European Journal of Psychology of Education (2022) 37:227–255
https://doi.org/10.1007/s10212-021-00543-3

Patterns of motivating teaching behaviour and student engagement: a microanalytic approach

Miriam Cents-Boonstra[1,2] · Anna Lichtwarck-Aschoff[1] · Mayra Mascareño Lara[3] · Eddie Denessen[1,4]

Received: 27 March 2020 / Revised: 5 February 2021 / Accepted: 2 March 2021 / Published online: 23 April 2021
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Abstract
Positive student engagement is a prerequisite for students' educational success. In this study, a microanalytic approach was used to explore patterns in teachers' use of specific motivating teaching behaviours from the perspective of self-determination theory in relation to indicators of students' positive engagement. The lessons of 52 teachers were observed and event-based coded. Results showed that specifically asking motivating questions and providing positive feedback and support during exercises were associated with subsequent positive student engagement. Unexpectedly, some demotivating teaching behaviours were also found to relate to positive student engagement, although to a lesser extent. Implications and directions for future research are discussed.

Keywords Student engagement · Motivating teaching · Microanalytic approach · Student-teacher interaction

✉ Miriam Cents-Boonstra
m.centsboonstra@pwo.ru.nl

Anna Lichtwarck-Aschoff
a.lichtwarck-aschoff@pwo.ru.nl

Mayra Mascareño Lara
m.n.mascareno.lara@rug.nl

Eddie Denessen
e.denessen@pwo.ru.nl

[1] Behavioural Science Institute, Radboud University, Postbus 9104, 6500 HENijmegen, The Netherlands

[2] Graafschap College, J.F. Kennedylaan 49, 7001 EADoetinchem, The Netherlands

[3] Faculty of Behavioural and Social Sciences, University of Groningen, Grote Rozenstraat 3, 9712 TGGroningen, The Netherlands

[4] Department of Education and Child Studies, Leiden University, Postbus 9555, 2300 RBLeiden, The Netherlands

Students' positive engagement in classrooms is an important prerequisite for students' educational success (Abbott-Chapman et al., 2014; Archambault et al., 2009; Rumberger & Lim, 2008; Wang & Fredricks, 2014). When students are engaged, they show more attention and task-related behaviour and are less distracted from their work, with positive outcomes, such as higher levels of deep-level learning, skill development, and academic achievement, as a result (Barkoukis et al., 2014; Reeve, 2012; Reeve & Tseng, 2011; Skinner, 2016; Skinner et al., 1998). Yet, there is strong variability in the way students engage in their own learning process, varying from enthusiastically participating and asking questions to gazing out the window (disengagement) or actively disrupting lessons (Cooper, 2014).

The self-determination theory (SDT; Ryan & Deci, 2000) posits that certain teaching behaviours are related to students' engagement (Reeve, 2012; Reeve et al., 2004) and that this relation is indirect, i.e. via students' motivation (Ryan & Deci, 2016; Niemiec & Ryan, 2009). More concretely, the theory postulates a relation between teaching behaviours and the quality of students' motivation. Some teaching behaviours—motivating teaching—are thought to foster autonomous and intrinsic forms of motivations, whereas others— demotivating teaching—are thought to promote more extrinsic and controlled forms of motivations (De Meyer et al., 2014; Haerens et al., 2015; Van den Berghe et al., 2013). The idea is then that these underlying motives, which remain hidden to the observer's eye, will translate into observable manifestations in the form of students' engagement in class (Reeve, 2012; Jang et al., 2009; Walker et al., 2006; but also Skinner & Belmont, 1993).

The literature on SDT has operationalized motivating teaching in at least two ways. Typically, studies would address motivating behaviour as a teaching style, that is, as a relatively stable, trait-like factor (De Meyer et al., 2014). These studies (Jang et al., 2012; Jang et al., 2010; Reeve et al., 2004; Van den Berghe et al., 2016) have demonstrated that motivating teaching style, applied in the classroom, indeed fosters students' interest, participation and involvement. In particular, teachers can increase their students' engagement by establishing an overall motivating classroom climate (Assor et al., 2002) and through adopting a motivating teaching style (Aelterman et al., 2014; Soenens et al., 2012; Van den Berghe et al., 2013).

However, recent SDT research suggests that motivating teaching is situation-dependent, and dynamically manifested in moment-to-moment teaching behaviours (Aelterman et al., 2019; Domen et al., 2019). In the current study, a microanalytic approach was applied to extend previous SDT-related work, and to offer new insights into the dynamics of motivating teaching behaviours and students' engagement within everyday classroom interactions. Specifically, the aim was to explore patterns of teachers' use of motivating and demotivating teaching behaviour in relation to specific indicators of students' engagement.

Student engagement

Student engagement is a multidimensional concept that includes behavioural, cognitive, and emotional attributes associated with being deeply involved in an activity (Skinner, 2016; Wigfield et al., 2015). Researchers have operationalised student engagement in many different ways. Two important characteristics of student engagement, however, are discussed in the majority of the research.

Firstly, not all states of student engagement are associated with positive student outcomes. Therefore, it is important to distinguish between students' positive and negative states of

engagement (Skinner, 2016). Students' positive engagement (such as paying attention, asking questions, supplementing the teacher without any prompt, or taking initiative) is considered an important prerequisite for students' success at school and beyond (Abbott-Chapman et al., 2014; Archambault et al., 2009; Rumberger & Lim, 2008; Wang & Fredricks, 2014). In contrast, negative engagement such as being distracted, expressing boredom, disobeying rules, or complaining can seriously jeopardise this success (Connell et al., 1994; Connell et al., 1995; Henry et al., 2012; Janosz et al., 2008; Li & Lerner, 2011; Skinner et al., 1990).

