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ORIGINAL PAPER

The role of teachers' motivation and mindsets in predicting a (de) motivating teaching style in higher education: a circumplex approach

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Abstract

Although different measures for (de)motivating teaching are available for primary and secondary education, a fine-grained instrument to assess a variety of motivating and demotivating teaching practices in higher education is lacking. Adopting a Self-Determination Theory perspective, this study first used the newly developed Situation-in-School Questionnaire—Higher Education to examine in a sample of higher education teachers ($N=357$; $M_{age}=43.90$ years) whether a broad set of need-supportive and need-thwarting teaching practices are organized in a similar circular structure as in secondary education (Aelterman et al. in J Educ Psychol 111:497–521, 2019). Second, this study addressed the role of higher education teachers' motivation to teach (i.e., autonomous, controlled, amotivation) and their beliefs about the malleability of students' intelligence (i.e., fixed and growth mindset) in relation to the various distinguished teaching approaches. Results of multidimensional scaling analyses confirmed the hypothesized circular structure of eight different (de)motivating teaching approaches that differ in their level of need-supportiveness and directiveness. Second, hierarchical regression analyses provided evidence for the fairly independent role of teachers' motivation and mindsets, with the predictive role of each predictor systematically varying as one moves along the circumplex. Autonomous motivation and a growth mindset related positively to more motivating approaches (e.g., guiding, attuning), while controlled motivation, amotivation and a fixed mindset related positively to more demotivating approaches (e.g., domineering, abandoning). The present findings shed new light on the factors that underlie teacher-reported engagement in (de) motivating practices in higher education.

Keywords Teaching styles · Motivation to teach · Fixed and growth mindset · Higher education · Self-determination theory

While ex-cathedra teaching has long been a common practice in higher education, nowadays, there is an increasing focus on adopting a more activating teaching style (Ramsden 2003). For activating teaching practices to be truly engagement- and motivation-promoting, according to Self-Determination Theory (Ryan and Deci 2017; Vansteenkiste et al. 2020) they need to be supportive rather than undermining of students' psychological needs for autonomy, competence, and relatedness. Congruent with the recently developed integrative and fine-grained circumplex approach towards need-supportive and need-thwarting teaching in secondary education (see Fig. 1; Aelterman et al. 2019; Vansteenkiste et al. 2019), the present study sought to provide evidence for the validity of a newly developed instrument to measure a broad range of (de) motivating teaching practices in higher education.

A second objective was to shed light on the question why some higher education teachers predominantly rely on motivating or need-supportive teaching approaches, while others act in a more demotivating or need-thwarting manner, thereby both considering the role of teachers' beliefs about students' ability and teachers' motivation for teaching. Due to the increasing democratization of education in Western Europe, higher education teachers are facing a growing and more heterogeneous student group in terms of interests, competencies, and natural talents (Schofer and Meyer 2005; Altbach et al. 2010). As a result, some teachers may start questioning whether all enrolled students are suitable to follow higher education training. While some teachers might

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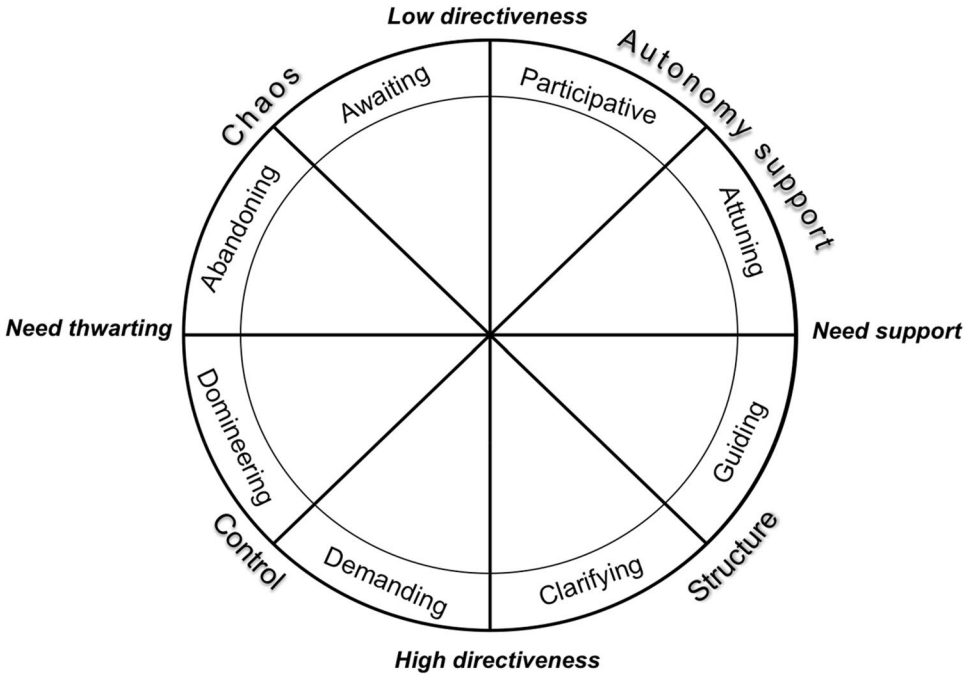

Fig. 1 Graphical representation of the circumplex model (Aelterman et al. 2019)

consider students' prior education or knowledge and skills as starting points for growth and development, other teachers might believe that there is little room for growth, emphasizing the importance of students' endowed intelligence as essential to succeed (Dweck and Leggett 1988). This raises the question whether teachers' mindsets about the malleability of students' intelligence would predict their engagement in motivating or rather demotivating teaching styles. In addition to their mindsets, teachers' quality of motivation to teach may also affect how they interact with students. Indeed, a unique feature of teachers in higher education is that teaching is only one aspect of their job, especially for those working at the university (Anderson et al. 2011). As a result, some teachers may be rather poorly motivated or even amotivated for their teaching duties, consequently relating to a less involved and less motivating teaching approach. Before addressing the role of these two antecedents of higher education teachers' (de)motivating style, we first introduce the circumplex model on (de)motivating teaching.

A circumplex approach to teachers' (de) motivating teaching style

According to SDT, teachers' interaction style can be more supportive or thwarting of students' basic psychological needs, with implications for students' motivation, well-being, and thriving in school (Vansteenkiste et al. 2006). When students' psychological needs for autonomy (i.e., experiencing a sense of ownership and psychological freedom), competence (i.e., experiencing a sense of effectiveness and mastery) and relatedness (i.e., feeling close to others) are met, students report more high-quality motivation and engagement (Orsini et al. 2016; Patall et al. 2018; Skinner et al. 2008) and they are more likely to deeply process the learning material and to perform better (e.g., Vansteenkiste et al. 2005; Jang et al. 2016b). Recent research among university students in particular indicated that those reporting increasing need satisfaction over time also experienced more well-being and engagement (Gillet et al. 2019), while being less vulnerable for stress and poor sleep (Campbell et al. 2018).

To nurture students' needs, teachers do well to adopt a need-supportive style and to avoid being need thwarting. Consistent with other circumplex models capturing teachers' interpersonal behavior (e.g., den Brok et al. 2004; Wubbels and Brekelmans 2005), Aelterman et al. (2019) recently developed an SDT-based circumplex model of (de)motivating teaching and tested this model among students and teachers in secondary education. The model distinguished between eight different approaches that can be organized in a circular structure along two dimensions. As can be noticed in Fig. 1, the horizontal dimension represents teachers' level of provided need support, with autonomy support and structure (Jang et al. 2010) being more need-supportive in nature and with control and chaos representing more need-thwarting in nature. The vertical axis reflects teachers' level of directiveness, with structure and control representing more directive styles and with autonomy support and chaos being less directive. As can be observed, each of the identified broader teaching styles (i.e., autonomy support, control, structure, and chaos) are

distinguished into two specific teaching approaches, of which a more detailed description is provided in Table 1. When teachers adopt an *autonomy-supportive* teaching style, they display a receptive and supportive attitude towards their students (Reeve 2009), thereby using practices that are *participative*, such as offering choice to students (McLachlan and Hagger 2010; Waterschoot et al. 2019) or *attuning*, such as explaining the personal relevance of a certain task (Assor et al. 2002). When teachers adopt a *structuring* teaching style, they express a progress- and process-oriented attitude towards their students (Vansteenkiste et al. 2019), thereby making use of *guiding* teaching practices, such as offering desired help, encouragement and growth-oriented feedback (Jang et al. 2010), or *clarifying* teaching practices, such as setting clear expectations for students (Belmont et al. 1988). When adopting a *controlling* teaching style, teachers start from a tunnel-perspective, thereby rigidly sticking to their own viewpoint and leaving little or no room for students' own perspective (Reeve 2009). Reflective of a controlling teaching style, teachers can rely on both *demanding* practices, such as the use of forceful language or threatening with sanctions (Assor et al. 2005), or on *domineering* practices by making use of intrusive strategies like guilt-induction or public shaming (Soenens et al. 2012). Lastly, teachers who adopt a *chaotic* style are rather indifferent vis-à-vis their students' progress. They can either adopt an *abandoning* approach, for instance, when they are unresponsive to students' struggles and concerns or give up on earlier introduced rules in case of student resistance, or they can adopt a wait-and-see attitude while more direction is needed, which is illustrative for an *awaiting* approach (Aelterman et al. 2019).

Dozens of correlational, diary, and experimental studies have examined the role of teachers' need-supportive and need-thwarting teaching styles, with a number of meta-analyses summarizing these effects (Lochbaum and Jean-Noel 2016; Su and Reeve 2011). The vast majority of these studies were performed in secondary education, showing that student perceived autonomy support (Patall et al. 2018) and structure (Jang et al. 2010; Sierens et al. 2009) relate to various favorable outcomes, including behavioral engagement, self-regulated learning, and well-being (see Reeve 2016 for an overview). In contrast, perceived teacher control is associated with disengagement (Jang et al. 2016a), poorer self-regulated learning, and diminished achievement (Soenens et al. 2012; see Haerens et al. 2016 for an overview). In the more refined and integrative circumplex model proposed by Aelterman et al. (2019), the discerned teaching approaches displayed a gradual pattern of correlations with positive student outcomes (e.g., self-regulated learning). The attuning and guiding approaches yielded the strongest correlates and the correlations gradually decreased and became negative as one moves along the circumplex to the domineering and abandoning approaches.

