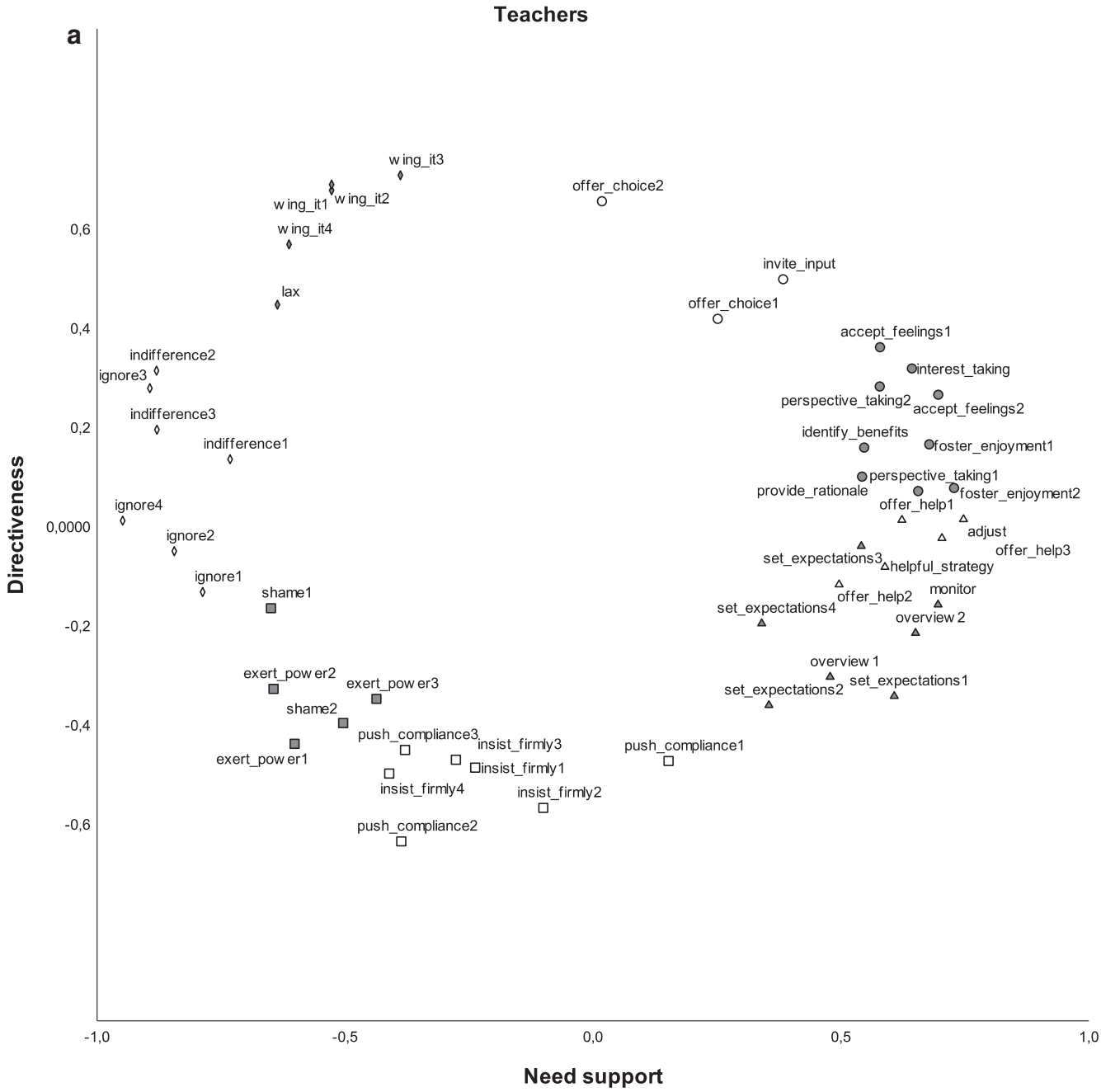

Figure 2. (a) Two-dimensional configuration of the SIS items among teachers (Sample 1, 2, 3, and 5). Items belonging to the same subarea are indicated in the same shape with participative = empty dot, attuning = black dot, guiding = empty triangle, clarifying = black triangle, demanding = empty square, domineering = black square, abandoning = empty diamond, and awaiting = black diamond. (b) Two-dimensional configuration of the SIS items among students (Sample 4 and 5). Items belonging to the same subarea are indicated in the same shape with participative = empty dot, attuning = black dot, guiding = empty triangle, clarifying = black triangle, demanding = empty square, domineering = black square, abandoning = empty diamond, and awaiting = black diamond.

modeling the 48 items as indicators of their respective subarea (e.g., five items loading on the guiding subarea) yielded a significantly better model fit among teachers, $\chi^2(1052) = 2694.01$, $p < .001$, CFI = .83, TLI = .82, RMSEA = .04, SRMR = .06, with loadings from .33 to .80, and students, $\chi^2(1052) = 4480.12$, $p < .001$, CFI = .85, TLI = .84, RMSEA = .04, SRMR = .06, with loadings ranging from .36 to .73; yet, the CFIs and TLIs were still quite below the usually