Secondly, with regards to student engagement within the classroom, visible and invisible aspects can be distinguished, related to the way in which engagement is measured. In the bulk of the relevant literature, student engagement is measured with self-reports that allow measuring students' cognitive perception of their own involvement. In other words, they inform us about how they assess their engagement in class (behaviourally, cognitively and/or emotionally; Van Uden et al., 2014). Yet, observational research allows investigating the more visible aspects of students' actual behaviour, as relates to engagement in the classroom (Jang et al., 2010; Reeve et al., 2004; Van den Berghe et al., 2016).

Initially, SDT-related work was predominantly focused on aspects of student engagement (Lawson & Lawson, 2013) that can be frequently observed in classrooms, e.g. students reacting to triggers and stimuli of their teachers (passive, compliant behaviours indicating student engagement). Recently, however, there is increased interest in a more action-oriented definition of engagement (Appleton et al., 2008), which describes students as active agents of their own learning process. This form of engagement has also been called agentic engagement (Reeve, 2013; Reeve & Tseng, 2011) and contributes to a self-determined learning process (Jang et al., 2016a, b; Reeve, 2012; Ryan & Deci, 2000, 2016).

Within the current research on SDT, students' engagement is typically measured from a rather broad perspective, aggregating various indicators of student engagement across the span of a full lesson (rather than looking at the occurrence of students' specific behaviours within small segments thereof). Although students' perception of their engagement in general could be rather stable, findings of Shernoff et al. (2016) indicate that individual students reported significant variation in their engagement from one instructional episode to the next. This suggests that student engagement is also situationally dependent and related to various contextual factors (e.g. their learning environment and the support they receive from their teachers; see also Hornstra et al., 2015).

Teachers' use of motivating behaviours to foster student engagement

SDT suggests that teachers can support their students by satisfying their basic needs: autonomy (the freedom to be yourself, to be in charge of your own learning process), competence (the feeling to be competent in completing what is asked) and relatedness (the need to experience closeness with one's teachers and peers; Ryan & Deci, 2000). Regarding teachers' behaviours in practice, researchers in the field (e.g. Aelterman et al., 2019; Haerens et al., 2018; Vansteenkiste et al., 2012) often draw a distinction between *motivating* teaching behaviours (that support students' basic needs) and *demotivating* teaching behaviours (that have been found to thwart the fulfilment of students' basic needs).

"Motivating teaching behaviours consist of (combinations of) autonomy support, a structure to enhance students' feelings of competence, and relatedness support (Aelterman et al., 2019; De Meester, 2020; Haerens et al., 2018; Vansteenkiste et al., 2012). Teachers can offer autonomy support within lessons by addressing students' interest or opinions by asking

questions or by offering choices or encouraging their students' independent problem solving (Haerens et al., 2013; Van den Berghe et al., 2013). Within lessons teachers can provide structure by providing their students with support during assignments and positive constructive feedback (Aelterman et al., 2019; Haerens et al., 2013; Jang et al., 2010; Mouratidis et al., 2011; Niemiec & Ryan, 2009). Regarding relatedness support within lessons, teachers can provide warmth and unconditional regard to develop mutually positive relationships with their students (Connell & Wellborn, 1991).

Demotivating teaching behaviours, in contrast, neglect the basic needs of students and consist of (combinations of) controlling, chaotic or 'cold' teaching. Teachers can exercise control, pressuring students by asking controlling or interrogative questions, or referring to tests or by telling students exactly what to do. Inside the classroom, students can experience a sense of inferiority or failure when teachers frustrate their need for competence by being disorganised or providing negative feedback (De Meyer et al., 2014; Van den Berghe et al., 2013, 2016)."

Traditionally, SDT research has described teachers' use of motivating teaching behaviour from the perspective of establishing a warm and caring environment (Assor et al., 2002) and applying a motivating teaching style. There are multiple studies describing a variety of aspects and behaviours related to a motivating teaching style (e.g. Aelterman et al., 2014; Assor et al., 2002; Jang et al., 2016a, b; Niemiec & Ryan, 2009; Reeve & Halusic, 2009; Reeve, 2016). Within these studies, a distinction is made between teachers with a motivating teaching style who predominantly use motivating teaching behaviours during their lessons and teachers with a more demotivating teaching style who prefer to use more authoritative teaching behaviours (De Meyer et al., 2014). Describing teachers as having either a motivating or demotivating teaching style, implies that teachers are rather consistent in their use of either motivating or demotivating behaviours as a means of engaging students. This suggests that teaching behaviours are relatively stable teacher-traits.

Recently, there has been a shift from this trait-like perspective on teaching styles to a more fine-grained approach that suggests teachers to alternate between motivating and demotivating behaviours between lessons—and even, within the course of a single lesson (Aelterman et al., 2019; Amoura et al., 2015). Research has shown that, indeed, teachers apply different (de)motivating teaching behaviours, depending on (1) the stage of a lesson (Cents-Boonstra et al., submitted; Haerens et al., 2013; Van den Berghe et al., 2015), (2) their perception of the differences in students' needs and motivation (Domen et al., 2019; Hornstra et al., 2015), and (3) the educational context (Assor et al., 2002). Assor et al. (2002), in addition, showed that the effectiveness of motivating behaviours varied across lessons. None of the observed motivating teaching behaviours could be indicated as consistently most effective in fostering students' engagement; rather, the utility of any specific behaviour was determined by its relevance within a given context. These studies thus suggest that teachers' use of motivating teaching behaviours is not only a trait-like entity but, can also vary from moment to moment, depending on the immediate situational factors.