Comparatively speaking, far less research has been performed in higher education, with previous studies mainly focusing on teachers' need-supportive styles, thereby largely ignoring the role of need-thwarting teaching (but see Amoura et al. 2015 for an exception). For instance, correlational research showed that university students who perceived their teachers as more autonomy-supportive reported more autonomous motivation and less anxiety for the subject later in the semester (Black and Deci 2000). Students who received informational feedback (which is a component of structure) felt more competent and reported more autonomous motivation (Levesque et al. 2004). Experimental research with college students further confirmed this pattern of findings, with those students receiving instructions (Vansteenkiste et al. 2004) or syllabi material (Young-Jones et al. 2019) filled with informational (instead of controlling) language reporting greater value of the course or task. In one study (Leenknecht et al. 2017), various need-supportive teaching dimensions were assessed, with teachers who were perceived as autonomy-supportive being also perceived as more involved and structuring. All three need-supportive teaching styles related positively to students' autonomous study motivation and grades.

The present study aims to advance this growing body of knowledge in two ways. First, as most of the research on need-relevant teaching styles has been conducted in primary and secondary education, the question is whether the integrative circular model proposed in Fig. 1 also emerges in teachers in higher education. Teachers in higher education differ considerably from their colleagues in secondary education, as many of them do not have a pedagogical degree or only received limited teacher education training (e.g., Postareff et al. 2007). The study extends prior work because it aims to simultaneously assess a variety of need-supportive and need-thwarting teaching practices, while most prior studies examined these dimensions in isolation. Second, given the manifold desirable and undesirable student outcomes associated with, respectively, a more need-supportive and need-thwarting teaching style (e.g., Cheon et al. 2014; Soenens et al. 2012), identifying their antecedents is essential. As higher education teachers might not necessarily consider teaching a priority in their daily tasks (Anderson et al. 2011) and believe that only smart students will succeed in the cognitively challenging environment of higher education, herein we seek to examine whether teachers' mindsets and motivation may independently predict higher education teachers' reliance on a (de)motivating teaching style.

Table 1 Conceptual definitions of the four teaching styles and description of the eight identified teaching approaches (Aelterman et al. 2019)

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

Two distinct predictors of a (de)motivating teaching approach

Teachers' mindsets

Teachers' cognitive beliefs, either explicitly or implicitly (Gigerenzer 2007), play a critical role in their daily decision-making regarding a variety of issues, including teachers' perceptions and behavior in the classroom (Kagan 1992; Pajares 1992). Specifically, prior research has shown that teachers' beliefs about teaching (e.g., effectiveness and feasibility beliefs; Aelterman et al. 2016), learning (e.g., constructivist view on learning; Brooks and Brooks 1999) and student characteristics, such as students' gender (Taylor et al. 2009) and motivation (Katz and Shahar 2015; Pelletier et al. 2002), all relate to their teaching style.

Herein, we focus on teachers' implicit beliefs about the malleability of students' intelligence (Dweck 2008; Dweck and Leggett 1988). Teachers can either hold a fixed mindset, thereby viewing intelligence as an innate and rather stable trait that cannot be altered, or a growth mindset, conceiving intelligence as changeable through learning and effort. These implicit schemes about intelligence have numerous implications for aspects of higher education students' functioning, including effort-expenditure (Sriram 2014), perceptions of self-efficacy (Komarraju and Nadler 2013), coping with failure (Kennett and Keefer 2006), and well-being (Robins and Pals 2002). While students with a growth mindset display a more resilient pattern, those holding a fixed mindset are more likely to withdraw and become helpless when facing failure (Dweck 2008). This pattern may also generalize to teachers' mindsets, although there is a paucity of work on this topic. Prior studies on teachers' mindsets were qualitative in nature (e.g., Rissanen et al. 2018), were conducted among teachers in elementary or secondary education (e.g., Jonsson et al. 2012) and focused on specific areas, such as mathematics (e.g., Heyder et al. 2020), presumably because these beliefs may be more prevalent in these domains (e.g., Leslie et al. 2015).

Although limited in number, prior studies do shed preliminary light on the role of teachers' mindsets in their teaching style. Teachers' fixed mindset was positively related to the use of person-praise (Jonsson and Beach 2012) and to a stronger performance focus (Park et al. 2016b), while a growth mindset was related to mastery-oriented instruction (e.g., acknowledging individual progress; Matteucci et al. 2017). More directly informative for our purposes, a fixed mindset among elementary school teachers related to lower engagement in an autonomy-supportive style (i.e., engaging less in dialogue; refraining to take students' perspective) and to a less structuring style (i.e., less monitoring of expectations; Leroy et al. 2007). An opposite pattern of correlates was observed for a growth mindset. Notably, these findings obtained with self-report measure have been confirmed in observational work among American elementary school teachers, where those with a fixed mindset referred more frequently to grades, were more critical, and provided less encouragement and choice to students (Stipek et al. 2001).

Only a handful studies have examined the role of teachers' mindsets in the context of higher education, thereby mostly focusing on teachers' own implicit self-beliefs instead of the beliefs they hold about the malleability of students' intelligence (e.g., Thadani et al. 2010; Yorke and Knight 2004). The study of the latter beliefs deserves attention, as it is especially in higher education that teachers may come to believe that students' innate ability, which may not be sensitive to change, is required to succeed. The circular model presented in Fig. 1 also allows us to examine whether the predictive role of teachers' mindsets gradually changes as one moves along the circumplex. Much as students with a fixed mindset become helpless and give up in case of failure, teachers holding a fixed mindset may abandon their students in case of resistance or when noticing a lack of progress. Instead, those holding a growth mindset may intensify their guidance and further try to attune their teaching style to students' needs and preferences in case of difficulty.

Teachers' motivation

Although teachers' mindsets may relate to their teaching style, teachers also need to have sufficient energy available to act upon these beliefs. In this regard, teachers' own teaching motivation might act as an energy supplier (Niemiec and Ryan 2009). According to SDT (Ryan and Deci 2017), teachers' motives to teach can differ in a qualitative manner: teachers who are *autonomously* motivated to teach find the teaching to be highly enjoyable and valuable, such that they are very passionate and committed to the teaching (Fernet et al. 2016). Conversely, teachers who are *controlled* motivated, put effort into their teaching because that is what is expected and requested from them or because they feel an internal compulsion to do so, with the investment in teaching being functional to avoid feelings of guilt or to bolster their self-worth (Niemiec and Ryan 2009). Lastly, teachers can display *amotivation* for teaching, in which case the intention to teach is absent, either because teachers do not feel capable to teach or because they do not value the teaching (Ryan and Deci 2002).

A number of studies in primary and secondary education, both among teachers (Katz and Shahar 2015; Pelletier et al. 2002; Taylor et al. 2008; Van den Berghe et al. 2013a) and students (Lam et al. 2009; Roth et al. 2007), confirmed that teachers' autonomous motivation to teach

predicts their self- and student-reported engagement in autonomy-supportive teaching practices. In contrast, controlled motivation was found to relate to teachers' reliance on a more controlling (Soenens et al. 2012; Van den Berghe et al. 2013b) and a more performance- and ego-oriented teaching style (Abós et al. 2018). Aelterman et al. (2019) extended this pattern of findings by relating secondary education teachers' autonomous and controlled motivation to the eight teaching approaches discerned in Fig. 1. Consistent with the circumplex structure, a gradual pattern of correlations emerged, with correlations for autonomous motivation significantly peaking in the case of the attuning and guiding approach, and with correlations for controlled motivation being most pronounced in the case of the demanding and domineering approach. Unfortunately, teachers' amotivation was not taken into account in the Aelterman et al. (2019) study.

Similar preliminary evidence has been documented for teachers in higher education (e.g., Van den Berg et al. 2013). Yet, most of these studies assessed teachers' motivation for their job as a whole (rather than their motivation for teaching more specifically; see Wilkesmann and Lauer 2018 for an exception). Because higher education teachers have various roles in addition to teaching, such as conducting research or being involved in the valorization of research findings (e.g., Anderson et al. 2011), it is important to assess their work motivation at a specific (rather than global) level. Focusing specifically on motivation for teaching, a recent study found that autonomously motivated teachers in higher education reported providing clearer instructions and fostering greater collaboration among students (Stupnisky et al. 2018). The present study sought to extend this limited body of research by examining the role of different types of motivation (autonomous, controlled, and amotivation) in relation to a broader variety of teaching approaches.

The present study

The aim of the present study was twofold. First, we sought to provide evidence for the circular organization of the teaching practices of teachers in higher education. To achieve this aim, we developed a new questionnaire that contained a variety of motivating and demotivating teaching practices. Second, as the majority of the studies investigating teachers' mindsets, motivation and teaching behavior was performed in the context of elementary school (e.g., Leroy et al. 2007) or secondary education (e.g., Soenens et al. 2012), this study contributes to the literature by examining the role of these variables in the prediction of (de)motivating teaching in the context of higher education. The following four hypotheses were examined:

First, congruent with prior work in secondary education (Aelterman et al. 2019; see Fig. 1), we expected that a variety of autonomy-supportive, controlling, structuring, and chaotic teaching practices could best be organized along two dimensions, representing the degree of need-supportive versus need-thwarting teaching (i.e., horizontal dimension) and the level of directiveness of each practice (i.e., vertical dimension; Hypothesis 1A). Further, in line with Aelterman et al. (2019), we examined whether the four broader teaching styles (e.g., autonomy support) could be decomposed into two fairly distinct approaches (e.g., participative and attuning approach; Hypothesis 1B). Then, congruent with the circular structure of the data, a sinusoid pattern of correlations was hypothesized between the identified approaches, with adjacent approaches being most strongly positively correlated and with the pattern becoming gradually less positive and even negative when moving further away from that teaching approach along the circle (Hypothesis 1C).