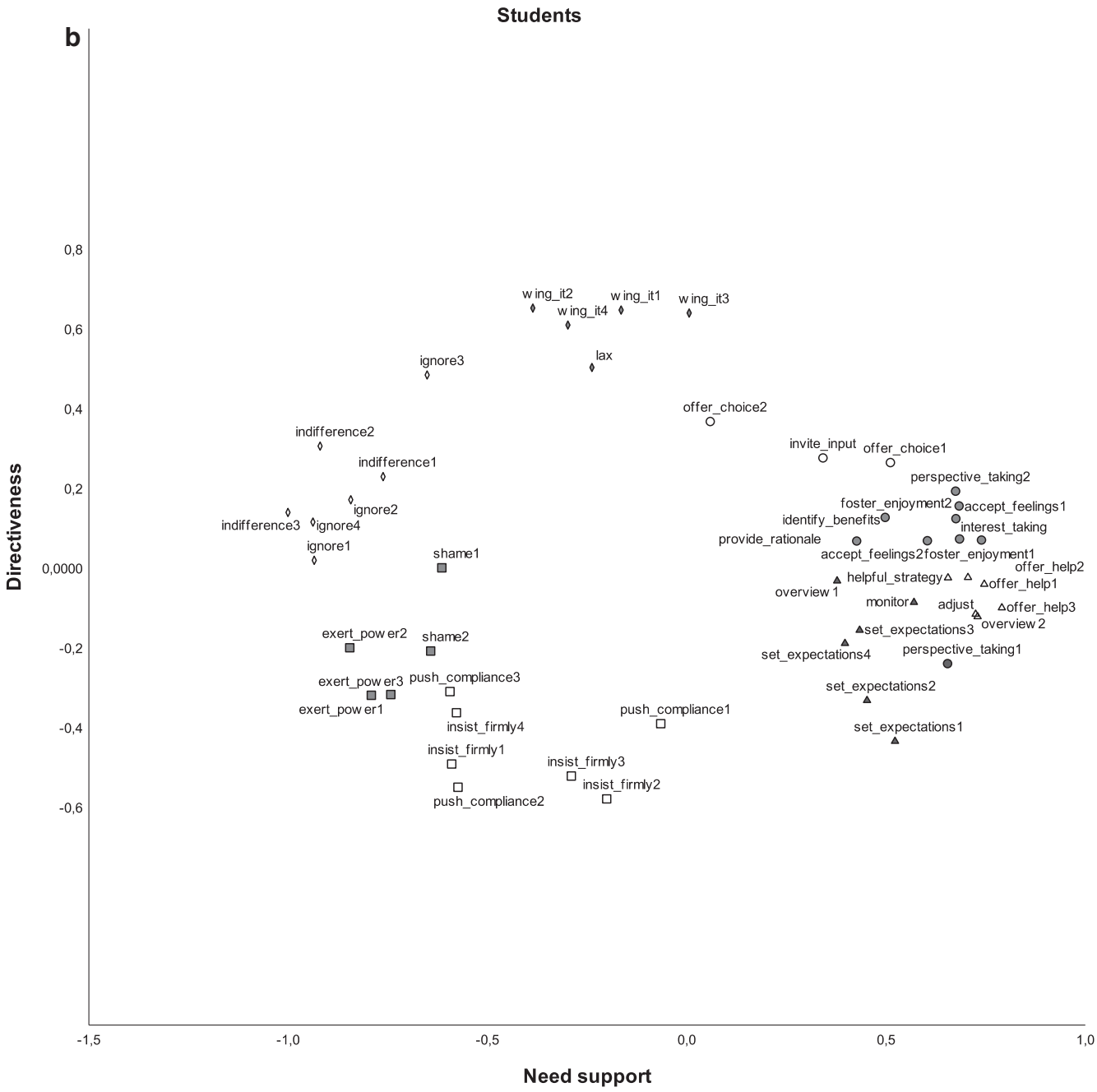

Figure 2 (*continued*).

suggested values for acceptable model fit (Hu & Bentler, 1999). This suboptimal fit may result from violations of the assumption of uncorrelated residuals (Heene, Hilbert, Freudenthaler, & Bühner, 2012). Indeed, given the format of the questionnaire (i.e., vignettes), it is likely that items are interrelated across styles, but within the same vignette. In addition, items tapping into the same style across vignettes may also be interrelated due to similar item wording. Therefore, we relied on the procedure suggested by Saris, Satorra, and van der Veld (2009), using the expected parameter change (EPC) in combination with the modification index (MI) and the power of the MI test to detect model misspecifications. We did so by loading the output of the eight-factor CFA in the JRule for Mplus (Oberski, 2013) computer program to obtain the suggested decisions for all restricted parameters. Decisions about which error correlations to include were based on statistical grounds as well as substantive arguments (i.e., interpretability). Ultimately, this alternative method yielded an overall acceptable model fit among teachers, $\chi^2(1025) = 2020.73$, $p < .001$, CFI = .90, TLI = .89, RMSEA = .03, SRMR = .06, with loadings ranging from .33 to

.79, and students, $\chi^2(1003) = 2983.29$, $p < .001$, CFI = .91, TLI = .90, RMSEA = .03, SRMR = .05, with loadings ranging from .35 to .72, without changing the factor loadings, neither the correlations among the latent factors.[3]

Correlational pattern. As can be noticed among both teachers (see Table 4) and students (see Table 5), autonomy support and structure were positively correlated and control and chaos were positively correlated. In addition, autonomy support was significantly negatively related to both control and chaos in the student data, while only being negatively related to chaos in the teacher data. As for structure, it was negatively related to chaos among both students and teachers, while being unrelated to control in the student data and positively related to control in the teacher data.

By breaking down the four broader areas in eight subareas, the pattern of correlates became clearer. In fact, as hypothesized (Hypothesis 2), evidence was obtained for an ordered pattern, with each subarea being most strongly correlated with the adjacent subareas and the pattern becoming decreasingly positive and increasingly negative as one moves along the circle. To illustrate, the attuning approach correlated most strongly with the participative and guiding approaches, with the strength of these correlations further declining as one moves away from these adjacent subareas. Correlations became negative in case subareas were situated further away of one another in the circumplex. The correlations situated on the diagonal are indicative of the strength of the correlation between each pair of adjacent subareas. Although each of these correlations was positive, the correlation between the participative and awaiting subarea, and between the clarifying and demanding subarea was somewhat less pronounced compared with the correlations between each other pair of adjacent subareas. This suggests that there is a wider gap between need-supportive and need thwarting teaching practices. Moreover, the positive correlation between the two subareas of chaotic teaching was somewhat less pronounced when compared with the correlation between two subareas of the other three dimensions.

Aim 2: Psychometric Properties and Construct Validation

Reliabilities. Tables 4 and 5 show that, across both samples, internal consistencies were acceptable to good for the four quadrants ($.78 < \alpha < .82$ and $.80 < \alpha < .86$ for teachers and students, respectively) as well as for the eight identified subareas. Specifically, Cronbach's alpha for the subareas ranged between $.73 < \alpha < .82$ and $.71 < \alpha < .86$ for teachers and students, respectively. One exception was the three-item participative subarea ($\alpha_{teacher} = .50$, $\alpha_{student} = .53$), which had fairly poor internal consistency.

To investigate the test–retest reliability of the SIS items we correlated T1 and T2 data of teachers ($N = 89$) in Sample 3. The results indicated that test–retest reliability was high with correlations ranging between .48 and .80 (see Table 4). Need thwarting practices ($.71 < r < .80$) appeared to be more stable over time than need-supportive practices ($.48 < r < .68$), both at the level of the quadrants and the subareas. The subareas of structure in particular were somewhat less stable (guiding $r = .48$, clarifying $r = .56$).

Social desirability. The social desirability tendency of teachers correlated positively with the attuning, guiding, and clarifying approach, while being negatively related to the two chaotic approaches. Interestingly, social desirability was unrelated to the two controlling teaching approaches (see Table 4).

Construct validity. As can be noticed in Table 6, the strongest pattern of correlates emerged for each scale's corresponding construct validation measure (indicated in bold), thereby confirming Hypothesis 3. To illustrate, controlling for social desirability response tendencies, the broader autonomy support area as well as its two subareas (i.e., participative and attuning approach) correlated most strongly with two previously used measures of autonomy support (i.e., TASQ and TRS). A similar pattern could be observed for structure, control, and chaos. In most cases, the broader areas as well as their constituting subareas correlated most strongly with the corresponding construct validation measure. If any exceptions emerged, the areas adjacent to a specific subarea yielded an equally strong correlation with the construct validation measure. Interestingly, involvement correlated most strongly with the need-supportive quadrants and subareas, while being negatively related to the need-thwarting quadrants and subareas, except for a null-relation with the demanding approach. Given that the autonomy-supportive subareas also correlated with construct validation measures of structure (and vice versa), we performed supplemental analyses, thereby deconstructing the TASCQ subscales of autonomy support and structure into subcomponents and correlating these subcomponents with the eight identified subareas. Results of these more refined analyses (see Table 6b in the online supplemental material) pointed to a more differentiated pattern, especially when controlling for the adjacent subareas, and hence provide additional evidence for the discriminating construct validity of the autonomy-supportive and structuring approaches of the SIS.

Teacher–student convergence. Given that students in Sample 5 were asked to report on their experiences with their head teacher, data from the teachers could be compared directly to the data of their students. Estimation of intraclass correlation coefficients (ICCs) indicated that there was significant between-class (or between-teacher) variance in each of the four overarching teaching styles (autonomy support: 25%, control: 24%, structure: 21%, and chaos: 11%; all $\chi^2(1)$-values $p < .001$), as well as in the eight subareas (participative: 14%, attuning: 27%, guiding: 21%, clarifying: 17%, demanding: 23%, domineering: 20%, abandoning: 16%, and awaiting: 16%; all $\chi^2(1)$-values $p < .001$). As can be noticed in Table 7, multilevel regression analyses further revealed that significant convergence was found for autonomy support ($b =$

[3] Because of the nested structure of the student data (i.e., students being nested within classes), a multilevel CFA would be a more appropriate and preferable way to investigate whether the internal structure can be confirmed among students. However, relying on multilevel CFA, the eight-factor could not converge due to the large number of parameters at level 2 relative to the number of clusters. Therefore, we decided to simplify the model by running separate multilevel CFAs for each pair of adjacent subareas within (e.g., participative and attuning) and across (e.g., attuning and guiding) overarching styles. These models did converge, and each two-factor model fitted the data reasonably well with all χ^2-values $p < .001$, $.03 <$ RMSEA $< .05$, $.86 <$ CFI $< .94$, $.03 <$ SRMR within $< .04$, and $.08 <$ SRMR between $< .16$. The less stable SRMR index at the between-level is probably still attributable to the number of parameters relative to the sample size. Importantly, independent of which subareas were combined, each of these two-factor models had a significantly better fit than each of the one-factor models, all $\Delta\chi^2(1)$ values significant at $p < .001$.