Present study: a situational perspective (microanalytic approach)

"The aim of the current study was to contribute to the existing body of SDT-related research on the interplay of (de)motivating teaching behaviour and students' engagement, and how it unfolds within real-time interactions between students and teachers. More specifically, we wanted to explore the situated nature of teacher and student behaviours within and across

lessons. For this purpose, we employed an observational methodology design, which allows us to get insight into real-time manifestations of teacher and student behaviours, and how these micro interactions unfold from moment to moment. Our situational perspective and microanalytical approach, thus allowed us to gain a more fine-grained understanding of teacher-student interactions (see for applications outside the field of SDT: Mainhard et al., 2012; Mascareño Lara et al., 2016; Pennings et al., 2014)."

A microanalytic approach entails the detailed analysis of social interactions, using recorded data, to 'dissect' and thereby elucidate (Bull, 2019). Key features of this approach are that global concepts (such as demotivating teaching or student engagement) can be studied through microanalysis of specific behaviours. When teachers are interacting with students, there are many things happening at the same time—not all of which are relevant in terms of motivating teaching and students' engagement (Magnusson, 2000). Yet, considering there is a relationship between motivating teaching and students' engagement, this would imply that—within their interactions—teachers and students display a recurrent structure of these behaviours during lessons. Identifying these iterative sequences (patterns), in relation to positive student engagement, could inform and extend recent investigations considering teaching behaviours and their association with student engagement.

In the current study, we employed two complementary micro-analytic approaches to investigate the patterns of teacher student interactions: lag sequential analysis (Bakeman & Quera, 2011) and T-pattern analysis (Casarrubea et al., 2015, 2018; Magnusson, 2000; Mascareño Lara et al., 2016). Both analyses require a focus on event coding, as opposed to traditional observational SDT research that relies on general interval ratings to study more stable, trait-like factors such as atmosphere and style. With our approach, every relevant behaviour of the teacher or students is coded at the exact moment it occurs, which results in a dataset where the temporal character of interaction is preserved. This way of coding allows the examination of patterns in the occurrence and variation of specific teacher and student behaviours. We use the term *pattern* in a general way, to refer to series of teacher and student behaviours that occur repeatedly (i.e. hold a statistical association) in the interaction we studied. The patterns stemming from lag sequential analysis correspond to series of consecutive teacher-student behaviours that were more likely than others to occur in the data. T-pattern analysis, on the other hand, was used to detect sequences of motivating teaching behaviours and students' engagement that did not necessarily follow each other consecutively in the data stream (Magnusson, 2000). With these different but complementary pattern detection techniques, we aimed at unveiling the temporal structure of teacher-student interactions.

To our knowledge this is the first study in the field of SDT that investigates teacher student interaction patterns from a micro-analytical perspective. Our goal was therefore to explore patterns comprising motivating and demotivating teaching behaviours on the one hand, and students' positive and negative engagement on the other hand, both within and across lessons. Based on earlier SDT research, we would expect patterns in which motivating teaching is related to positive student engagement. If a teacher for example asks autonomy-supportive questions, this should more often be followed by students' positive engagement expressed for instance by asking questions based on sheer interest. Demotivating teaching (e.g. asking controlling questions), on the other hand, should more often be followed by negative student engagement, as reflected in students complaining, for instance. Besides these rather broad hypotheses, no specific hypotheses were formulated given the explorative nature of the study.

Method

Observed lessons

All lessons were videotaped within one Vocational Education and Training (VET) college, whose board sought to explore effective ways to foster students' engagement during lessons. After discussing the nature and purpose of this study, managers of the VET tracks for Basic Care & Welfare (Level 2),[1] Social Cultural Work and Pedagogical Work (Level 4) decided to participate in the investigation. In total, video-taped lessons of 52 teachers were analysed preparing their first-year students (ages 15 to 27, with an average of 17.8 years; *SD* = 1.78). Of these teachers, 75% (*n* = 39) were female; their age ranged from 23 to 64 years (*M* = 42.58; *SD* = 11.52). Teaching experience within VET ranged from 0 to 35 years (*M* = 8.28; *SD* = 6.92). In order to prepare students for these professions, a wide variety of subjects are offered within these tracks, including general subjects (e.g. Dutch, Mathematics), creative subjects (e.g. Drama, Music), vocational subjects (e.g. Developmental Psychology, Pedagogics, Reporting, Planning or Conducting Activities for Children), and Counselling.

Procedure

Prior to data collection, all teachers were asked to provide informed consent to participate in the study. Participants were assured that their data would be handled anonymously and that they had the right to withdraw permission at any time. Before the start of the lesson recordings, two teachers withheld their consent due to personal circumstances. All students, taught by the participating teachers, were informed of the research and could indicate if they did not want to take part in this study. Parents of students under the age of 18 received the same information. No student or parent withheld consent for participation.[2] From the teachers' schedules, the lessons taught to first-year students (in consultation with the teachers) were selected. The scheduled lesson duration was 45 min. However, some lessons were shorter than scheduled; the shortest lesson recorded lasted 25 min.

Coding (de)motivating teaching behaviour and student engagement

"A microanalytic approach requires a coding scheme suitable for coding behaviours at the exact moment they occur (i.e. event coding). Because of the novelty of our study such a coding system was not available and we had to create our own. We did so, based on existing SDT-related coding schemes (Aelterman et al., 2012; Haerens et al., 2013;

[1] Vocational education in The Netherlands is divided into four levels. For example, within a specific track, these levels correspond to:

1. Assistant employee (Care aide)
2. Employee (Supporting in care and welfare)
3. Independent employee (Practical Nurse)
4. Specialized professional (Nurse)

[2] The research proposal was approved by the Ethics Committee of the Faculty of Social Sciences [*omitted in anonymous version*] (ECSW2015-1901-285) before the start of the data collection.