Second, we examined the construct validity of this newly developed model. We expected that the identified teaching approaches (e.g., participative approach) would be positively correlated with their corresponding construct validation measures (e.g., autonomy support, TASCQ, Belmont et al. 1988), with correlations again becoming less positive and even negatively going along the circle (Hypothesis 2).

Third, we addressed possible antecedents of teachers' self-reported (de)motivating teaching styles in higher education. We hypothesized that having a fixed mindset would be positively related to the demotivating teaching approaches and negatively to the motivating teaching approaches. The opposite pattern was expected for having a growth mindset (Hypothesis 3). Furthermore, we expected that autonomous motivation to teach would be positively related to motivating teaching approaches and negatively to demotivating teaching approaches. In contrast, both controlled motivation and amotivation to teach would yield a reversed pattern of correlations (Hypothesis 4). Finally, we also explored the possible interactive interplay between teachers' mindsets and motivation to teach in explaining teaching behavior, as teaching motivation might function as the energy supplier needed to act on those cognitive beliefs.

Method

Participants and procedure

A total of 357 Belgian higher education teachers from 13 colleges or universities participated in this study, with 43.4% of the respondents being male. On average, the participants were 43.90 years old ($SD = 9.96$), had 13.23 ($SD = 9.28$) years of teaching experience and spent 23.84 ($SD = 22.81$) hours per month teaching. A majority of the respondents

(74.9%) taught at the university, while a minority taught at a college (25.1%). As for the program that participants were teaching in, 37.5% and 11.2% taught solely in, respectively, the bachelor and master program, while 48.2% taught at both levels. The size of the student groups differed between 3 and 1550 with a mean of 180.73 ($SD = 197.78$). In terms of their education, 44.3% of the respondents had followed a short pedagogical training and 46.2% had a teacher education degree. Participants were recruited through a website about motivating teaching, a popular article in an educational magazine and as part of professional training sessions on the importance of motivating teaching delivered in various institutes. Teachers first filled out an online built-in active informed consent and then completed the questionnaire. After completion, teachers received feedback about their teaching style in the form of a personalized teaching profile. The study was conducted according to the ethical rules presented in the General Ethical Protocol of the Faculty of Psychology and Educational Sciences at Ghent University (Belgium).

Measures

Teachers completed all the reported measures in Dutch, their native language.

Teaching style

Inspired by the Situations-In-School Questionnaire-Education for Secondary Education (SISQ-SE, Aelterman et al. 2019), a vignette-based self-report questionnaire was developed to assess teachers' teaching style in higher education, entitled the Situation-in-School Questionnaire—Higher Education (SISQ-HE; see Appendix 1). This newly developed questionnaire was adjusted after extensive pilot testing,[1] resulting in ten vignettes representing diverse authentic teaching situations in higher education. Similar to the original SISQ-SE, the situations were either more reactive (i.e., a teacher reacting in response to student behavior) or more proactive (i.e., a teacher taking the lead) in nature and concerned situations dealing with either the learning content or student behavior. For each situation (e.g., "You are preparing a class, your priority is…"), participants were presented with multiple responses and had to specify to what degree each of these responses described their own teaching style, ranging from 1 (*does not describe me at all*) to 7 (*does describe me extremely well*). Each of the responses represented an autonomy-supportive (e.g., "to give students enough freedom to participate and offer suggestions during class"), structuring (e.g., "to ensure that your lesson is clear and complete"), controlling (e.g., "to insist that students pay attention; you don't tolerate any exceptions or excuses"), or chaotic (e.g., "to not invest too much time in preparation. Things will run smoothly") teaching approach.

Construct validation measures

Three validation measures were included. First, the Psychologically Controlling Teaching Questionnaire (PCT; Soenens et al. 2012; 7 items; $\alpha = .64$; e.g., "I make my students feel guilty when they dissatisfy me.") was used to measure teachers' use of intrusive and manipulative strategies. Second, two subscales of the teacher version of the Teacher as Social Context Questionnaire (TASCQ; Belmont et al. 1988) were used to assess teachers' autonomy support (12 items; $\alpha = .73$; e.g., "I try to give my students many options in assignments") and structure (15 items; $\alpha = .79$; e.g., "When a student does not understand the material, I use a different approach"). Items were rated on a Likert scale ranging from 1 (*I totally disagree*) to 5 (*I totally agree*). Third, to assess teachers' provided autonomy support in a more refined way, a number of subscales from the School

[1] In a first step, SDT experts and practitioners brainstormed about the content of the questionnaire, using the SISQ-SE as the basis, which resulted in a pilot version with 19 situations and 95 responses. In a second step, structured interviews were conducted with two teachers in higher education, using a thinking-aloud protocol (Van Someren et al. 1994) during which the participants were asked to vocalize every thought that came up while filling in the questionnaire. Further, two focus groups ($N = 6$ and 8) were organized with educational support staff members. In advance, the participants were asked to complete the questionnaire and to indicate for all the presented situations and responses (a) how credible they were, ranging from 1 (*totally not credible*) to 5 (*totally credible*), and (b) how frequently they occurred in higher education, ranging from 1 (*never*) to (*daily*). After clarifying the purpose and structure of the focus group discussion, participants were asked to indicate whether they perceive the items to be understandable and whether they had general remarks. Next, situations and responses were discussed one by one, thereby addressing the credibility, frequency, and social desirability of the items. Additional questions about the items were presented, including 'which teaching style (i.e., autonomy support, structure, control and chaos) do you observe in this response?.' In a second step, non-represented situations and responses were generated during a brainstorm phase to secure that the questionnaire covers the breath of relevant teaching situations in higher education. Based on the quantitative assessment and responses during the focus groups, several adjustments were made, resulting in a questionnaire containing 14 situations and 74 responses. Then, a second series of semi-structured interviews were conducted with university teachers ($N = 5$), leading to further refinements of the questionnaire. In a final step, a pilot study ($N = 447$; *Mean age* = 41.52; $SD = 9.35$) was conducted to provide a first indication of the internal validity of the scale through Multidimensional Scaling Analysis (Borg et al. 2013). Although the global structure fitted a circumplex structure, some of the distinguished approaches were not sufficiently covered, leading to further adjustments. This adapted version is presented herein.

Experiences Questionnaire (SEQ; Patall et al. 2013) were adapted to the teacher perspective, that is, choice provision (6 items; $\alpha = .83$; e.g., "I encourage students to work in their own way"), offering a rationale (6 items; $\alpha = .89$; e.g., "I explain to my students how what they learn may be important"), taking students' perspective (5 items; $\alpha = .76$; e.g., "I am accepting when students express that course material is hard") and showing consideration for students' interests and opinions (5 items; $\alpha = .81$; e.g., "I work the students' interests into my lessons"). Items were rated on a 7-point Likert scale ranging between 1 (*totally not true*) and 7 (*totally true*).

Teachers' mindsets

To measure a fixed mindset about intelligence, teachers completed a slightly adapted version of the Implicit Theory of Intelligence measure (3 items), developed by Dweck et al. (1995). One item was added to this scale to tap more into the specific context of higher education and to improve the reliability of the subscale (i.e., "Whether you are doing well in higher education depends mainly on the capacities that you are endowed with"). In addition, four items were constructed as indicators for a growth mindset (e.g., "Learning is primarily a matter of practicing and training yourself"). Items were scored on a 5-point Likert scale, ranging from 1 *(not true)* to 5 *(true)*. Internal consistency were satisfying ($\alpha = .86$ for fixed mindset and $\alpha = .69$ for growth mindset) and exploratory factor analysis yielded two factors explaining 62.09% of the total variance, with factor loadings ranging from .71 to .87 for the fixed mindset factor and from .46 to .75 for the growth mindset factor. Similar to prior research (e.g., Wang and Biddle 2001), fixed and growth mindsets were slightly negatively related ($r = -.14$; $p < .05$).

Motivation to teach

Teachers' motivation to teach was operationalized by taking into account both didactical (e.g., giving instruction) and managerial (e.g., maintaining discipline) aspects of teaching, using two subscales of the Work Task Motivation Scale for Teachers (WTMST; Fernet et al. 2008). Participants were provided with a stem for both teaching [i.e., "I put effort into teaching (e.g., giving instructions, answering questions, listening to the needs of the students…)…"] and group management [i.e., "I put effort into managing my class (e.g., maintaining discipline, applying rules, responding to class disruptions and conflicts between students…)…"]. Following these item stems, participants rated items tapping into intrinsic (e.g., "because I find this task interesting to do"), identified (e.g., "because it is important for me to carry out this task"), introjected (e.g., because I would feel guilty not doing it) and external motivation (e.g., "because the school obliges me to do it"), as well as amotivation (e.g., "I don't know, sometimes I don't see its purpose") using three items per construct. Because some of the internal consistencies of subscales in the original study (Fernet et al. 2008) could be improved, we added one item to each subscale. Combining the scores for teaching and group management, an overall score for autonomous motivation ($\alpha = .89$), controlled motivation ($\alpha = .89$) and amotivation ($\alpha = .91$) was computed.[2]

Plan of analysis

To examine the internal structure of the SISQ-HE (Hypothesis 1), Multidimensional Scaling (MDS; Borg et al. 2013) was conducted using the Proxscal procedure in SPSS 23. Specifically, MDS provides a graphical representation of the dimensional structure of the scale. That is, items that are strongly positively correlated will be represented closely to each other in the geographical space, while strongly negatively correlated items will be displayed in the opposite direction. By conducting analyses with one to six dimensions, we examined first whether the data could be optimally represented by a two-dimensional representation. For the analyses, ordinal proximity transformations and Euclidian distance measures between standardized responses were used. In a following step, a series of CFAs were performed on the items of two adjacent subareas (e.g., participative and awaiting items) to assess whether they are represented better by a two-factor versus a single-factor solution, using the Lavaan package (version 0.6-5; Rosseel 2012) in R (version 3.5.1) with Robust Maximum Likelihood estimation (MLR). Subsequently, correlational analyses were performed using the mean scores for all identified subareas. To examine the construct validity of the SISQ-HE (Hypothesis 2), correlational analyses were conducted to explore whether the identified subareas of the SISQ-HE were related to the construct validation measures (PCT, TASCQ, SEQ) in a meaningful way.