Table 4
Means, Reliabilities, Test–Retest Reliabilities, and Partial Correlations Among the Four Teaching Styles and Eight Identified Subareas Among Teachers (Samples 1, 2, 3, and 5)

Variable	N items	M (SD)	α	Test-retest reliability r	Social desirability r	1	2	3	4	5	6	7	8	9	10	11	12
Teaching styles																	
1. Autonomy support	12	5.11 (0.71)	.78	.68**	.23***	—											
2. Structure	12	5.57 (0.68)	.82	.63**	.29***	.65***	—										
3. Control	12	3.66 (0.97)	.82	.78**	.01	−.06	.18***	—									
4. Chaos	12	2.52 (0.79)	.79	.80**	−.19***	−.12**	−.36***	.22***	—								
Subareas																	
5. Participative	3	3.54 (1.21)	.50	.63**	.07	.74***	.30***	−.02	.15***	—							
6. Attuning	9	5.64 (0.69)	.79	.65**	.26***	.91***	.70***	−.07*	−.25***	.40***	—						
7. Guiding	5	5.83 (0.71)	.74	.48**	.26***	.63***	.84***	.03	−.29***	.28***	.68***	—					
8. Clarifying	7	5.39 (0.79)	.73	.56**	.27***	.55***	.94***	.25***	−.35***	.27***	.59***	.60***	—				
9. Demanding	7	4.08 (1.04)	.76	.76**	.06	−.01	.28***	.94***	.09*	−.02	−.00	.11**	.35***	—			
10. Domineering	5	3.08 (1.08)	.73	.74**	−.07	−.12**	.01	.89***	.36***	−.01	−.15***	−.08*	.07	.67***	—		
11. Abandoning	7	2.22 (0.80)	.74	.71**	−.14***	−.28***	−.36***	.35***	.82***	.02	−.39***	−.38***	−.29***	.23***	.44***	—	
12. Awaiting	5	2.93 (1.13)	.75	.73**	−.13***	.08*	−.23***	.03	.83***	.22***	−.03	−.11**	−.27***	−.09*	.17***	.35***	—
13. Age	—	40.81 (10.97)	—	—	.15***	.08*	.18***	.10*	−.04	.04	.10*	.14***	.18***	.09*	.09*	−.01	−.06

Note. Correlations among teaching styles and identified subareas are controlled for teachers' social desirability response tendencies (i.e., partial correlations).
* $p < .05$. ** $p < .01$. *** $p < .001$.

.52, $\chi^2(1) = 17.90$, $p < .001$) and control ($b = .19$, $\chi^2(1) = 13.58$, $p <$ 001), but not for structure ($b = -.05$, $\chi^2(1) = .14$, $p = .71$) and chaos ($b = .04$, $\chi^2(1) = .20$, $p = .65$). At the level of the subareas, the teacher-reported participative ($b = .18$, $\chi^2(1) = 6.41$, $p = .01$), attuning ($b = .53$, $\chi^2(1) = 17.30$, $p < .001$), and demanding ($b = .27$, $\chi^2(1) = 8.25$, $p = .004$) approaches converged with students' perceptions of these respective subareas, but no significant convergences were found for the other subareas. Thus, the pattern of teacher–student convergence was clearly mixed, with approximately half of the findings being significant and supporting Hypothesis 4a, and the other half being statistically nonsignificant.

In addition, as expected (Hypothesis 4b), results of the MANOVA in Sample 5 indicated that there were significant mean-level differences between teachers and students, Wilk's $\lambda = .90$, $F(1, 1050) = 12.89$, $p < .001$. Specifically, teachers reported to be significantly more autonomy-supportive and structuring, while being less controlling and chaotic than they were seen by their students (all F values $ps < .001$). A similar picture emerged at the level of the subareas (all F values $.00 < p < .008$),[4] with the only exception that no teacher–student differences were found for the participative approach, $F(1, 1058) = .01$, $p = .94$.

Aim 3: Nomological Network and Predictive Validity

As expected (Hypothesis 5), Table 6 shows that the broader areas of autonomy support and structure were positively correlated with autonomous motivation to teach and experiences of need satisfaction, and negatively correlated with depersonalization among teachers. In addition, structure, but not autonomy support, was negatively correlated with need frustration. As for the broader areas of control and chaos an opposite pattern of correlations was found. More interestingly, correlations (controlled for social desirability) between teacher outcomes and the eight subareas formed a sinusoidal pattern (see Figure 3a for an example). For example, teachers' autonomous motivation to teach was most positively related to the attuning and the guiding approach, while being most negatively related to the abandoning approach. Similar sinusoidal patterns of correlations were obtained for teachers' experiences of need satisfaction at school. In contrast, maladaptive teacher variables, including symptoms of burnout and experiences of need frustration yielded an opposite pattern of correlations. For example, depersonalization was most positively correlated to the domineering and abandoning approach, while being most negatively related to the attuning and the guiding approach. The other correlates fell in between these extremes, gradually shifting as one moves along the circumplex. Controlled motivation was correlated most positively with the demanding and domineering approach, while being unrelated to the motivating teaching approaches.

Concerning the student outcomes, the expected pattern of results was evident (Hypothesis 5). Specifically, Table 8 shows that the broader areas of autonomy support and structure were positively correlated with rated teacher quality, autonomous motivation, and

[4] Similar findings were obtained when inspecting overall mean-level differences between teacher- and student reports (see Table 4 and 5 for means and standard deviations) across the five samples with Wilk's $\lambda =$ .13, $F(12,2544) = 1367.13$, $p < .001$, and all F values of the univariate effects $.00 < p < .05$.

Table 5
Means, Reliabilities, and Correlations Among the Four Teaching Styles and Eight Identified Subareas Among Students (Samples 4 and 5)

Dimension	*N* items	*M* (*SD*)	α	1	2	3	4	5	6	7	8	9	10	11	12
Teaching styles															
1. Autonomy support	12	4.46 (1.03)	.85	—											
2. Structure	12	4.88 (.97)	.86	.87***	—										
3. Control	12	3.97 (.99)	.82	−.07**	.03	—									
4. Chaos	12	3.03 (.93)	.80	−.17***	−.24***	.37***	—								
Subareas															
5. Participative	3	3.26 (1.28)	.53	.68***	.48***	.06*	.17***	—							
6. Attuning	9	4.51 (1.11)	.84	.96***	.80***	−.07**	−.17***	.54***	—						
7. Guiding	5	5.08 (1.21)	.82	.88***	.92***	−.11***	−.33***	.43***	.77***	—					
8. Clarifying	7	4.74 (.94)	.73	.75***	.93***	.15***	−.14***	.47***	.71***	.72***	—				
9. Demanding	7	4.17 (1.02)	.71	.01	.12***	.93***	.25***	.07**	−.00	−.02	.22***	—			
10. Domineering	5	3.62 (1.24)	.73	−.20***	−.15***	.85***	.46***	.01	−.19***	−.27***	−.03	.61***	—		
11. Abandoning	7	2.79 (1.11)	.80	−.37***	−.41***	.43***	.87***	.03	−.38***	−.47***	−.29***	.31***	.54***	—	
12. Awaiting	5	3.36 (1.16)	.73	.17***	.07**	.12***	.75***	.30***	.18***	.01	.11***	.07**	.16***	.32***	—
13. Age	—	14.50 (1.85)	—	−.07**	−.10***	−.06*	−.02	−.08**	−.06*	−.07**	−.10***	−.08**	−.01	.10***	−.16***