Van den Berghe et al., 2013; Van den Berghe et al., 2016) and the SDT literature (e.g. Niemiec & Ryan, 2009; Reeve & Jang, 2006; Reeve & Halusic, 2009). The existing coding scheme of Haerens et al. (2013) and van den Berghe et al. (2013), based on interval coding was transformed into an event-coding scheme to code specific-teacher behaviours. The adjustments were as follows.

First, relatedness support is typically expressed by teachers creating a warm and welcoming atmosphere. In interval coding, this usually comes down to items such as 'is enthusiastic' or 'puts energy in the lesson' (Aelterman et al., 2012; Haerens et al., 2013; Van den Berghe et al., 2013), behaviours that cannot be easily coded on an event basis. Therefore, relatedness support as such was not included in the current event-coding scheme.

Second, items pertaining to autonomy support and structure from the coding scheme of Haerens et al. (2013) and van den Berghe et al. (2013) were considered suitable for event-based coding and translated to event-codes. Based on earlier work, we know that concrete utterances of teachers often represent a mix of dimensions (Aelterman et al., 2019) and cannot be exclusively assigned to one underlying dimension, such as autonomy support. Questions for instance can be asked in an autonomy supportive way or in a controlling way. Also, feedback can be provided in a positive (i.e. autonomy supportive), or negative (i.e. controlling) manner. Thus, rather than dividing teaching behaviours into strictly separable dimensions based on autonomy support versus control and structure versus chaos, our event-coded behaviours represent mixtures of these dimensions with the overall distinction of motivating and demotivating teaching behaviour (see Table 1).

Last, if no counterpart was available to any given behaviour in the existing coding schemes, we added those behaviours. For instance, providing positive feedback was included in the original coding scheme of Haerens et al. (2013) and Van den Berghe et al. (2013) under motivating teaching behaviours, so we added negative feedback as a demotivating teaching behaviour. An overview of the complete coding scheme can be found in Table 1, in which we provide examples of the coded behaviours for each of the codes.

Motivating teaching behaviour

Regarding SDT-related motivating teaching behaviour (i.e. autonomy support and/or structure), seven types of such behaviours were included. The coded items for motivating teaching were: 'provides choice', 'encourages independent thinking', 'asking autonomy supportive questions', 'provides a rationale', 'offers student autonomy supportive help during exercises', 'provides (non) verbal positive feedback' and 'calls to account (motivating).'

Demotivating teaching behaviour

Regarding SDT-related demotivating teaching behaviour (i.e. control and/or chaos), six such behaviours were included. The six coded behaviours were: 'providing one-dimensional instruction for students' (an instruction that does not invite students to ask further questions, to reflect or contribute), 'Asks controlling questions', 'Refers to the test', 'provides controlling support during exercises', 'call to account (demotivating)' and 'providing negative feedback'.

Table 1 Coding scheme with examples, frequencies, minimum and maximum of the observed behaviours within lessons and unique occurrence in number of lessons

Actor	Value	Behaviour	Coded example	Frequency	Minimum per lesson	Maximum per lesson	Observed in unique lessons (*n*)
Teacher	Motivating (*n* = 3335)	Provides choice	'Guys, you can take a short break if you want.' 'You can go on the computers here or in the study centre.' 'We will first make groups and then as a group you will choose one of those cases.'	56	1	8	24
		Provides a rationale	'It must be on paper, if you have only discussed it with each other then you have to retrieve everything from memory completely, while if you have worked it out on paper you only have to read it.' 'I found this case more special, as this will challenge you to think about providing a really good intake.'	82	1	10	29
		Encourages independent problem solving and active contributions	'What else can you do; who has an idea?' 'Try to interpret it' 'Yes, and how do you proceed?'	99	1	11	27
		Asks autonomy supportive questions	'What do you think is important about..?' 'Do you know the Barbapapa's? Why do I have a picture of the Barbapapa's?' 'The song helicopter is a new one, who knows it?' 'Why is 20% the same as 1/5?' 'Who can help Kira?'	2 173	5	94	51
		Offers student autonomy supportive help during exercises	A group of students is working, the teacher walks by and gives examples to clarify the assignment. 'How are you doing?' (a teacher starts a conversation with students to get them started)	184	1	19	39
		Call to account (motivating)	'Ladies, you are busy with something else.' 'We wait a while until everyone is quiet, then we know for sure that everyone is listening.'	385	1	34	48
		Provides (non) verbal positive feedback	'Super!' 'Very good!' Thumbs up	356	1	60	48

Table 1 (continued)

Actor	Value	Behaviour	Coded example	Frequency	Minimum per lesson	Maximum per lesson	Observed in unique lessons (*n*)
	Demotivating (*n* = 635)	Refers to the test	'You must hand it in because it counts towards the scoring.' 'This is what you have to do for the test.'	58	1	10	26
		Provides a one-dimensional instruction	'What you are going to do today is to pick up a folder at my desk with your group.' 'Hey, listen, you will find a quiet place and make a group of four people ..'	193	1	16	40
		Provides controlling support during exercises	'I think you will start with the papier-mâché next week. Paper mache is next week's main goal. You will never finish that next week'. 'So, you have to say how they should have that paper. You have to explain that.'	52	1	12	17
		Provides (non)verbal negative feedback	'What do you say, intake is not a word, I will decide if that is a word.' '(Sigh) Jennifer, Jennifer..' Ignores student and continues to the next topic: 'Let's go to the fractions first.'	103	1	13	22
		Asks controlling questions	Rhetorical questions, teacher asks a question and provides the answer him-/herself ('90 out of 100 is therefore 90%')	81	1	13	24
		Call to account (demotivating)	'Don't show me that there is chewing gum there, Lana!' 'Stop it!' 'Yvet, Yvet, three times, Yvet'	148	1	29	31
Student	Positive engagement (*n* = 1154)	A student asks a question from wanting	'That is not a natural cleaning product, is it?' 'When can you become pregnant?'	912	1	59	51
		A student supplements the teacher without any incentive (own contribution)	The students spontaneously call out what penalties they have received for being late and supplement the teacher with their examples. The student gives examples of unwanted pregnancies without being asked.	230	1	38	27