To examine possible antecedents of a (de)motivating teaching approach (Hypothesis 3 and 4), preliminary analyses were performed first, starting with a correlational analysis, followed by a multivariate analyses of covariance (MANCOVA; Johnson and Wichern 2002) using SPSS 23. By including background variables, we examined whether the adopted teaching approaches depended on both teacher characteristics, such as teachers' age, sex, teaching experience, hours of teaching per month and whether they have

[2] Averaging across the motives for teaching and group management was justified by the observation that associations between motives for both roles were moderate to strong. Specifically, correlations were .40, .68 and .65 for, respectively, autonomous motivation, controlled motivation and amotivation. In addition, the pattern of correlations between these task-specific motives and the discerned teaching approaches in the circumplex was similar. These findings are presented in Appendix 2.

a teacher education degree, and workplace characteristics such as student group size, at which level of education they teach (i.e., bachelor, master, a combination or other) and whether they teach at a university or a college. As for the main analyses, a series of hierarchical regression analyses were performed in SPSS 23. In Step 1, the different teaching approaches were regressed onto the background variables that were significant in the preliminary analyses. In Step 2, the main effects of teachers' beliefs about students' intelligence (i.e., fixed and growth mindset) and motivation to teach (i.e., autonomous, controlled and amotivation) were entered as predictors. In a third step, we entered two-way interactions between teachers' mindsets and teachers' motivation by multiplying the centered means of each pair of predictors.

Results

Aim 1: internal structure of the SISQ-HE

Dimensionality

The dimensionality of the scale was examined through inspection of one- up to six-dimensional representations generated by the non-metric MDS analysis. Results showed that a two-dimensional representation yielded the best fit with the data, thereby supporting Hypothesis 1A. That is, the scree plot indicated a two-dimensional representation and the normalized raw stress declined from .099 for the one-dimensional representation to .024 for the two-dimensional representation, while only a small further decline to .015 was observed when retaining three dimensions. When withholding two dimensions, 98% of the distances were represented in the model. Analogous to the findings reported by Aelterman et al. (2019) among secondary education teachers, the X-axis reflects a continuum from need-thwarting to need-supportive teaching behaviors, with all controlling and chaotic items (except for one) yielding negative coordinates and with all autonomy-supportive and structuring items yielding positive coordinates on this dimension. The Y-axis can be interpreted as the degree to which teachers are directive or instead leave the initiative more to students. Congruent with this interpretation, all controlling and all structuring items (except two) loaded positively, and all autonomy-supportive and chaotic items (except two) loaded negatively on this dimension.

Teaching styles and approaches

A visual inspection of the circumplex in Fig. 2 shows that four major quadrants could be distinguished, largely matching the theorized teaching styles. That is, teacher autonomy support ($\alpha = .83$) was located in the upper right quarter while teacher control ($\alpha = .86$) was located opposite in the lower left quarter. Similarly, teacher structure ($\alpha = .79$) was situated in the lower right quarter and teacher chaos ($\alpha = .80$) in the upper left quarter. Furthermore, supporting Hypothesis 1B and similar to the study of Aelterman et al. (2019), the items in each quadrant were largely organized in two meaningful areas (Hypothesis 1B). Specifically, on the need-supportive side, one set of autonomy-supportive items clustered together in a *participative* approach, containing practices such as providing choice, inviting students' input and engaging in an interactive dialogue. A second set of items represented an *attuning* approach and contained practices such as taking interest in students, fostering enjoyment, and providing meaningful rationales and identifying the benefits of learning. Structure practices, such as offering students help, adjusting tasks to their competence level and expressing trust, clustered together in a *guiding* approach, while practices such as setting clear expectations and providing an overview grouped together in a *clarifying* approach. On the need-thwarting side, controlling items that highlight students' obligations and duties and insist on their immediate compliance fell into a *demanding* approach. In contrast, more intrusive controlling practices such as shaming and exerting power were part of the *domineering* approach. Lastly, chaos could be broken down into an *abandoning* approach, which contained practices such as ignoring situations while there is a clear need to intervene and being indifferent, and an *awaiting* approach, which contained practices such as letting things on their behalf and not planning much in advance. In order to verify the structure of the above mentioned approaches, a series of CFAs were performed on the items of two adjacent approaches comparing a two-factor versus a single-factor solution (see Delrue et al. 2019 for a similar approach). Results of χ^2 change tests showed that a two-factor solution was more suitable for each pair of adjacent approaches, as indicated by a significant better fit to the data in all cases ($24.27 < \Delta\chi 2\ (1) < 192.77$, $p < .001$). Moreover, reliability analyses showed that internal consistencies for the eight approaches were acceptable to good, varying between .61 (i.e., clarifying approach) and .79 (i.e., demanding approach; see Table 2).

Correlational pattern

As shown in Table 2, autonomy support and structure (i.e., the need-supportive teaching styles) were positively correlated, and so were control and chaos (i.e., the need-thwarting teaching styles). Further, autonomy support and control and structure and chaos were negatively correlated. Inspecting the correlations between the eight teaching approaches, evidence for an ordered pattern was found, in

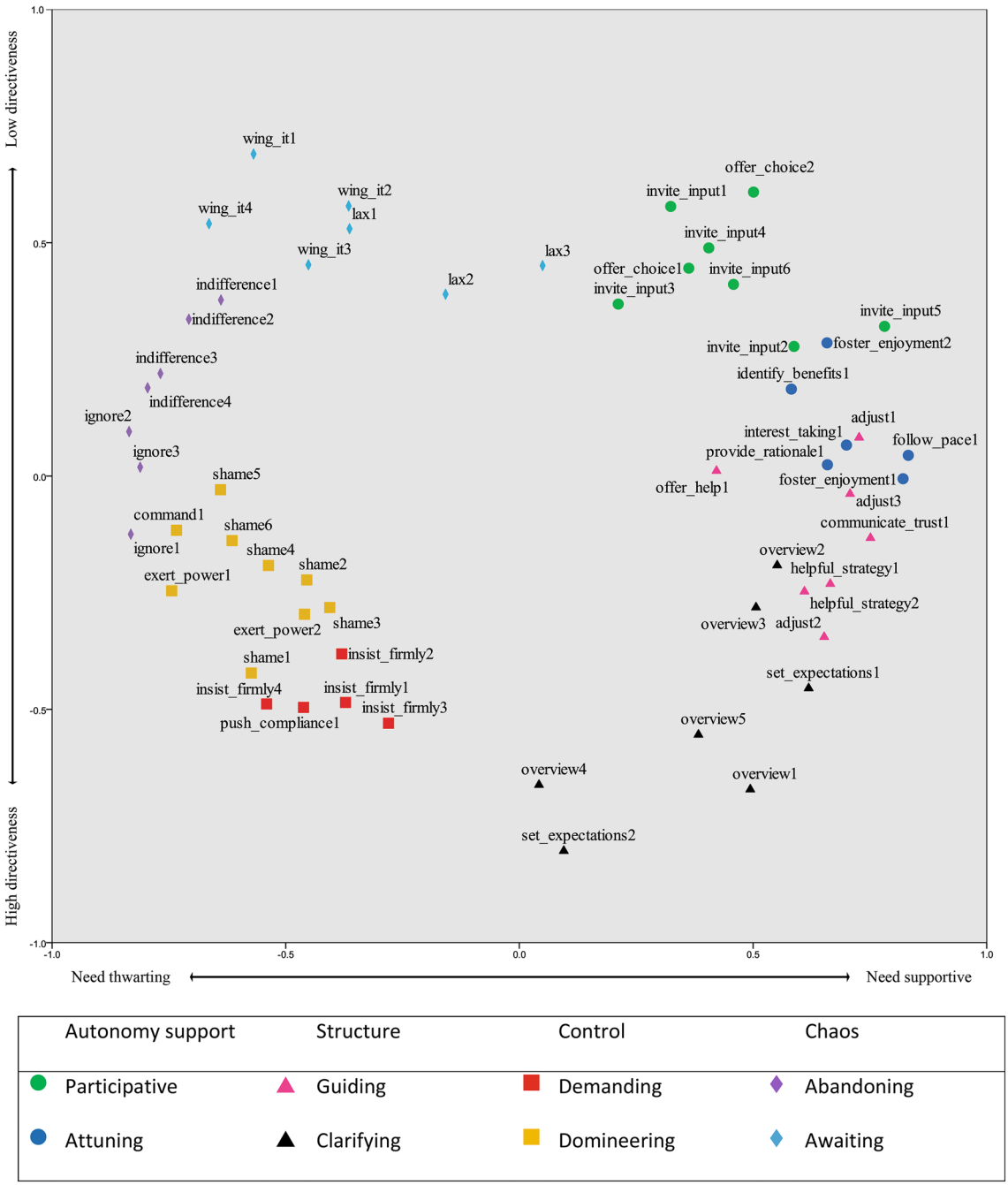

Fig. 2 Two-dimensional MDS-representation of the teaching practices of the Situation-in-School Questionnaire - Higher Education (Color figure online)

which adjacent teaching approaches were most strongly and positively correlated and in which the strength of the correlations decreases and even becomes negative when moving along the circumplex to teaching approaches situated at the opposite side (Hypothesis 1C). To illustrate, the guiding approach was related most strongly to both the attuning and clarifying approaches, yet was unrelated to a demanding and awaiting approach and significantly negatively related to the domineering and abandoning approach. Although all adjacent approaches were correlated positively, this was less the case for the areas denoting the transition from the need-supportive

Table 2 Descriptives of and correlations between teaching styles, approaches and antecedents