* $p < .05$. ** $p < .01$. *** $p < .001$.

self-regulated learning, and negatively with amotivation and oppositional defiance, whereas an opposite pattern of correlations was observed for the broader areas of control and chaos. In addition, a similar ordered pattern of correlations between student outcomes and the eight subareas could be observed. To give one example of such an ordered pattern, the more the students felt that teachers were attuning and guiding, the more they rated their teacher positively (i.e., $r = .65$ and $r = .65$, respectively). In contrast, to the extent that students perceived their teacher to rely on an abandoning and domineering style ($r = -.49$ and $r = -.35$, respectively), the more they would like to "run away from them" and the less they would recommend them to others (see Figure 3b). Similar ordered patterns of correlations were obtained for students' autonomous motivation and all aspects of self-regulated learning (e.g., surface learning strategies, deep-level learning strategies, planning, monitoring, and persistence), whereas an opposite pattern of correlations was found for students' amotivation and oppositional defiance. Interestingly, students' controlled motivation was positively related to all subareas on the circumplex with the exception of a guiding approach, though correlations were strongest with the demanding and domineering approach.

Supplemental Work: Toward an Optimized Scale

Having provided evidence for the robustness and validity of the two-dimensional representation of the SIS, we also recognized a few limitations with the 12 vignettes. Initially, the items for the 12 vignettes were generated from the conceptual definitions and defining features of the autonomy-supportive, structuring, controlling and chaotic teaching styles as widely described in the literature (as per Table 1). Then, based on the data of large teacher- and student-samples, it was confirmed that the defining features grouped themselves together into two subareas per overarching teaching style. However, some subareas were represented with a larger number of items than were other subareas. Particularly, the participative approach included only three items and Cronbach's alpha coefficient for this same scale was fairly low, thereby potentially undermining its predictive validity. To address these shortcomings, we decided to further refine the instrument by adding three more vignettes that included the underrepresented subareas. The final SIS including 15 vignettes (i.e., 60 items) and the scoring key can be found in the online supplemental material. For the comfort of the reader, the three added vignettes are indicated in green font.

To examine the internal validity of this optimized instrument, an additional independent teacher sample ($N = 486$) was surveyed (i.e., Sample 6; see Table 2 and 3), in which participants were asked to fill out the 15 vignettes of the SIS. Similar to the findings of the 12-vignette version, MDS analyses (Borg et al., 2013) revealed that the (de)motivating practices could best be graphically represented by a two-dimensional configuration, accounting for 98% of dispersion. The identical eight subareas could be identified along a circumplex model and, as can be noticed in Table 9, correlations between these distinguished subareas followed a similar ordered pattern as with the 12 vignettes. By the addition of three vignettes, internal consistencies were acceptable to good for all subareas, including the participative approach, with Cronbach's alpha ranging between $.69 < \alpha < .90$ (average $\alpha = .80$). Importantly, the alpha coefficients for the 15-vignette SIS were consistently larger than were the alpha coefficients for the original 12-vignette SIS (compare column 3 in Table 9 versus Table 5).

Finally, CFAs were performed to investigate the factorial validity of the 15-vignette SIS following the same sequence of analyses as with the 12-vignette SIS. The four-factor model modeling 60 items as indicators of their respective overarching styles yielded an unsatisfactory fit, $\chi^2(1704) = 3782.82$, $p < .001$, CFI = .79, TLI = .79, RMSEA = .05, SRMR = .07, with loadings ranging from .26 to .80. The fit significantly improved when testing the 8-factor model modeling the items as indicators of their respective subareas, $\chi^2(1682) = 3060.91$, $p < .001$, CFI = .86, TLI = .86, RMSEA = .04, SRMR = .06, with loadings ranging from .33 to .81. Applying the procedure suggested by Saris et al. (2009) using JRule for Mplus (Oberski, 2013) to detect model misspecifications resulted in an overall acceptable fit, $\chi^2(1653) = 2559.91$, $p < .001$, CFI = .91, TLI = .90, RMSEA = .03, SRMR = .06, with loadings ranging from .32 to .81.

Table 6
Ordered Pattern of Partial Correlations of the Four Teaching Styles and Eight Identified Subareas With Construction Validation Measures and Outcomes Among Teachers (Samples 1, 2, 3, and 5)

	Overarching teaching styles				Subareas							
Teacher reports	Autonomy support	Structure	Control	Chaos	Participative	Attuning	Guiding	Clarifying	Demanding	Domineering	Abandoning	Awaiting
Construct validity												
Autonomy support (TASCQ)	.41***	.18***	−.32***	−.12**	.36***	.33***	.19***	.13**	−.29***	−.29***	−.21***	.03
Autonomy support (TRS)	.69***	.50***	−.15*	−.02	.42***	.69***	.53***	.40***	−.13	−.15*	−.17**	.13
Psychological control (PCT)	−.05	.01	.40***	.22***	.08	−.11*	−.07	.06	.3é***	.39***	.29***	.06
Control (TRS)	−.20**	.00	.64***	.19**	−.19**	−.16**	−.02	.06	.59***	.60***	.29***	.03
Structure (TASCQ)	.44***	.63***	.04	−.40***	.14**	.50***	.55***	.57***	.13**	−.09	−.44***	−.20***
Structure (TRS)	.43***	.65***	.19**	−.21**	.15*	.49***	.59***	.58***	.20*	.13*	−.24***	−.12
Chaos (TRS)	.02	−.12	.20**	.54***	.16*	−.07	−.03	−.17*	.14*	.254***	.49***	.42***
Involvement (TASCQ)	.56***	.47***	−.11*	−.21***	.31***	.56***	.49***	.38***	−.07	−.15**	−.35***	−.02
Predictive validity												
Teaching motivation												
Autonomous	.35***	.42***	.03	−.18**	.13*	.40***	.41***	.36***	.06	−.02	−.20**	−.11
Controlled	−.00	.00	.36***	.25***	.06	−.04	−.06	.04	.36***	.31***	.29***	.14*
Burn-out												
Emotional exhaustion	−.02	−.10	.03	.07	−.01	−.03	−.06	−.11	.03	.03	.09	.04
Depersonalization	−.13*	−.18**	.31***	.25***	−.02	−.16**	−.18**	−.16**	.28***	.30***	.34***	.10
Need-based experiences												
Need satisfaction	.24***	.36***	−.01	−.13*	.06	.29***	.32***	.32***	.02	−.05	−.17**	−.06
Need frustration	.01	−.23***	.12*	.23***	.14*	−.07	−.15*	−.25***	.11	.13*	.24***	.16**

Note. TASCQ = Teacher as Social Context Questionnaire; PCT = Psychologically Controlling Teaching; TRS = Teacher Rating Scale. All correlations are controlled for teachers' social desirability response tendencies (i.e., partial correlations).
* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 7
Teacher–Student Convergence for the Four Teaching Styles and Eight Identified Subareas (Sample 5)