Table 1 (continued)

Actor	Value	Behaviour	Coded example	Frequency	Minimum per lesson	Maximum per lesson	Observed in unique lessons (*n*)
			Student unsolicited shares her example of using the lancing device.				
		A student takes initiative	'Shall I do the rabbit song?' 'I am going to work in the study centre.' Student steps forward to present a dance pass that the teacher is explaining.	12	1	3	10
	Negative engagement (*n* = 264)	A student complains/ is nagging the teachers	'That is stupid.' 'I really didn't understand a damn thing about it.' 'And … (teachers name), and me, am I being ignored here again or something?'	103	1	17	30
		A student asks a question from must	'What do you actually need to complete before the test week?' 'Do I still have to do that assignment?'	100	1	14	29
		A student does not keep appointment	Student is late. (Teacher): 'Are you doing the assignment?'(Student): 'No, I already know which political party I vote for.'	61	1	12	30

Positive engagement

With regard to positive student engagement, the following three behaviours were included: 'students ask questions from interest', 'students take initiative', and 'students supplement the teacher without any incentive'.

Negative engagement

Regarding students' negative engagement, three specific student behaviours were included: 'students ask questions about what they must do', 'students complain to the teacher' and 'students do not keep appointments'.

Coding procedure

The coding team included a theoretical expert, a coding coordinator and two research master students. All videos were coded in The Observer XT (Noldus Information Technology, 2011). After three training sessions, with a total of 14 hours of training per coder (with specific feedback on coded test videos), the reliability was considered sufficient (K = .68, which is moderate to good; Landis & Koch, 1977) to start coding all lessons. During the coding, the coding coordinator monitored all completed files of the coded videos to check interrater reliability and avoid coder drift; any found inconsistencies were discussed throughout the coding process.

The coding coordinator randomly divided the recorded lessons among the four coders. To compute the interrater reliability, five videos (10% of the available videos) were double coded. The double coding was done using the following procedure: the second coder received a list with the time points that a randomly assigned first coder had coded for specific behaviours. They then were asked to code the behaviours they observed at those specific times. This was done because the main interest concerning interrater agreement was in terms of the content of the behaviours (as opposed to their exact timing). Interrater reliability was (K = . 69), which is considered sufficient for further analysis (Landis & Koch, 1977).

Analytic strategy

To answer the research question and identify patterns in (de)motivating teaching and student engagement, the results of the observations were analysed in three different ways.

(1) To gain a sense of the most recurrent behaviours reflecting (de)motivating teaching and student engagement, descriptive statistics (frequencies, minimum and maximum occurrences) of all coded teacher and student behaviours were derived from the software The Observer XT (Noldus Information Technology, 2011).
(2) Second, lag-sequential analyses were extracted from Noldus to investigate the relationship between motivating or demotivating teaching behaviour (lag_0), and subsequent positive or negative student engagement (lag_{+1}). To investigate the sequential relationship between motivating and demotivating teaching, on the one hand, and positive and negative student engagement, on the other, a *Chi*-square test was performed. Additionally, for each specific teaching behaviour (lag_0), the relative frequency of subsequent

positive and negative student engagement (lag_{+1}) was also calculated, also called *transitional frequencies.*

(3) T-pattern analyses were applied to identify patterns in teacher and student behaviour (Casarrubea et al., 2015; Casarrubea et al., 2018; Magnusson, 2000; Mascareño Lara et al., 2016). All data files were prepared to be compatible for analyses with the software Theme6 Edu (64bit).[3] A T-pattern is a set of binary relations between events, which repeatedly occur in the data following the same order and within a specific time window. Unlike the lag sequential analysis, T-pattern analysis bases its detection on units of time (i.e. a data-driven critical time window) rather than on lags of events. The pattern AB is detected when events A (e.g. teacher, motivating, asks autonomy-supportive question) and B (e.g. student, positive engagement, asks a question from wanting) are statistically significantly-related, that is, when within a critical time window, they follow each other more often than expected by chance. Therefore, the detection of this AB pattern does not necessarily mean that the events A and B follow each other directly—as in a sequential analysis with a lag+1. It means that although there could be other events coded in between A and B, those other events do not occur regularly in the same order within the critical time window, and therefore do not belong to the pattern.

Following the recommendations of the Theme6 manual and a previous study led by one of the authors (Mascareño Lara et al., 2016), we used the following pattern detection parameters: (a) considering that classroom interaction is not a random process, we set a rather strict significance level of $p < .001$ for pattern detection, (b) we used a lumping factor of .90, which implies that when in 90% of the occasions an event is associated with the same other event, the two events were lumped and taken as a unit and (c) we also requested the detection of bursts, which are repetitions of the same event in a significantly ($p < .005$) shorter time frame than average.

After the preliminary search 24,566 patterns were identified.[4] Although the software Theme6 can find patterns of substantial lengths (the maximum in this data file was a pattern of 211 behaviours), there was no way of knowing if the behaviours contained in these patterns had a meaningful association in the natural flow of interaction. So, it could be that a question of a student was not necessarily a direct response to the teacher. Therefore, the aim was to capture the smallest possible interactional units (AB). Additionally, we also analysed interactional units that contained three behaviours (ABC) to explore whether there could be combinations of (de)motivating teaching behaviours and student engagement associated with positive or negative student engagement (ABC). In sum, we used quantitative selection criteria in order to further refine the pattern list to those relevant to this study: patterns of events that contained two actors (teacher and student), a minimum of one or two switches between actors and, a maximum length of three events were selected. This selection yielded 329 patterns.