	N	*M* (*SD*)	α	1	2	3	4	5	6	7	8	9	10	11	12
Teaching styles															
1. Autonomy support	14	4.44 (0.87)	.83	–											
2. Structure	14	5.21 (0.72)	.79	.42***	–										
3. Control	14	2.20 (0.79)	.86	− .17**	.01	–									
4. Chaos	14	2.39 (0.75)	.80	− .06	− .31***	.27***	–								
Teaching approaches															
5. Participative	8	3.80 (1.05)	.77	.93***	.29***	− .14**	.08	–							
6. Attuning	6	5.30 (0.90)	.71	.81***	.50***	− .16**	− .26***	.54***	–						
7. Guiding	7	5.23 (0.84)	.77	.49***	.85***	− .10	− .18**	.40***	.49***	–					
8. Clarifying	7	5.21 (0.80)	.61	.22***	.86***	.10*	− .32***	.10	.34***	.44***	–				
9. Demanding	5	2.78 (1.14)	.79	− .13*	.08	.89***	.12*	− .13*	− .09	− .00	.14**	–			
10. Domineering	9	1.88 (0.73)	.79	− .18**	− .06	.92***	.35***	− .13*	− .20***	− .16**	.05	.63***	–		
11. Abandoning	7	2.11 (0.83)	.78	− .27***	− .30***	.34***	.85***	− .15**	− .37***	− .36***	− .16**	.16**	.43***	–	
12. Awaiting	7	2.64 (0.85)	.64	.13*	− .24***	.15**	.87***	.24***	− .08	− .03	− .37***	.04	.22***	.45***	–
Antecedents															
Fixed mindset	4	2.28 (0.82)	.86	− .36***	− .13*	.27***	.22***	− .33***	− .32***	− .19**	− .03	.20***	.30***	.30***	.06
Growth mindset	4	4.12 (0.49)	.69	.01	.26***	.02	− .11	− .06	.12*	.20***	.24***	.06	− .02	− .09	− .09
Autonomous motivation	16	3.68 (0.66)	.89	.37***	.39***	− .01	− .20**	.31***	.36***	.40***	.27***	.04	− .06	− .24***	− .09
Controlled motivation	16	2.49 (0.79)	.89	− .24***	− .07	.24***	.24***	− .21***	− .21***	− .13*	.01	.24***	.21***	.27***	.13*
Amotivation	8	1.43 (0.62)	.91	− .18**	− .27***	.27***	.37***	− .10	− .27***	− .28***	− .18**	.17**	.32***	.42***	.21***

*$p < .05$, **$p < .01$, ***$p < .001$ (two-tailed)

Table 3 Correlations of the teaching styles and approaches with construct validation measures

	Teaching styles				Teaching approaches					
	Autonomy support	Structure	Control	Chaos	Participative	Attuning	Guiding	Clarifying	Demanding	Domineering	Abandoning	Awaiting
Autonomy support (TASCQ)	**.52*****	.17**	− .41***	− .18**	.45***	**.49*****	.26***	.02	− .38***	− .37***	− .34***	.03
Choice provision (SEQ)	**.60*****	.34***	− .20***	− .07	**.58*****	.48***	.41***	.15**	− .18**	− .19**	− .22***	.10
Offering a rationale (SEQ)	.43***	**.49*****	− .13*	− .32***	.27***	**.58*****	.46***	.38***	− .09	− .15**	− .38***	− .17**
Taking students' perspective (SEQ)	.44***	**.45****	− .25***	− .33***	.33***	**.48*****	.47***	.29***	− .16**	− .29***	− .43***	− .13*
Consider students' interest and opinions (SEQ)	**.64*****	.33***	− .10	− .11	**.58*****	.55***	.36***	.20***	− .09	− .10	− .26***	.07
Structure (TASCQ)	.43***	**.52*****	− .18**	− .46***	.29***	.53***	**.55*****	.32***	− .05	− .27***	− .58***	− .20***
Psychological control (PCT)	− .09	− .15**	**.51*****	.37***	− .01	− .19**	− .20***	− .05	.32***	**.59*****	.37***	.26***

Bold values indicate highest correlations that were also theoretically expected

TASCQ Teacher as social context questionnaire, *SEQ* school experiences questionnaire, *PCT* psychologically controlling teaching questionnaire

*p < .05, **p < .01, ***p < .001 (two-tailed)

to a need-thwarting side (i.e., participative and awaiting approach; clarifying and demanding approach).

Aim 2: external validity of the SISQ-HE

As displayed in Table 3, the observed pattern of correlations between theoverarching teaching styles and their constituting teaching approaches largely confirms the construct validity of the SISQ-HE (Hypothesis 2). Specifically, the autonomy-supportive, structuring and controlling teaching styles in the SISQ-HE were related strongly to their corresponding construct validation measures. A similar pattern emerged for the separate teaching approaches, with structure as measured by the TASCQ, for instance, being related strongly positively to the guiding approach and negatively to the abandoning approach and with psychological control (PCT) being related strongly positively to the domineering approach. A clear-cut pattern of correlations was also present when considering the narrower construct validation measures of autonomy support (SEQ). A participative approach was linked predominantly to the provision of choice and considering students' opinions. An attuning approach was related predominantly to offering a rationale and taking students' perspective.

Aim 3: antecedents of a (de)motivating teaching approach

Preliminary analyses

Correlations between the antecedents show that a fixed mindset was related to less autonomous motivation ($r = -.13$, $p < .05$), more controlled motivation ($r = .21$, $p < .001$) and more amotivation to teach ($r = .20$, $p < .001$). A growth mindset was unrelated to any of the motivation measures (autonomous, $r = .11$, $p = .05$; controlled, $r = .04$, $p = .54$; amotivation, $r = -.07$, $p = .22$). Correlations between the antecedents and the teaching approaches are presented in Table 2.

To determine whether teachers' personal and workplace characteristics were related to their teaching approach, a MANCOVA was performed, indicating that there was no significant multivariate effect (based on Wilk's lambda) for teachers' age ($F(8,310) = 1.12$, $p = .35$), the amount of monthly teaching hours ($F(8,310) = 0.48$, $p = .87$), whether they had a teaching degree $F(8,310) = 1.11$, $p = .35$), or at which educational level they taught (i.e., bachelor, master, a combination or other; $F(24,900) = 1.50$, $p = .06$). A significant multivariate effect on teaching approach did occur for teachers' sex ($F(8,310) = 2.60$, $p < .01$, $\eta^2 = .06$), teaching experience ($F(8,310) = 2.27$, $p < .05$, $\eta^2 = .06$), students' group size ($F(8,310) = 3.48$, $p < .01$, $\eta^2 = .08$), and type of educational institution (i.e., university or college; $F(8,310) = 3.04$, $p < .01$, $\eta^2 = .07$). Specifically, male teachers

Table 4 Hierarchical regression analyses of implicit beliefs about students' intelligence and teachers' work motivation with the eight teaching approaches

	Autonomy support		Structure		Control		Chaos	
	Participative approach	Attuning approach	Guiding approach	Clarifying approach	Demanding approach	Domineering approach	Abandoning approach	Awaiting approach
Mindset								
Fixed mindset	− .24***	− .20***	− .08	.05	.13*	.22***	.19***	.03
Growth mindset	− .11*	.06	.15**	.21***	.08	.04	− .05	− .07
Teaching motivation								
Autonomous motivation	.30***	.33***	.35***	.24***	.02	− .02	− .18**	− .07
Controlled motivation	− .21***	− .17**	− .09	.01	.14*	.05	.17**	.10
Amotivation	.05	− .08	− .16*	− .12	.13*	.25***	.27***	.11
R^2	.31	.26	.24	.16	.19	.19	.28	.08
ΔR^2	.19***	.24***	.23***	.13***	.09***	.14***	.27***	.05*

Only results of main effects of mindsets and motivations (Step 2) are included. R^2 = total variance explained in teaching approach by control variables (Step 1) and main effects (Step 2). ΔR^2 = additional variance explained in Step 2

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

reported being slightly more abandoning ($M_{male} = 2.16$, $SD = .11$; $M_{female} = 1.95$, $SD = .10$; $F(1,317) = 4.47$, $p < .05$, $\eta^2 = .01$) and awaiting ($M_{male} = 2.76$, $SD = .11$; $M_{female} = 2.55$, $SD = .10$; $F(1,317) = 5.07$, $p < .05$, $\eta^2 = .02$) compared to their female counterparts. Also, more experienced teachers acted in a more demanding ($b = .04$, $F(1,317) = 14.06$, $p < .001$, $\eta^2 = .04$) and somewhat more domineering way ($b = .02$, $F(1,317) = 4.65$, $p < .05$, $\eta^2 = .01$). In addition, as students' group size increased, teachers reported teaching in a more clarifying ($b = .001$, $F(1,317) = 9.31$, $p < .01$, $\eta^2 = .03$) and demanding way ($b = .001$, $F(1,317) = 8.89$, $p < .01$, $\eta^2 = .03$). Finally, teachers who taught at a university used a less participative approach than the colleagues who taught in a college ($M_{university} = 3.69$, $SD = .10$; $M_{college} = 4.32$, $SD = .17$; $F(1,317) = 12.84$, $p < .001$, $\eta^2 = .04$). Based on these findings, teachers' sex, years of teaching experience, students' group size and type of educational institution were controlled for in the main analyses.

The unique role of mindsets and motivation

As can be seen in Table 4, after controlling for background variables, the five predictors were found to explain significant variance in all eight teaching approaches (Hypothesis 3 and 4). Across the approaches, a fixed and growth mindset yielded a unique association with, respectively, five and three approaches. As for teacher motivation, autonomous motivation, controlled motivation and amotivation were related significantly to, respectively, five, four, and four teaching approaches. Of the 21 obtained unique effects, all but one effects were in the expected direction, with the maladaptive cognitive and motivational predictors (i.e., fixed mindset, controlled motivation, amotivation) being most strongly related to need-thwarting approaches (in 8 of the 9 cases). In contrast, the need-supportive approaches were predicted by both adaptive predictors (i.e., autonomous motivation, growth mindset; 7 out of 12 cases) and maladaptive predictors (5 out of 12 cases), with the adaptive predictors relating positively to need-support and with the maladaptive predictors relating negatively.

Zooming in on specific predictors, a fixed mindset related negatively to both the participative and attuning approach, was related positively to both the demanding and domineering approaches and to the abandoning approach. An identical pattern emerged for controlled motivation, except that it was unrelated to the domineering approach. Amotivation also yielded a unique positive association with the demanding, domineering and the abandoning approaches, and was related negatively to the guiding approach. A growth mindset related positively to both the guiding and clarifying approaches, while yielding an unexpected but small negative relation with the participative approach. Autonomous motivation related uniquely positively to the two structuring approaches (i.e., guiding and clarifying) and to the two autonomy-supportive approaches (i.e., participative and attuning) approaches. Further, it was related negatively to the abandoning approach.