Student reports	Teacher reports: Autonomy support *B* (*SE*)	Structure *B* (*SE*)	Control *B* (*SE*)	Chaos *B* (*SE*)
Fixed effects				
Intercept	4.47 (0.063)	4.95 (0.06)	3.96 (0.06)	3.09 (0.05)
Autonomy support	.52 (.12)***	.30 (.12)**	−.29 (.12)*	−.09 (.10)
Structure	−.20 (.14)	−.05 (.13)	−.05 (.13)	.02 (.11)
Control	−.07 (.05)	−.30 (.05)	.19 (.05)***	.06 (.04)
Chaos	−.01 (.10)	.07 (.10)	−.04 (.10)	.04 (.08)
Random effects				
Teacher-level variance	.17 (.04)	.15 (.04)	.15 (.04)	.09 (.03)
Student-level variance	.75 (.04)	.69 (.03)	.73 (.03)	.74 (.03)
Test of significance				
IGLS Deviance reference model	2671.45	2576.83	2648.36	2611.26
IGLS Deviance test model	2611.99	2524.77	2579.12	2567.83
$\chi^2(4)$	59.46***	52.05***	69.24***	43.43***

Student reports	Teacher reports: Participative *B* (*SE*)	Attuning *B* (*SE*)	Guiding *B* (*SE*)	Clarifying *B* (*SE*)	Demanding *B* (*SE*)	Domineering *B* (*SE*)	Abandoning *B* (*SE*)	Awaiting *B* (*SE*)
Fixed effects								
Intercept	3.29 (0.07)	4.50 (0.07)	5.14 (0.07)	4.81 (0.05)	4.18 (0.06)	3.60 (0.06)	2.83 (0.06)	3.47 (0.06)
Participative	.18 (.07)*	.16 (.07)*	.12 (.08)	.10 (.06)	−.00 (.06)	.00 (.07)	−.06 (.07)	.16 (.07)*
Attuning	.10 (.13)	.53 (.13)***	.35 (.14)*	.10 (.11)	−.25 (.12)*	−.60 (.12)***	−.32 (.12)**	.11 (.12)
Guiding	−.32 (.13)*	−.22 (.13)	.00 (.14)	−.01 (.10)	−.08 (.12)	−.07 (.12)	−.04 (.12)	−.40 (.12)***
Clarifying	.13 (.15)	−.04 (.14)	−.09 (.16)	−.04 (.12)	−.06 (.13)	.14 (.14)	.16 (.13)	.28 (.14)*
Demanding	−.07 (.10)	−.21 (.10)−	−.16 (.11)	−.10 (.08)	.27 (.09)**	.24 (.10)*	.16 (.09)	−.08 (.10)
Domineering	−.06 (.11)	.12 (.11)	.10 (.12)	.10(.09)	−.07 (.10)	−.11 (.11)	−.12 (.10)	.10 (.11)
Abandoning	.13 (.15)	.18 (.14)	.08 (.16)	.06 (.12)	−.23 (.14)	−.17 (.14)	.05 (.14)	−.01 (.14)
Awaiting	−.07 (.07)	−.09 (.07)	−.03 (.07)	−.10 (.06)	.07 (.06)	.10 (.06)	.06 (.06)	.02 (.06)
Random effects								
Class-level variance	.16 (.05)	.18 (.04)	.13 (.05)	.12 (.03)	.15 (.04)	.14 (.04)	.14 (.04)	.14 (.04)
Student-level variance	1.39 (.06)	.86 (.04)	1.06 (.05)	.67 (.03)	.79 (.04)	1.14 (.05)	1.03 (.05)	1.13 (.05)
Test of significance								
IGLS Deviance reference model	3254.24	2816.23	3014.98	2532.23	2730.75	3088.29	2956.13	3057.50
IGLS Deviance test model	3191.30	2747.04	2949.33	2484.22	2659.78	3001.63	2900.19	2994.38
$\chi^2(8)$	62.94***	69.19***	65.66***	48.00***	70.97***	86.66***	55.93***	63.12***

* $p < .05$. ** $p < .01$. *** $p < .001$.

Discussion

School principals, teachers, and parents all share the contention that the nurturance of children's engagement, learning, and development requires teachers to adopt a facilitating motivating style. As a result, a great deal of attention has been devoted to what the critical components of such a motivating style exactly are (Reeve, 2009) and what teachers do when they rely on demotivating practices (e.g., Van den Berghe et al., 2013). Yet, at least within the Self-Determination Theory literature, this body of work has remained somewhat fragmented, with scholars focusing on a limited number of motivating or demotivating components (e.g., choice) or styles (e.g., autonomy support). The present study aimed to draw a more integrative and refined picture by, first, assessing a variety of need-supportive and need thwarting practices simultaneously and, second, by examining the relations between different teaching practices, both within and across different styles.

Toward More Integrative and Refined Insights in (De)Motivating Teaching

The first aim of the study was to examine the internal validity of a newly developed vignette-based scale, thereby producing both more integrative and refined insight into how a variety of teaching practices relate to one another. Consistent with our expectation (cfr. Hypothesis 1) we found evidence for a two-dimensional circumplex structure (see Figures 2 and 3) with a horizontal axis denoting the extent to which teaching practices are supportive (i.e., autonomy support and structure), relative to thwarting (i.e., control and chaos), of students' basic psychological needs, while the vertical axis reflects the degree to which the teacher is highly directive (i.e., structure and control) or leaves more room for students to take the lead (i.e., autonomy support and chaos). These two constituting dimensions provide a more integrative picture of the key teaching styles discerned within SDT, while also allowing for more detailed insight into their (dis)similarities.