Subsequently, qualitative as well as quantitative selection criteria were applied to answer the third research question. A qualitative selection was made to derive patterns that started with

[3] The software Data Exchange Platform (DEPxe version 2 - PatternVision Ltd, 2012 – add on for Theme 6) was used to transfer all data files from the Observer to the software Theme6 Edu 64bit (Pattern Vision Ltd, 2012). From DEP coded lessons were transferred to the format that is needed for analyses in Theme. All transferred data files were imported in toTheme6 Edu and one final check was made to remove any errors in the event codes.

[4] Prior to the search for T-patterns, all data files were aggregated into one multi-sample file. This file allowed a search for patterns in the overall dataset instead of a separate analysis per data file, still indicating which pattern occurred in which lesson (Magnusson, n.d.). Within the present study, the search included patterns of events up to three levels.

(de)motivating teaching behaviours and ended with student engagement. Within the 329 found patterns, 126 patterns were relevant in answering our research questions. These consisted of 91 *TS* patterns (27.66%) that started with (de)motivating teaching behaviour *(T)* and ended with student engagement *(S)*, and 35 *(S/T)TS* patterns (10.64%) that started with student engagement *(S)* or motivating teaching behaviour *(T),* followed by motivating teaching behaviour *(T),* and ended with student engagement *(S)*.[5]

Out of these 126 patterns, all patterns that started with teaching behaviours followed by student behaviour *(TS)* were selected and investigated their distribution across lessons. Then a quantitative selection was made and only the *TS* patterns that occurred in at least six lessons were kept (which is about 10% of all recorded lessons). These selection criteria yielded 41 relevant and statistically significant patterns ($p < .001$ in the present study)[6,7] between (de)motivating teaching and student engagement (patterns 1–41; see Table 2). Students taking initiative was considered to be an important indicator of (active) positive student engagement, but raw occurrences of this behaviour were rather low (12 times in total). Therefore, the search included all patterns that ended with students taking initiative; with this, one additional pattern was found.

Results

Baseline frequencies

In total, 5388 teacher and student behaviours were coded within 52 lessons (see Table 1). Overall, there was quite some variability across the lessons with respect to which certain behaviours were applied (see the ranges of the coded behaviour). For example, with regards to the teaching behaviour 'asking autonomy-supportive questions', there was one lesson in which the teacher did not express this particular behaviour at all, but there was also a lesson in which the teacher was observed to ask autonomy-supportive questions 94 times.

Of all coded teaching behaviours, 84% were coded as motivating. Teachers were mostly observed asking autonomy-supportive questions, calling students to account in a motivating way and providing them with positive feedback. To a far lesser extent were teachers observed providing students with choices, a rationale for a particular action or encouragement of their independent problem solving. Only 16% of the observed teaching behaviours, however, were coded as demotivating (n = 635; 15.96%). The most frequently observed demotivating behaviours were: asking controlling questions, providing negative feedback and one-dimensional instructions. Providing controlling support during exercises and referring to the test were observed to a much lesser extent.

[5] In addition, there were 115 patterns (35%) that started with student engagement and ended with (de)motivating teaching behaviour and 93 patterns (28.27%) that started with (de)motivating teaching behaviour and also ended with (de)motivating teaching behaviours.

[6] It is important to note that, there could be overlap in the frequency in patterns of two or three behaviours. For instance, the 211 instances that pattern 2 was found could overlap in the 247 instances that pattern 1 was detected. Therefore, they should not be seen as completely different patterns.

[7] Since the pattern search is based on recurrent binary relations, the output usually yields patterns that overlap in content, such as patterns ((AB)C), (A(BC)) and ((BC)A); as these patterns are not substantially different, they were merged.

Table 2 Frequencies of motivating or demotivating teaching behaviour followed directly by positive or negative student engagement (lag_1)*

	Positive student engagement	Negative student engagement
Motivating teacher behaviour	613	109
Demotivating teacher behaviour	115	60

*It is important to note that, in the majority of cases, teacher behaviour was actually followed by teacher behaviour and not student behaviour. When teachers displayed motivating teaching behaviour, this was followed in 22% of the instances by an action indicating either positive or negative student engagement. In addition, demotivating behaviours were followed by actions of student engagement in 28% of the follow ups.

Of all coded student behaviours, more than 81% were rated as positive student engagement. The majority of behaviours related to students' positive engagement stemmed from a desire to know something; to a lesser extent were students observed to supplement the teacher without any incentive. Students taking initiative were hardly ever observed. Indicators of students' negative engagement (19% of all student behaviours) were mostly expressed by students complaining or asking what they had to do. To a lesser extent were students observed to disregard appointments.

Lag sequential results

Results of the lag sequential analyses showed that motivating teaching (lag_0) was followed directly by positive student engagement (lag_1) in 85% of the occurrences (see Table 2). Teachers' demotivating behaviour (lag_0) was also most often followed by positive student engagement (lag_1), but to a lesser extent (66%). The association between (de)motivating teaching behaviour and student engagement was significant ($\chi^2[1] = 33.92$, $p < .001$, $\Phi = .19$), indicating that teachers use of either motivating or demotivating behaviour was sequentially associated with student engagement behaviours in the next consecutive turn of the interaction. Yet, the strength of the association was weak.