Finally, adding interactions between teachers' mindsets and motivation to teach in Step 3, only 3 out of 48 interaction effects were significant. However, none of these interactions significantly increased the variance explained, indicating that their role was minimal.

Discussion

A topic for lively debate among teachers, students, and policy makers is the question how teachers can best motivate their students. Proponents of Self-Determination Theory (Ryan and Deci 2017; Vansteenkiste et al. 2020) advocate that higher education teachers do well to foster students' experience of freedom to map out their own learning path (i.e., need for autonomy), feelings of competence to master the course material (i.e., need for competence), and experiences of a warm and supportive relationship with the teacher (i.e., need for relatedness; Ryan and Deci 2017). Developing a need-supportive teaching style may be particularly challenging in college or university classrooms because of the limited interpersonal contact between teacher and students, the large size of at least some groups of students and the increased heterogeneity of students who enroll in higher education studies nowadays (Altbach et al. 2010; Cotten and Wilson 2006). In spite of these challenging circumstances, prior research on the motivating teaching style of teachers in higher education is rather scarce within the SDT-literature (but see Leenknecht et al. 2017 and Vansteenkiste et al. 2009 for exceptions). Given the promising findings regarding the circular structure of teachers' (de)motivating styles in prior research among secondary school teachers (Aelterman et al. 2019), in the present study we sought to modify and develop this model to the context of higher education.

Apart from 'how' higher education teachers interact with their students, an equally important aim was to advance our understanding of 'why' they teach in that manner. Building upon previous research showing that elementary school teachers' beliefs about students' intelligence were related to their teaching behavior (Leroy et al. 2007), we examined higher education teachers' fixed and growth mindsets as cognitive predictors of teachers' reliance on the identified (de)motivating teaching approaches. Furthermore, as recent research in the context of higher education demonstrates that autonomous motivation to teach relates to more need-supportive teaching (Stupnisky et al. 2018), teachers' type of motivation (i.e., autonomous, controlled and amotivation) was included as a motivational predictor.

A circumplex approach on (de)motivating teaching

In line with Aelterman et al. (2019), the assessed (de)motivating practices could be represented graphically by a circumplex pattern along two dimensions (see Fig. 2). The horizontal dimension represents the degree to which teachers support or instead thwart students' basic psychological needs for autonomy, competence, and relatedness, with autonomy-supportive and structuring teaching practices yielding positive coordinates, and with controlling and chaotic practices yielding negative coordinates on this dimension. The vertical dimension denotes teachers' degree of directiveness. That is, teachers can be more in charge in the classroom, which is the case when they adopt a structuring or controlling style, and students have more opportunity to take initiative or play a leading role when teachers are more autonomy-supportive or chaotic. Although the four overarching teaching styles of autonomy support, structure, control and chaos generally fell into the four quadrants of the circumplex, there was room for refinement within each of them. That is, within each teaching style (e.g., autonomy-supportive style), two groups of teaching practices could be identified (i.e., participative and attuning approach). As a result, eight teaching approaches were identified, which mirrored those identified by Aelterman et al. (2019) among secondary school teachers. Congruent with their location in the circumplex, these approaches were related meaningfully to one another, thereby reflecting an ordered or gradual pattern of correlations. Technically, a sinusoid pattern of correlations emerged between teaching approaches, with each approach (e.g., attuning) being correlated most positively with adjacent subareas (i.e., participative and guiding approach) and with correlations becoming non-significant (i.e., demanding and awaiting) or even negative (i.e., abandoning and domineering) when moving along the circumplex. Notably, the same sinusoid pattern was also present with the construct validation measures included in this study.

The strength of the correlation between a pair of adjacent teaching approaches varied between .43 and .63, with some exceptions on the borders between the need-supportive and need-thwarting teaching styles, where the adjacent subareas (e.g., clarifying and demanding; participative and awaiting) displayed lower correlations. That is, the participative approach covaries less strongly with teachers' use of an awaiting approach than with their use of an attuning approach. Similarly, a clarifying approach goes less easily hand in hand with a demanding than with a guiding approach. These findings help to explain why the obtained findings do not represent a perfect circular but instead more an oval structure, with the more need-supportive practices clustering on the right side and with the more need-thwarting practices clustering on the left side.

Nevertheless, there is substantial variation within need-supportive and need-thwarting areas, with the identified approaches varying in their degree of need-supportiveness and teacher directiveness. For instance, when being participative, teachers in higher education transfer more initiative to students themselves, while they take the lead when they adopt a clarifying approach. Also, the need-nurturing potential of these different teaching approaches may differ. That is, especially the guiding (e.g., offer of positive feedback; Grouzet et al. 2004) and attuning (e.g., validating the students' perspective; Marbell-Pierre et al. 2019) approaches

may be directly supportive of students' psychological needs, and the participative and clarifying approaches could create the conditions for need satisfaction to occur, such that these approaches can be considered need-enabling teaching approaches (Aelterman et al. 2019; Vansteenkiste et al. 2019). Indeed, the autonomy- and competence-enhancing effect of the offer of choice, a key practice in the participative approach, depends on a number of criteria, including the number and type of offered options (De Muynck et al. 2019; Patall et al. 2008; Schneider et al. 2018) as well as characteristics of the chooser (e.g., trait indecisiveness; Waterschoot et al. 2019). To illustrate, some teachers in higher education might activate their students by assigning homework that students need to prepare independently prior to the class. When working on themselves at home, some students may need greater clarity about what is expected or even wish to be guided through a model in order to find their way. Thus, the risk of a participative approach is that it may be perceived as too open, which explains its positioning closer to the awaiting approach compared to the other need-supportive approaches. Notably, as the participative and demanding approaches are only mildly negatively correlated, some teachers may combine a participative and a demanding approach, for instance, when students are sanctioned for failing to submit their independently completed homework in time. These examples show that the teacher can rely on a range of possible (de)motivationing approaches and associated practices, either in isolation or in combination, depending on the characteristics of the situation or the learner. Critical from the SDT-perspective is to ongoingly act in need-supportive ways, which requires considerable sensitivity from the side of the teacher to *calibrate* their practices to the situation, to characteristics of the learners, and to the learning objectives at hand (Vansteenkiste et al. 2019). The circumplex structure might be of help in this regard, as it provides deeper theoretical insights what it means to teach in need-supportive ways in higher education.

The role of teachers' mindsets and motivation

Having identified different (de)motivating teaching styles in higher education, the second aim of the present study was to examine the role of teachers' mindsets, that is, their implicit beliefs about students' intelligence, and motivation, that is, their type and amount of motivation to teach, as unique and complementary predictors of these different teaching approaches. A clear pattern of findings emerged for each of the included predictors, with a growth mindset and autonomous motivation being predictive of more need-supportive approaches and a fixed mindset, controlled motivation and amotivation yielding a double role as a potential risk factor for need-thwarting approaches and as an obstacle to the use of more need-supportive approaches.

As for teachers' motivation, teachers in higher education who are fully committed to the teaching and who even enjoy doing so, reported making greater use of need-supportive approaches "across the board". To illustrate, autonomously motivated teachers invest more in their teaching preparation by aligning the course material with students' interests, life world, and values (i.e., attuning approach), they are more open for students' input and opinion when teaching (i.e., participative approach), communicate their expectations more clearly (i.e., clarifying approach) and provide more help and encouragement (i.e., guiding approach). Such findings are consistent with prior work among elementary and high school physical education teachers showing that autonomous motivation to teach is related to the self-reported and student perceived use of autonomy-supportive and structuring strategies in the classroom (e.g., Katz and Shahar 2015). Presumably, autonomously motivated teachers have more energy available, contributing to their alertness and psychological availability when teaching, thereby enabling a maximal support of students' psychological needs. Similarly, a recent study among parents found that daily variation in parents' experiences of need satisfaction covary with daily variation in parents' psychological availability which relates to parallel variation in parents' use of autonomy-supportive practices towards their child (Van der Kaap-Deeder et al. 2019). Further, interestingly, autonomous motivation was related negatively to an abandoning teaching approach, showing that good quality motivation even serves as a buffer against giving up on students and abandoning them all together.

The pattern of correlates for autonomous motivation stands in rather sharp contrast to the pattern observed for controlled motivation. When teachers perceive their teaching job as a daunting duty, that is, as an obligation they cannot escape, they reported being less autonomy-supportive (both less participative and less attuning), instead relying on a more demanding and more abandoning approach. Presumably, because the teaching requires too much effort for controlled motivated teachers, they have less patience to attune their viewpoint to their students' perspective, use more forceful language and demanding strategies when they face resistance, and eventually give up on students who fail to cooperate or who do not make sufficient progress. These findings are in line with previous studies among secondary school teachers, who found that controlled motivated teachers reported using less autonomy-supportive strategies (Taylor et al. 2008), and even reported creating a more demanding, performance-oriented class climate and being more likely to give up on students (i.e., abandoning approach, Abós et al. 2018).

The pattern of findings for amotivation is even more pronounced, which is to be expected because amotivation, relative to controlled motivation, represents an even less

self-determined form of motivation (Ryan and Deci 2017). Although the average scores for amotivaiton are fairly low, teachers who report higher levels of amotivation reported being less guiding and scoring higher on three out of four of the identified need-thwarting teaching approaches (i.e., demanding, domineering and abandoning approach). The detriments of amotivation are thus far-reaching, presumably because amotivated teachers do not only lack energy to invest in their teaching (e.g., burnout, Abós et al. 2018) but also do not feel sufficiently skilled to optimally motivate students, which may put these teachers more at risk for adopting a need-thwarting approach. Indirect evidence for this claim was presented by Fernet et al. (2008) who found that, compared to controlled motivation, amotivation for teaching and class management showed the strongest relation with poor self-efficacy in the classroom.