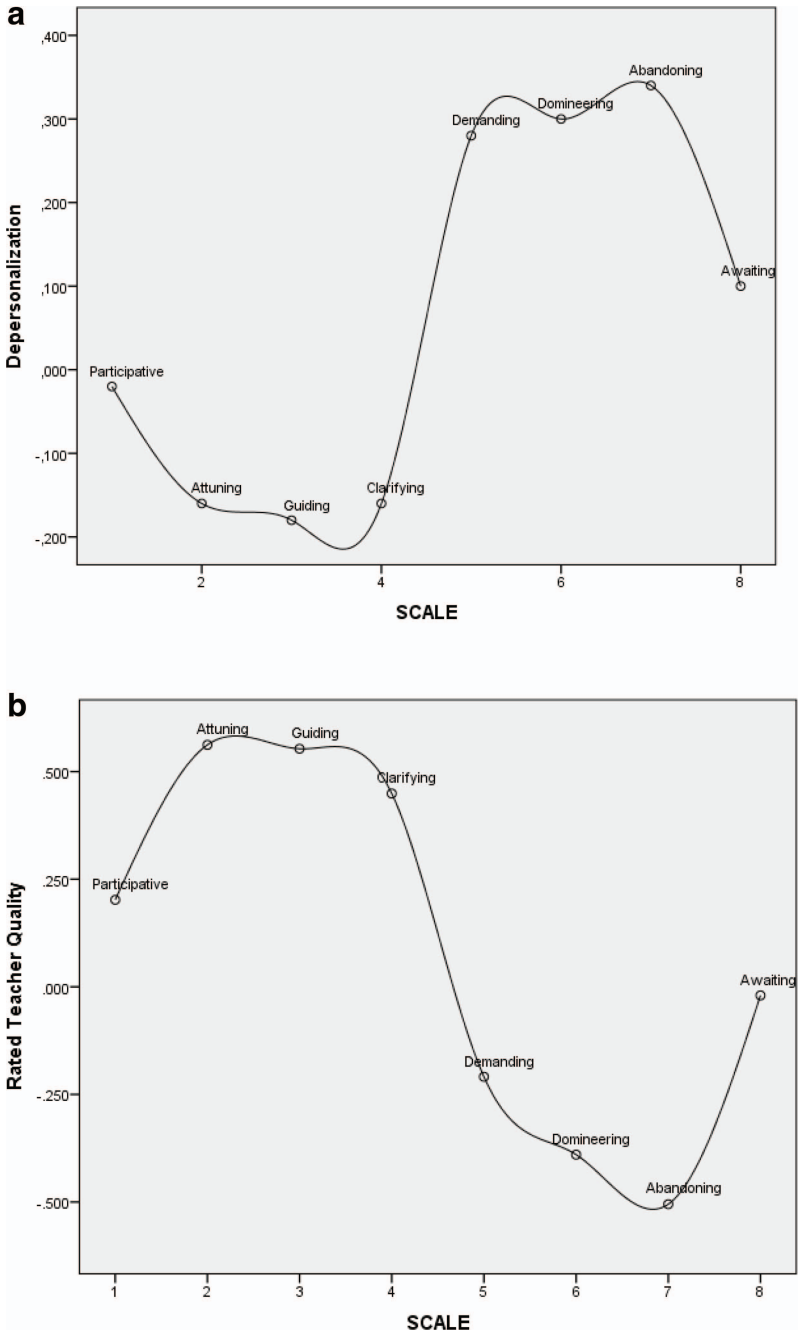

Figure 3. (a) Example of sinusoid relations between the eight subareas and teachers' depersonalization (Samples 1, 2 and 5). (b) Example of sinusoid relations between the eight subareas and student rated teacher quality (Samples 4 and 5).

Notably, the obtained circumplex structure was remarkably consistent across teacher and student reports, as a direct comparison of both two-dimensional configurations resulted in a minimal loss of fit. The present findings are in line with previous work within the Interpersonal Theory (Wubbels et al., 2006). Specifically, the dimension 'affiliation' or 'proximity,' which involves the contrast between 'opposition' and 'cooperation,' is in line with the need support—need thwarting dimension. In addition, the dimension 'control' or 'influence' in the Interpersonal Theory, reflecting the contrast between dominance and submission, is reflected by the extent to which the teacher is directive and taking the lead as observed in the present data.

The use of MDS analyses provided both a helicopter-viewpoint on (de)motivating teaching styles, and more refined insights about the way the four overarching styles could be partitioned into two subareas (i.e., regions). Consistent with the obtained circumplex

Table 8
Pattern of Correlations of the Four Teaching Styles and Eight Identified Subareas With Outcomes Among Students (Samples 4 and 5)

Student reports	Overarching teaching styles				Subareas							
	Autonomy support	Structure	Control	Chaos	Participative	Attuning	Guiding	Clarifying	Demanding	Domineering	Abandoning	Awaiting
Predictive validity												
Rated teacher quality (composite)	.65***	.64***	−.24***	−.35***	.27***	.65***	.65***	.55***	−.14***	−.35***	−.49***	.00
Recommended	.59***	.57***	−.19***	−.27***	.27**	.59**	.57**	.48**	−.11**	−.29**	−.40**	.02
Excellent	.58***	.58***	−.17***	−.30***	.20**	.56**	.55**	.45**	−.21**	−.39**	−.51**	−.02
Continued education	.56***	.54***	−.30***	−.37***	.21**	.48**	.48**	.45**	−.06*	−.22**	−.35**	.01
Clarity	.49***	.50***	−.13***	−.24***	.24**	.57**	.59**	.49**	−.10**	−.27**	−.42**	−.00
Study motivation												
Autonomous	.40***	.42***	.05	−.03	.23***	.39***	.38***	.40***	.08**	−.03	−.10***	.08**
Controlled	.08**	.07**	.28***	.22***	.12***	.08**	.01	.11***	.26***	.24***	.23***	.12***
Amotivation	−.17***	−.24***	.21***	.41***	.08**	−.18***	−.26***	−.19***	.15***	.26***	.46***	.17***
Oppositional defiance	−.17***	−.20***	.25***	.44***	.08	−.18***	−.22***	−.15***	.16***	.31***	.44***	.25***
Self-regulated learning												
Surface learning strategies	.25***	.27***	.07	−.08*	.17***	.23***	.24***	.26***	.13**	−.01	−.12**	.00
Deep-level learning strategies	.30***	.29***	.13**	−.05	.22***	.28***	.26***	.28***	.15***	.06	−.09*	.04
Planning	.29***	.30***	.05	−.11**	.19***	.28***	.27***	.28***	.09*	−.03	−.15***	.01
Monitoring	.29***	.32***	.16***	−.06	.17***	.28***	.26***	.33***	.21***	.06	−.09*	.01
Persistence	.28***	.31***	−.04	−.17***	.12**	.27***	.29***	.29***	.04	−.14**	−.22***	−.04

* $p < .05$. ** $p < .01$. *** $p < .001$.

structure and our theorizing (i.e., Hypothesis 2), the eight distinguished subareas yielded a remarkably ordered (i.e., sinusoid) pattern of correlates; that is, the correlations between a specific subarea and adjacent scales were strongest and positive, whereas these correlations decreased in strength and even became negative once moving to more distant subareas. The correlation between adjacent areas varied between, .20 and .68, and between .22 and .77 across teachers and student reports, respectively, with the highest correlations emerging in the areas tapping into either need-supportive or need thwarting teaching. Said differently, there was a tendency for the need-supportive and need thwarting subareas to cluster more strongly together, such that the difference between the more need-supportive and the more need thwarting subareas and vice versa was somewhat wider, as reflected in lower correlations between adjacent subareas (i.e., clarifying and demanding; participative and awaiting).

A second important aim of the present study was to examine the psychometric properties and construct validity of the SIS in greater detail. Evidence was obtained for the test–retest reliability of the overarching styles and constituting subareas. Also, congruent with this circumplex approach, a sinusoid pattern of correlates emerged when considering the pattern of correlations between the subareas and the construct validation measures (cfr. Hypothesis 3).

As for the correspondence between teacher and student reports, correlations were fairly modest, and for some constructs the observed convergence was higher than for other constructs (cfr. Hypothesis 4a). Only autonomy support and control were found to significantly correlate with the corresponding styles as perceived by the students. More specifically, there was significant convergence for the participative, attuning, and demanding approaches, but not for the other five approaches. Presumably, some behaviors (e.g., shouting; De Meyer et al., 2014) may be more salient to both teachers and students, such that they more easily share a similar opinion on their occurrence.

Further, in terms of mean-level differences and similarities, teachers reported teaching in a more need-supportive and less need thwarting way compared with how they were perceived by students, as we had hypothesized (cfr. Hypothesis 4b). These findings are congruent with previous research (see den Brok et al., 2006 for an overview), which found teachers to score higher on teaching behaviors that relate positively to student motivation and achievement, while scoring lower on teaching behaviors that relate negatively to student motivation and achievement (den Brok et al., 2006). Although students may be overly critical for their teachers, it is also possible that teachers' own ideals may lead to inflated perceptions of their own teaching. That is, both dynamics of wishful thinking and self-protection may account for the observed discrepancies. Alternatively, attribution processes may be at play, with teachers and students focusing on different elements or valuing elements differently when rating specific teaching behaviors (den Brok et al., 2006). Overall, the present findings provide further support for the idiosyncratic viewpoint of teachers and students on the same situation (Könings et al., 2014; Taylor & Ntoumanis, 2007) and calls for future research that examines potential moderators of these discrepancies.