When looking at the specific motivating teaching behaviours and their direct follow-up with student engagement (see Fig. 1), motivating behaviours were most often followed by positive student engagement and hardly ever by negative student engagement. Furthermore, demotivating teaching behaviours were also most often followed by positive student engagement, but the results showed that—in contrast to motivating behaviours—there was a higher percentage of direct negative student engagement follow-ups. Specifically, providing negative feedback, asking controlling questions and/or referring to the upcoming test seemed to be followed by negative student engagement more frequently than any of the motivating behaviours.

Regarding motivating and demotivating teaching behaviours, some similarities and differences were observed. In particular, teachers' motivating support during exercises and their controlling support during exercises were equally likely to result in either positive or negative student engagement. Furthermore considering positive feedback, the vast majority of consequential student engagement was positive. With negative feedback, the chances of positive versus negative engagement were almost equal. Interestingly, calling students to account in a motivating way had a higher chance of being followed by negative student engagement (e.g. students complaining).

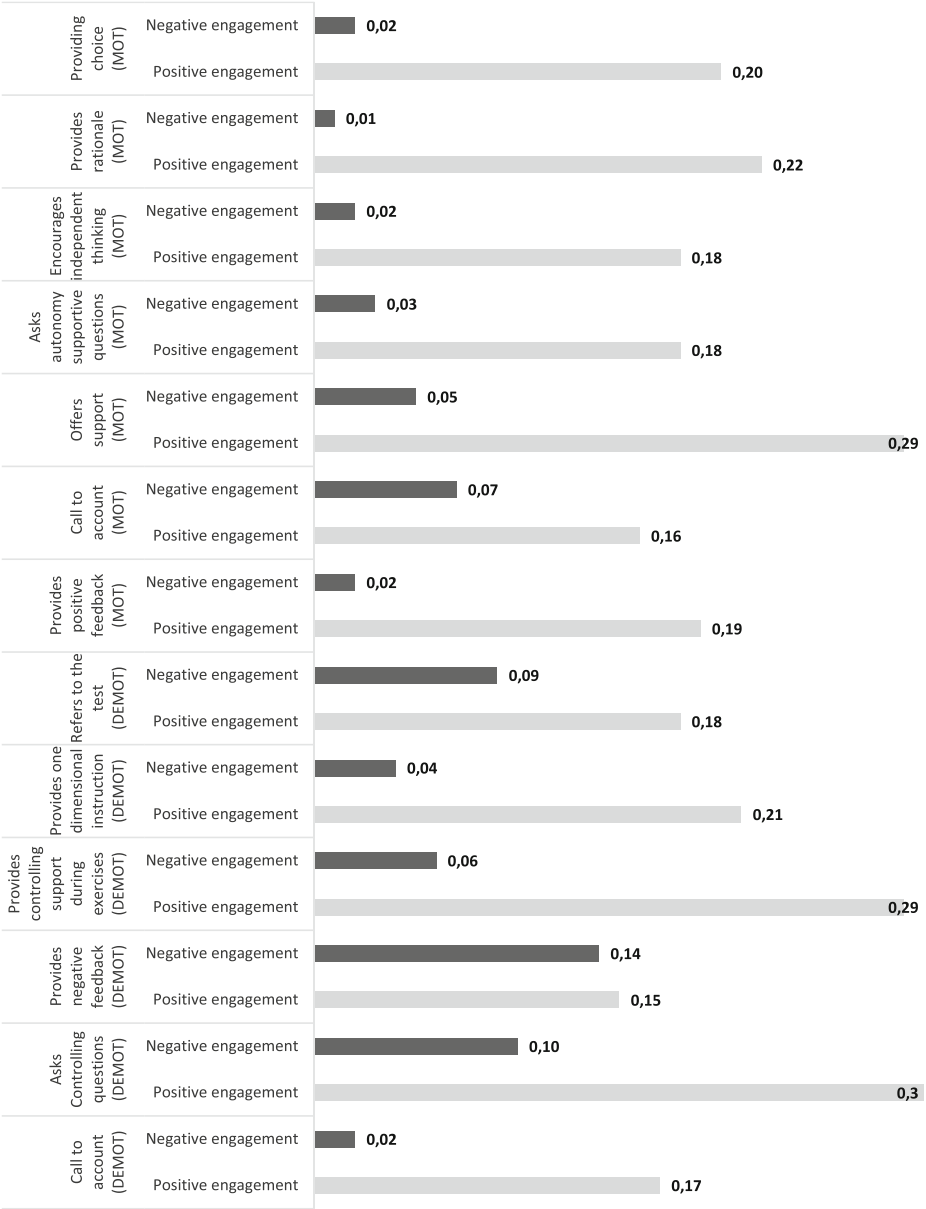

Fig. 1 Relative frequency of (de)motivating teaching followed by student engagement (lag+1)

T-pattern results

The first and most recurrent pattern types were those in which motivating teaching behaviours were associated with positive student engagement (i.e. a student asking a question from wanting; patterns 1–9; see Table 3). The motivating teaching behaviours followed by students' positive engagement were when teachers asked autonomy-supportive questions, provided

Table 3 Motivational patterns starting with student or teaching behaviour and resulting in positive or negative student engagement