Whereas the effects of teacher motivation were rather general, that is, not being tied to a specific teaching style, those obtained for teachers' mindset appeared more approach-specific. A growth mindset contributed uniquely and exclusively in the prediction of the two structuring teaching approaches (i.e., guiding and clarifying). These findings make good sense as adopting a growth mindset implies having a process-oriented focus, which is the basic attitude that underlies a structuring teaching style (Vansteenkiste et al. 2019). This finding is also congruent with previous research, showing that teachers with a less pronounced growth mindset used less mastery-oriented practices towards students (Miele et al. 2019).

A fixed mindset predicted lower engagement in autonomy-enhancing approaches (i.e., participative, attuning) and more use of autonomy-thwarting approaches (i.e., demanding, domineering). These results confirm findings reported by Leroy et al. (2007) among elementary school teachers, showing that teachers with a fixed mindset use less autonomy-supportive practices, such as inviting students to give input or share their opinion. Presumably, when teachers hold the belief that achievement is mainly determined by differences in students' innate intelligence, autonomy-supportive strategies such as engaging in dialogue and providing student-centered rationales might not be considered functional, as such strategies predominantly influence students' interest and motivation, but not their achievement. In a way, this reasoning might also apply to teachers with a growth mindset, considering the unexpected small but negative relation between a growth mindset and a participative approach. Perhaps teachers with a growth mindset perceive themselves as actors of change, therefore focusing on competence development and the use of structure, leaving less room for participative strategies.

Rather surprisingly, a fixed mindset was unrelated to the provision of structure. Possibly, teachers with a fixed mindset may be more *selective* in their provision of feedback, encouragement, and help. Teachers with a fixed mindset would then treat high and low ability students differently, for example by providing guidance only to students who are perceived as highly able, yet providing less feedback and learning opportunities to students who are perceived as having low ability (because these students are considered hopeless). Along similar lines, the role of teachers' fixed mindset may especially manifest when students face difficulties in mastering the learning content. Teachers with a fixed mindset may even leave their students to their own device when confronted with failure, as illustrated by the positive relation with the abandoning teaching approach herein. The latter finding is line with the observation that both preservice and in-service teachers with a fixed, compared to those with a growth, mindset perceive themselves as less responsible for students' academic achievement (Patterson et al. 2016).

Three additional findings need to be highlighted. First, compared to the significant role played by teachers' mindsets and motivation in predicting all other approaches in the circumplex, the null-findings observed for the awaiting approach are striking. Although some of these non-significant findings are meaningful as they are congruent with the ordered pattern observed with the adjacent approaches, future research may want to examine additional antecedents. For instance, teachers' openness (e.g., Reeve et al. 2018) or lack of conscientiousness (e.g., Bolding 2017) may predict their greater wait-and-see attitude. Second, several workplace characteristics were related to a (de)motivating teaching style. Teachers at the university level made less frequent use of participative strategies than those teaching at the college level. Although the size of the student groups might be larger at university, this could not explain the above relation, as the effect occurred after controlling for group size. Those teaching larger groups of students indicated using both a more clarifying and demanding approach. Presumably, especially in response to disturbing students, teachers in larger groups feel the need to take the lead and restate their expectations, with some of them doing so in a more forceful way. Third, this study also explored possible interactions between teachers' mindset and motivation to teach in relation to their (de)motivating teaching style. The results indicate that mindsets and motivation are related uniquely to adopting a (de) motivating teaching style, as both factors explained between eight (i.e., awaiting approach) and 31% (i.e., participative approach) of the variation in teaching practices, with no significant increase in explained variance when including possible interactions between both predictors.

Limitations and future directions

The present study has a number of limitations that should be acknowledged. First, although the SISQ-HE has a sound theoretical basis and is built upon a well validated scale in

secondary education, further research is required to confirm the validity of this scale across different educational settings internationally. Throughout this process of ongoing validation, it would be instructive to relate the current circumplex model to the model proposed by Interpersonal Theory (den Brok et al. 2006). A multi-informant design combining teachers', students' and even an observer perspective is advisable to see whether a similar organization of teaching practices could be found across informants (e.g., Aelterman et al. 2019). This type of research would additionally allow us to examine the predictive validity of the discerned approaches in the circumplex in the prediction of student outcomes (e.g., engagement, need satisfaction), as demonstrated in secondary education (Aelterman et al. 2019).

Second, as the study is cross-sectional in nature, no causal conclusions about the role of teachers' mindsets and motivation in the prediction of teachers' (de)motivating teaching styles can be inferred. Some evidence for relationships in the opposite direction comes from an intervention study (Cheon et al. 2014), which showed that teachers who acquired a more autonomy-supportive teaching style through a training also reported more autonomous motivation to teach up to 4 months later. The increase in autonomy-supportive teaching may also be accounted for by the positive spiral that unfolds between students and teachers, with students' agentic engagement (Reeve 2013; Matos et al. 2018) affecting the quality of student–teacher interactions. That is, the proactive attempts of agentic students to mold the teaching context might yield a positive influence on teachers' autonomous motivation and perceived growth mindsets, which then catalyzes a more autonomy-supportive response from the side of the teacher (Jang et al. 2016a; Reeve, 2013). Future research would do well to examine this complex dynamic in individual student–teacher interactions, as the different (de) motivating styles may also apply at the individual level, for instance when teachers are supervising an assignment or research project (e.g., Litalien and Guay 2015).

Third, teachers' mindsets were measured using a partly self-constructed self-report questionnaire in which the items tapping into a fixed mindset assessed the malleability of intelligence, whereas the items tapping into a growth mindset rather captured teachers' effort-based attributions for student performance. Thus, rather than tapping into the malleability of intelligence as such, the items focused on the extent to which teachers hold the belief that effort plays a critical role in students' performance. Although not measuring exactly the opposite sides of the same coin, such attributions are key to those holding a growth mindset as it is exactly through increased and sustained effort that one makes progress. This approach allowed us to include both fixed and growth mindset separately as predictors of (de) motivating teaching, as they were only slightly negatively correlated, in contrast to previous research combining fixed and growth mindset in an overall score based on large negative correlations between the measures (e.g., Park et al. 2016a). Moreover, as Elliot et al. (2017) argued that theories of intelligence might not be easily available in the conscious mind, future research could also consider an implicit measure of teachers' mindsets, such as the one proposed by Mascret et al. (2015).

Practical implications

At the individual level, the SISQ-HE has great potential as an ecologically valid feedback instrument for higher education teachers. After completing the questionnaire, teachers can be provided with a personalized teaching profile and associated personalized feedback that is meant to increase their awareness about their current teaching style. The circumplex could also be used as a tool for self-reflection when preparing one's classes as well as during training, supervision and intervision sessions when discussing good practices or difficulties when trying to motivate students in higher education. Combining a repeated assessment of the SISQ-HE with an online or face-to-face training allows teachers to monitor their own progress and receive customized advice about (de)motivating teaching. Future intervention research on need-supportive teaching (Cheon et al. 2020) could make use of the circumplex model to strengthen the effectiveness of the training.

The present study suggests that a teacher training could also target teachers' beliefs about the malleability of students' innate intelligence, as has been done in previous interventions with students (e.g., Yeager and Walton 2011). For instance, in an online 45-min during intervention (Paunesku et al. 2015), high school students read an article about neuroplasticity, combined with a writing exercise that consists of writing a brief summary of the article and giving advice to a hypothetical student who thinks he is not smart enough to do well in school. Results showed that after taking part in the intervention, participants reported having more growth beliefs, thereby illustrating that a growth mindset can be elicited even through brief interventions (Yeager and Walton 2011).

With regards to teachers' motivation to teach, it is recommended that school policy adopts an appreciative attitude towards teaching. First, especially relevant at the university level, faculty could be offered the opportunity to prioritize their teaching, research or valorization role. Because of such prioritization, academic faculty may more deliberately choose to specialize themselves in the teaching profession, thus being more autonomously motivated for this task to begin with. Also, these more autonomously motivated teachers may be more open for training and feedback to further optimize their motivating teaching skills. Second, school

policy would do well to facilitate a need-supportive environment while avoiding restricting or pressuring their teachers, as this has been shown to be related to more autonomous work motivation (e.g., Collie et al. 2016) and a more motivating teaching style (e.g., Vermote et al. 2020). For instance, teachers could be offered freedom and choice about what they teach and how they organize their teaching, which is especially relevant at the college level, where teaching assignments are often subject to change, due to changing student numbers and resources, as well as the available staff at that moment. Likewise, teachers need to feel capable of handling the daily interactions in class, while in the meantime managing all the other tasks at hand.

Conclusion

Given the large dropout rates in higher education throughout Europe (Vossensteyn et al. 2015) and the importance of an autonomy-supportive and structuring teaching style for students' learning and achievement (Niemiec and Ryan 2009; Vansteenkiste et al. 2019), it is imperative to have a well-validated instrument available that maps the variety of higher education teachers' (de)motivating teaching practices. At the same time, it is necessary to gain an insight in the teacher attributes that predict teachers' motivating style. The present study provides an ecologically valid way to measure teachers' (de)motivating teaching styles that are organized in a meaningful fashion in a circumplex structure. The findings also suggest that both a cognitive and motivational "pathway" underlie the (de)motivating approach of teachers in higher education. To the extent teachers hold the belief that their students' intelligence is malleable and they are fully committed to their teaching job, they engage in a variety of need-supportive strategies. Instead, when students' intelligence is conceived as a fixed trait, with no room for progression, and they feel pressured or indifferent around their teaching duties, teachers are more vulnerable for adopting a need-thwarting style.

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Appendix 1

The SISQ-HE vignettes and scoring key

(*) = This situation or response is inspired by the Situation-in-School Questionnaire - Secondary Education (SISQ-SE; Aelterman et al., 2019) and adapted to the higher education context, (+) = This situation or/and corresponding response is unique to the Situation-In-School Questionnaire - Higher Education (SISQ-HE).