A final aim concerned the predictive validity of the identified overarching styles and subareas. Again congruent with the hypothesized circumplex (cfr. Hypothesis 5; see Figure 3a and Figure 3b), the identified subareas were found to display a sinusoid pattern of

Table 9
Internal Validity of the 15 Vignettes SIS Among Teachers (Sample 6)

Dimension	*N* items	*M* (*SD*)	α	1	2	3	4	5	6	7	8	9	10	11
Overarching teaching styles														
1. Autonomy support	15	4.86 (0.90)	.88	—										
2. Structure	15	5.46 (0.86)	.91	.79***	—									
3. Control	15	3.26 (0.96)	.87	−.01	.15**	—								
4. Chaos	15	2.35 (0.72)	.82	−.00	−.05	.36***	—							
Subareas														
5. Participative	5	3.54 (1.21)	.69	.80***	.46***	−.08	.03	—						
6. Attuning	10	5.50 (0.94)	.90	.92***	.85***	.02	−.02	.51***	—					
7. Guiding	8	5.66 (0.91)	.89	.79***	.94***	.09	−.04	.48***	.84***	—				
8. Clarifying	7	5.24 (0.95)	.80	.69***	.92***	.21***	−.06	.40***	.74***	.74***	—			
9. Demanding	8	3.68 (1.04)	.77	.01	.21***	.94***	.25***	−.07	.06	.14**	.26***	—		
10. Domineering	7	2.74 (1.03)	.79	−.05	.05	.89***	.43***	−.08	−.03	−.01	.10*	.69***	—	
11. Abandoning	10	2.13 (0.73)	.79	−.15**	−.14**	.45***	.85***	−.10*	−.16***	−.16**	−.10*	.33***	.52***	—
12. Awaiting	5	2.73 (1.09)	.78	.17***	.07	.13**	.78***	.14**	.15**	.11*	.01	.07	.18***	.37***

* $p < .05$. ** $p < .01$. *** $p < .001$.

correlates with the motivational (e.g., autonomous teaching motivation; psychological need satisfaction) and affective (e.g., burnout) functioning of teachers as well as the motivational functioning (e.g., autonomous motivation, amotivation) and learning outcomes of students (e.g., rated teacher quality, self-regulated learning). Overall, the attuning and guiding approaches yielded the strongest positive correlates with adaptive outcomes and the strongest negative correlates with maladaptive outcomes, whereas the opposite pattern was found for the domineering and abandoning approaches, both among teachers and students. In what follows, we move along the circle, thereby discussing (dis)similarities between different subareas (see Table 1 for a detailed description).

Moving Along the Circumplex

Teachers often express the concern that an autonomy-supportive approach may include an element of chaos, with children taking the lead in the class and teachers needing to renounce their authority position and give in to overly assertive children. Looking at the obtained circumplex, this concern is legitimate. The *participative* subarea, which includes autonomy-supportive practices like welcoming student suggestions, encouraging student initiative, and providing choice, was situated next to the *awaiting approach,* which is part of the overarching chaos style. Although waiting to see how the situation evolves may be functional on some occasions, in new or problematic situations children will likely benefit from teachers' leadership and directiveness. Importantly, teachers' concern that a potential pitfall of autonomy support is chaos does not apply to both distinguished autonomy-supportive subareas equally. The attuning approach was situated further away from the awaiting approach and leaned more closely to the practices representing teacher structure. When teachers are attuning, they foster students' autonomy by taking the students' frame of reference, nurturing their interests and curiosity and aligning learning tasks with what learners find personally relevant and meaningful in their own lives (Jang, 2008; Reeve & Jang, 2006; Vansteenkiste et al., 2018). Herein, the teacher more strongly takes the lead, so an attuning approach is somewhat more directive than the participative approach.

The subarea situated next to the attuning approach, *guiding,* was experienced as highly motivating by students. To optimally guide learners' competence development, teachers can—much as they do when attuning the learning material—best take the learners' frame of reference, thereby adjusting the nature of the task, the amount of help, feedback, and encouragement according to learners' skill-level (Vansteenkiste & Soenens, 2015). Both the attuning and guiding approach yielded the most pronounced positive correlates with external outcomes, presumably because they both maximize children's experienced need satisfaction. Next to guiding, the *clarifying* approach constituted the second subarea of teacher structure, in which case teachers are more directive and take the lead. Although the correlates between the clarifying, relative to the guiding, approach and student outcomes were similar, both may be different in terms of their need-supportiveness. One possibility is that the setting of expectations for learning and disciplined behavior and their subsequent monitoring constitutes a need-enabling condition instead of being directly need-nurturing. That is, without clear expectations from their teachers, learners do not know what is required to build a sense of competence and without sufficient teacher monitoring students may remain stuck when struggling with learning tasks.

Interestingly, compared with the guiding approach, the clarifying approach was situated closer to the controlling area and, more specifically, to teachers being *demanding*. Such findings suggest that a potential pitfall of setting and monitoring expectations is that teachers become rigid and overly script students' behavior. Notably, the setting of expectations and its monitoring, which involves a high level of directiveness, does not need to come with a more pressuring approach (Vansteenkiste et al., 2012). Even when setting expectations, teachers can act in an autonomy-supportive way, for instance, by providing a meaningful rationale for expectations or acknowledging and accepting students' negative affect as understandable.

Apart from being demanding, a second identified subarea of teacher control is teachers being *domineering*, with this approach likely coming with more intense pressure and control as exemplified by its stronger correlates with maladaptive behaviors among students. One potential reason for this is that domineering teachers

would use harsher and more intrusive person-oriented controlling strategies, such as shaming, guilt-induction, or personal attack, to implement their directiveness. Instead, when demanding, teachers may focus on the misbehavior of the learner, thereby making use of controlling strategies to correct their misbehavior (e.g., threatening with sanctions; promising rewards).

Moving further along the circle, rather interestingly, the domineering approach correlated moderately positively with the *abandoning approach*. The common feature of both is likely their need thwarting properties, which may explain their stronger correlates with maladaptive outcomes compared with the demanding and awaiting subareas. The fact that both of these approaches may—at least among some teachers—go hand in hand suggests that the domineering approach may be perceived as the ultimate 'rescue ring' by teachers. If a domineering approach turns out to be equally ineffective, teachers may (temporarily) give up any attempt to stay further involved with their students.

Finally, we are back to the awaiting approach, which formed the subarea in between the abandoning and participative approach. The less pronounced costs associated with the awaiting approach indicate that this approach may be merely need-depriving, that is, it fails to support learners' psychological needs but do not necessarily yield a need thwarting effect. In fact, the awaiting approach correlated positively with all forms of motivation (i.e., autonomous and controlled) and lack thereof (i.e., amotivation and oppositional defiance). The motivational effects of an awaiting approach may thus be quite variable, perhaps determined by learners' skill-level or initial interest in the activity at hand. That is, some may come to see the awaiting approach as an attractive opportunity to act upon their preferences, while those who feel helpless may feel overwhelmed and lost if their teacher is too awaiting.

The Merits of a Circumplex Approach: Implications for Theory and Research

The present findings have important implications for current theorizing and research on motivating and demotivating teaching. First, conceptual gains are made as the four overarching (de)motivating styles get segmented into subareas (i.e., refinement) and each of these subareas is located in a circular structure that provides further conceptual depth (i.e., integration). Specifically, each subarea can be characterized according to the constituting dimensions of the circumplex, which represents a significant advancement compared with previous research. Indeed, whereas autonomy support, control, and structure have often been treated in a nondifferentiated way (but see, e.g., Assor et al., 2002; Patall et al., 2013) or were studied in isolation from each other (but see Sierens et al., 2009), their simultaneous examination herein allows for a more precise conceptual description of each teaching style and its constituting subareas.