Instructions

The *Situations in School Questionnaire - Higher Education* contains 10 different teaching situations that occur regularly when teaching a (large) group of students. For each situation, several ways in which a teacher can respond are presented. You are asked to indicate to what extent each reaction describes what you have done this academic year in a similar situation. Each of these reactions may apply. If the presented reaction describes very well what you did, please circle a number close to 7. If the presented reaction does not describe at all what you did, please circle a number close to 1. If the presented reaction somewhat describes your approach, please circle a number close to 4, using the following 7-point scale:

1	2	3	4	5	6	7
Does not describe me at all			Somewhat describes me			Describes me extremely well

If a particular situation occurs rarely or not at all in your course, we ask you to imagine this situation for yourself and to think about how you would act if the situation would occur. To obtain a valid view of your teaching style, please answer the questions as honestly as possible. There are no right or wrong answers, only your personal actions and feelings matter to us. Don't think too long about the questions. Your first thoughts typically best describe your approach.

Situation 1: behavioral guidelines and rules in your course

You think about behavioral guidelines and rules for your course, you… (*)

Set_expectations1	… clarify your norms and expectations for cooperation. (*)
Wing_it1	… wait and see. You will introduce fitting guidelines and rules when problems arise. (+)
Invite_input1	… ask the students to help decide on the rules and guidelines. (*)
Provide_rationale1	… discuss with the students why certain rules may be useful for them. (+)

Shame1	… firmly speak to your students: "Those who are not able to follow the rules should stay at home. This is not kindergarten." (+)

Situation 2: lesson preparation

You are preparing a class, your priority is… (*)

Insist_firmly1	… to insist that students pay attention; you don't tolerate any exceptions or excuses. (*)
Wing_it2	… to not invest too much time in preparation. Things will run smoothly. (*)
Overview1	… to ensure that your lesson is clear and complete. (+)
Invite_input2	… to give students enough freedom to participate and offer suggestions during class. (+)
Communicate_trust1	… to give your students the confidence that they will be able to master the more difficult subject matter of the course. (+)
Shame2	… to emphasize that you will be disappointed if they don't put enough effort into this class. (+)

Situation 3: an extra effort is needed

You are covering a difficult subject that requires a lot of effort from the students, you… (*)

Foster_enjoyment1	… seek new or different ways to make the lesson more interesting and meaningful for the students. (*)
Exert_power1	… simply command them: "Stay attentive during this class! If not, you won't make it!" (+)
Helpful_strategy1	… divide the lesson content into pieces and ensure that there is sufficient time for repetition (+)
Offer_choice1	… offer students the option to go through an introductory text in preparation for the lesson. (+)
Lax1	… don't worry too much in advance. You wait and see if any difficulties arise. (+)
Push_compliance1	… make it clear to the students that they have to pay attention or otherwise they have to leave the classroom. (+)

Situation 4: talking students

You want to start the lesson, but the students are still talking loudly to each other, as they often have in previous classes. Even when you have everything set up and make it clear non-verbally that you want to start, the chatter and noise doesn't stop. You… (+)

Set_expectations2	… ask the students for silence so that you can start the lesson. (+)
Indifference1	… start the lesson despite the chatter. If they don't understand it, they have to figure it out themselves. (+)
Invite_input3	… attract attention with a thought-provoking statement and invite the students to react. (+)
Exert_power2	… insist that the students have to stop talking. If you come to class, you are expected to pay attention! (+)

Situation 5: the lesson starts

The lesson starts. You… (*)

Overview2	… begin with a clear schedule and overview of the lesson. (*)
Wing_it3	… just begin where you ended the previous lesson and take things as they come. (*)
Insist_firmly2	… strongly insist that students have to learn what you teach them. If students come to class, it is their duty to cooperate. (*)
Foster_enjoyment2	… use an interesting statement or case to trigger your students' curiosity. (+)
Invite_input4	… ask the students for any suggestions on the lesson topic. (*)
Helpful_strategy2	… teach the learning material step-by-step so that the students have the feeling that they understand everything. (+)
Shame3	… warn the students: "Now it is time to pay attention or your exam will be a disaster" (+)
Indifference2	… just start your lesson and waste as little energy as possible. (+)

Situation 6: holding students' attention

You want to keep the students' attention during class. You… (*)

Shame4	… say that students who can't pay attention during a full lesson don't belong in higher education. (+)
Adjust1	… check to what extent the students understand the subject matter and you adjust your explanation accordingly. (+)
Identify_benefits1	… discuss with the students how the subject matter can be relevant in their daily lives or future careers. (*)
Indifference3	… don't do anything special. Students are responsible for staying attentive. (+)
Insist_firmly3	… demand a maximum attention from the students present. (+)
Overview3	… show the students what they can expect from today's class through a clear overview. (+)

Situation 7: lack of cooperation

You ask your students a challenging but interesting question in an attempt to involve them in class. However, just like during the previous lesson, no one raises their hand to give an answer. You… (*)

Command1	… force a student to answer: "You, show me what you are worth. What is the answer to my question?!" (*)
Invite_input5	… first let the students discuss the question with each other and then ask if there are students who want to share their answer. (*)
Follow_pace1	… provide the students enough time to think and then invite them to give it a shot. (+)
Overview4	… explain the correct answer step by step and show them clearly what the desired answer looks like. (+)
Lax2	… wait in silence until you get an answer from one of the students. (+)
Ignore1	… give the answer yourself. If they don't want to cooperate and learn something, that is their problem. (+)

Situation 8: background noise

A more difficult part of the lesson elicits a lot of background noise. You… (*)

Insist_firmly4	… insist that the noise stops. You demand full attention of the group. (+)
Adjust2	… gradually reintroduce the more difficult part. (+)
Ignore2	… ignore the noise and continue with the lesson. Students have to figure out themselves how they can overcome obstacles. (*)
Invite_input6	… discuss this with the students and ask how you can organize the remainder of the class. (+)

Situation 9: a wrong answer

You ask a question during class. After waiting for a while, someone raises their hand and gives a partially wrong answer. You… (+)

Ignore3	… give the right answer yourself and continue with the lesson. You don't waste any further energy. (+)
Shame5	… express your disappointment: "No. That is wrong. Someone who does know the right answer?" (+)
Adjust3	… ask some additional questions and guide the group towards a correct answer. (+)
Interest_taking1	… show interest in how the student came to their answer. (+)
Overview5	… gradually develop reasoning underlying the correct answer so that the students clearly know what is expected. (+)
Lax3	… don't respond to the answer and you wait for other students to respond. (+)

Situation 10: preparation students

You consider it necessary for students to go through a reading at home before the next lesson. You… (*)

Wing_it4	… don't explain too much and see how the assignment turns out. (*)
Offer_choice2	… offer the students various readings and ask them to choose one to read. (*)
Indifference4	… don't really explain the assignment; after all, students in higher education do not need to be pampered. (+)
Offer_help1	… tell the students that you offer extra help and guidance if necessary. (+)
Shame6	… make it clear that you are disappointed in students who don't complete the assignment: "Do students really need hand holding in higher education?!" (+)

Scoring key for calculating the subscales

Autonomy support

- *Participative:* (Invite_input1, Invite_input2, Offer_choice1, Invite_input3, Invite_input4, Invite_input5, Invite_input6, Offer_choice2)/8
- *Attuning:* (Provide_rationale1, Foster_enjoyment1, Foster_enjoyment2, Identify_benefits1, Follow_pace1, Interest_taking1)/6
- *Autonomy support:* (Invite_input1, Invite_input2, Offer_choice1, Invite_input3, Invite_input4, Invite_input5, Invite_input6, Offer_choice2, Provide_rationale1, Foster_enjoyment1, Foster_enjoyment2, Identify_benefits1, Follow_pace1, Interest_taking1)/14

Structure

- *Guiding:* (Communicate_trust1, Helpful_strategy1, Helpful_strategy2, Adjust1, Adjust2, Adjust3, Offer_help1)/7
- *Clarifying:* (Set_expectations1, Overview1, Set_expectations2, Overview2, Overview3, Overview4, Overview5)/7
- *Structure:* (Communicate_trust1, Helpful_strategy1, Helpful_strategy2, Adjust1, Adjust2, Adjust3, Offer_help1, Set_expectations1, Overview1, Set_expectations2, Overview2, Overview3, Overview4, Overview5)/14

Control

- *Demanding:* (Insist_firmly1, Push_compliance1, Insist_firmly2, Insist_firmly3, Insist_firmly4)/5
- *Domineering:* (Shame1, Shame2, Exert_power1, Exert_power2, Shame3, Shame4, Command1, Shame5, Shame6)/9
- *Control:* (Insist_firmly1, Push_compliance1, Insist_firmly2, Insist_firmly3, Insist_firmly4, Shame1, Shame2, Exert_power1, Exert_power2, Shame3, Shame4, Command1, Shame5, Shame6)/14

Chaos

- *Abandoning:* (Indifference1, Indifference2, Indifference3, Ignore1, Ignore2, Ignore3, Indifference4)/7
- *Awaiting:* (Wing_it1, Wing_it2, Lax1, Wing_it3, Lax2, Lax3, Wing_it4)/7
- *Chaos:* (Indifference1, Indifference2, Indifference3, Ignore1, Ignore2, Ignore3, Indifference4, Wing_it1, Wing_it2, Lax1, Wing_it3, Lax2, Lax3, Wing_it4)/14

Appendix 2

See Table 5.

Table 5 Correlations between motivation for teaching and group management with teaching styles

	Participative approach	Attuning approach	Guiding approach	Clarifying approach	Demanding approach	Domineering approach	Abandoning approach	Awaiting approach
Autonomous motivation for teaching	.22***	.36***	.45***	.28***	− .04	− .16**	− .30***	− .16**
Autonomous motivation for group management	.30***	.26***	.25***	.19**	.09	.05	− .12*	.00
Controlled motivation for teaching	− .26***	− .27***	− .13*	− .02	.22***	.20***	.28***	.12*
Controlled motivation for group management	− .11*	− .11	− .09	.04	.21***	.19**	.23***	.13*
Amotivation for teaching	− .06	− .26***	− .28***	− .19**	.19**	.35***	.39***	.22***
Amotivation for group management	− .13*	− .22***	− .24***	− .14*	.13*	.23***	.37***	.16**

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

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