The fact that the assessed (de)motivating practices can best be graphically represented by a circumplex structure suggests that a different approach toward motivating and demotivating styles is necessary and even illuminating: instead of treating them as rather distinct entities, as is the case in a *categorical approach*, the relative differences between the different subareas suggest that a more *gradual approach* toward (de)motivating teaching is warranted. That is, not all autonomy-supportive and structuring practices are equally motivating, presumably because some of them are more directly *need-nurturing* and others are merely *need-enabling*. Such a gradual approach also appears fruitful to better understand the variation in the demotivating practices: some of the identified subareas (e.g., domineering, abandoning) may be truly *need-thwarting*, thereby actively undermining learners' motivation and engagement, whereas other approaches (e.g., awaiting) may be merely *need-depriving*. That is, they fail to support learners' psychological needs and motivation but do not necessarily yield a need-thwarting effect.

A second implication of the circumplex structure and the associated gradual perspective is that different need-supportive dimensions or components (e.g., Patall et al., 2013) do not necessarily need to "fight" for unique variance in outcomes. Indeed, scholars have increasingly pitted several need-supportive dimensions against each other in an attempt to examine which dimension yields the strongest predictive power. Although such a decomposition of need support is informative, the overall picture may get lost. By assessing a broad variety of teaching practices and locating these into a circular structure, it becomes clear why certain practices yield stronger effects than do others. Also, such a circular structure may better align with daily teaching reality as teachers often simultaneously engage in a variety of need-supportive or need-thwarting practices in a given situation.

Does this imply that each of the identified subareas cannot be related to specific outcomes or be rooted in specific characteristics of teacher functioning? No, the quest for unique correlates with both teacher and student variables continues. But demonstrating such a unique pattern (for instance through regression analyses) is no longer an absolute prerequisite. In our view, what matters especially is that the pattern of correlates should be ordered along a continuum of decreasing magnitude as one moves away from a specific subarea to the other side of the circle, and increasingly positive when reverting back to the specific subarea. Such an ordered pattern of correlates is informative in its own right and lessens the need to garner evidence for unique correlates of specific subareas.

Related to the previous issue, the circumplex structure can also speak to the question of whether high correlations between need-supportive styles (Jang et al., 2010), which may be a source of concern for some scholars, are really troublesome. Autonomy support and structure are indeed highly correlated, especially among students. Yet, rather than treating such findings as an anomaly, the circumplex approach suggests that they are worthwhile in themselves. In fact, such high correlations provide an even stronger justification to differentiate the overarching styles into subareas, as the pattern of correlates among the autonomy-supportive and structuring subareas is dependent upon the pair of subareas under investigation.

Finally, the relations between the teaching styles that stand in opposition to each other in the circumplex also deserve discussion. After 45-degree rotation of the two retained dimensions, they can be reinterpreted as representing the provision of autonomy support, relative to control, and the provision of structure, relative to chaos. The circular structure in Figure 1 may even suggest that autonomy support and control and structure and chaos stand, by definition, in stark opposition to each other. Yet, this is not necessarily the case. Indeed, it is important to emphasize that the distance between the overarching styles in the circle is a reflection of their *relative* and not their *absolute* distance. Indeed, at the absolute level, autonomy

support and control were either unrelated (teachers) or slightly negatively related (students), while structure and chaos were only minimally negatively related among both teachers and students. Thus, across and possibly even within situations teachers may well rely on a combination of both controlling and autonomy-supportive (Haerens et al., 2018). Such findings are congruent with the postulation (Bartholomew et al., 2011; Ryan & Deci, 2017; Vansteenkiste & Ryan, 2013) and empirical demonstration (Haerens et al., 2015; Jang et al., 2016) of a dual process model, which suggest that teacher autonomy support and control may constitute a 'bright' and 'dark' pathway to students' optimal functioning (Haerens et al., 2015).

Limitations

The present study has several limitations. First, although most of the subareas had satisfying reliabilities, the participative approach of the 12-vignette version of the questionnaire was rather poor. This was rectified in the 15-vignette version, which involved two additional situations in this subarea. That said, the psychometric properties of this 15-vignette version among students, as well as its predictive validity among teachers and students still need to be further demonstrated. Second, the present study did not include a measure of students' need-based experiences. Because we suggested that not all teaching practices are equally need-nurturing or need thwarting, but instead some practices foster or undermine students' needs more indirectly (i.e., need-enabling and need-depriving approaches), a critical next step in future research is to investigate the extent to which the identified subareas meaningfully relate to students' need-based experiences. Third, the situations involved in the SIS are mainly characteristic of the context of secondary education, which raises questions about the generalizability of the results for other age groups. Future studies could investigate the validity of the SIS in primary and higher education, thereby making the necessary adjustments, so that the situations optimally match up with these contexts. Fourth, although we provided evidence for the validity of the SIS, it is advisable to complement self-reports with observations. In this respect, it is noteworthy that in a Korean version of the SIS (Cheon et al., 2017), teachers' self-reported teaching practices were found to correlate significantly with raters' in-class objective scoring of teachers' teaching practices. Finally, the SIS vignettes did not include responses tapping into teacher relatedness support and neglect/rejection, which constitute the third teaching dimension within SDT (Ryan & Deci, 2017; Skinner, 2016).

What Is Next? Developing a Systematic Program of Research

The identification of a circumplex structure in the present study provides a foundation for the development of a systematic program of research on motivating and demotivating teaching styles. We discuss three critical research lines.

First, future research should continue to examine the predictive validity of the identified subareas, focusing especially on for whom and under which conditions the need-enabling and need-depriving areas yield the most predictive power. To illustrate, in the case of the participative approach, the effect of choice may depend on a number of factors, including learner characteristics, such as their level of indecisiveness (Germeijs & Verschueren, 2011), type of motivation (De Meyer et al., 2016), and their competence level (Patall, Sylvester, & Han, 2014).

A second research line may involve the use of a person-centered approach toward teaching. The current circumplex identifies critical subareas of (de)motivating teaching, but teachers' daily teaching style consists of combinations of different subareas. Past research (see Matosic & Cox, 2014; Haerens et al., 2018; Vansteenkiste et al., 2012) has identified such profiles using the overarching teaching styles. Yet, the observed differentiation within these styles in the present study allows one to extend and refine the number of identified profiles in past work.

Finally, future research may focus on the moment-to-moment and day-to-day shifts in teaching approaches across the circumplex. Teachers may gradually shift along the circle away from more need-supportive to more need thwarting subareas as a function of their daily need-satisfying or need-frustrating experiences. Although such an issue deserves attention in longitudinal work, the specification of the gradual change in different teaching subareas along a circumplex also allows for a more dynamic account of teaching styles. For example, teachers may "regress" (i.e., shifting from need-supportive to need thwarting teaching) or "progress" (i.e., shifting from need thwarting to need-supportive teaching) over different periods of time. Indeed, research has already demonstrated that there exists considerable variation in teachers' motivating approach from day to day (Patall et al., in press; Van der Kaap-Deeder et al., 2017), and even from lesson to lesson (Mouratidis et al., 2011).

Conclusion

What motivating and demotivating teachers do exactly has been a source of intense examination in the past decades in the teaching and motivation literatures. Guided by Self-Determination Theory, the present study sheds a refreshing light on the question of how these different teaching styles fit together and whether they can be refined. Specifically, a two-dimensional structure involving eight subareas arranged along circumplex emerged, both among students and teachers. These eight subareas correlated in a systematic way among each other and with external variables, suggesting that a gradual approach toward motivating and demotivating teaching is warranted. We hope that other researchers will share our excitement to help build a systematic program of research that allows teachers to gain a more precise insight into their own teaching style so that they can adopt a more need-supportive style that benefits both their students and themselves (Reeve, 2016).

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