No.	Pattern of behaviour	Frequency	Occurred in n lesson	Range
Students asking questions from wanting				
1	(S) Asking a question from wanting (T) Asking an autonomy supportive question (S) Asking a question from wanting	247	36	1–39
2	(T) Asking an autonomy supportive question (S) Asking a question from wanting	211	41	1–27
3	(T) Providing positive feedback (S) Asking a question from wanting	83	31	1–10
4	(S) Asking a question from wanting (T) Autonomy support during exercises (S) Asking a question from wanting	62	21	1–9
5	(S) Asking a question from wanting (T) Providing positive feedback (S) Asking a question from wanting	58	25	1–7
6	(T) Asking an autonomy supportive question (T) Providing positive feedback (S) Asking a question from wanting	47	23	1–7
7	(S) Asking a question from wanting (T) Call to account (motivating) (S) Asking a question from wanting	39	23	1–8
8	(T) Provides choice (T) Providing positive feedback (S) Asking a question from wanting	11	10	1–2
9	(T) Autonomy support during exercises (S) Asking a question from wanting	9	6	1–2
10	(T) Providing one dimensional instruction (S) Asking a question from wanting	50	25	1–5
11	(T) Call to account (demotivating) (S) Asking a question from wanting	50	25	1–7
12	(S) Asking a question from wanting (T) Providing negative feedback (S) Asking a question from wanting	25	10	1–9
13	(T) Refers to the test (S) Asking a question from wanting	23	16	1–6
14	(T) Providing negative feedback (T) Call to account (demotivating) (S) Asking a question from wanting	17	10	1–7
15	(S) Complains (T) Call to account (demotivating) (S) Asking a question from wanting	16	13	1–2
16	(T) Call to account (demotivating) (T) Providing one dimensional instruction (S) Asking a question from wanting	13	10	1–3
17	(T) Asks a controlling question (T) Call to account (demotivating) (S) Asking a question from wanting	14	10	1–5
18	(T) Asks a controlling question (S) Asking a question from wanting	14	8	1–5
19	(T) Asks a controlling question (T) Call to account (demotivating) (S) Asking a question from wanting	14	10	1–5
20	(T) Asks a controlling question (T) Asking an autonomy supportive question (S) Asking a question from wanting	23	13	1–8

Table 3 (continued)

No.	Pattern of behaviour	Frequency	Occurred in n lesson	Range
21	(T) Providing negative feedback (T) Asking an autonomy supportive question (S) Asking a question from wanting	10	7	1–3
22	(T) Call to account (motivating) (T) Addressing to appointment (controlling) (S) Asking a question from wanting	23	14	1–6
23	(T) Asking an autonomy supportive question (T) Providing one dimensional instruction (S) Asking a question from wanting	14	9	1–5
24	(T) Call to account (motivating) (T) Asks a controlling question (S) Asking a question from wanting	10	7	1–3
25	(T) Asking an autonomy supportive question (T) Providing one dimensional instruction (S) Asking a question from wanting	9	7	1–3
26	(T) Providing a rationale (T) Providing one dimensional instruction (S) Asking a question from wanting	9	7	1–2
27	(T) Providing a rationale (T) Call to account (demotivating) (S) Asking a question from wanting	8	6	1–2
Students supplement the teacher without incentive				
28	(S) Supplement the teacher (input) (T) Asking an autonomy supportive question (S) Supplement the teacher (input)	83	18	1–16
29	(T) Asking an autonomy supportive question (S) Supplement the teacher (input)	45	19	1–8
	Students taking initiative			
30	(T) Asking an autonomy supportive question (T) Providing a rationale (S) Taking initiative	6	6	1
Students asking questions from Must				
31	(T) Providing one dimensional instruction (S) Asking a question from must	28	19	1–3
32	(T) Providing negative feedback (S) Asking a question from must	16	9	1–4
33	(S) Asking a question from wanting (T) Asking an autonomy supportive question (S) Asking a question from must	13	9	1–4
34	(T) Asks a controlling question (S) Asking a question from must	11	6	1–5
35	(T) Refers to the test (T) Providing one dimensional instruction (S) Asking a question from must	8	8	1
Students complain				
36	(T) Providing negative feedback (S) Complains	29	12	1–6
37	(S) Complains (T) Providing negative feedback (S) Complains	26	8	1–7
38	(T) Call to account (demotivating) (T) Providing negative feedback (S) Complains	23	8	1–3
39	(T) Call to account (demotivating) (T) Call to account (demotivating) (S) Complains	18	10	1–4

Table 3 (continued)

No.	Pattern of behaviour	Frequency	Occurred in n lesson	Range
40	(S) Complains (T) Call to account (motivating) (S) Complains	16	10	1–5
41	(T) Call to account (motivating) (S) Complains	9	7	1–3
42	(S) Complains (T) Call to account (motivating) (S) Complains	8	7	1–2

positive feedback and, to a lesser extent, providing autonomy support and calling students to account in a motivating way.

The second type of pattern (patterns 10–21, see Table 2) referred to patterns in which demotivating teaching behaviours were related to positive student engagement. The demotivating teaching behaviours associated with students asking questions from wanting, were combinations of one-dimensional instructions, calling students to account in a demotivating way, negative feedback referring to the test, and asking controlling questions.

In patterns 20–27, teachers used combinations of (de)motivating teaching behaviours in which they started with motivating instructional behaviours and then switched to demotivating behaviour (except for patterns 20, 21). Pattern 22, for instance, showed that a teacher first tried to call a student to account in a motivating way, but then combined this with a more controlling teaching behaviour (which relates to positive student engagement). Yet in pattern 20, it was the other way around: a teacher started with a controlling question, then quickly followed with an autonomy-supportive question (which also related to positive student engagement).

With regards to the other coded indicators of positive student engagement, only patterns 28 and 29 resulted in students supplementing the teacher without any incentive; in pattern 30 a student took the initiative. In patterns 28 and 29 the students were asked a question but the aspect they supplemented the teacher on was not simply answering this question but contributing further without being asked. Within these patterns specifically, teachers' use of autonomy-supportive questions seemed to be of importance. With regards to pattern 30, from the 12 occasions students were observed to take initiative, six were found to be part of a pattern that started with a teachers' use of autonomously-supportive questions and/or providing a rationale for the assignments or instruction.

Finally, patterns 31–42 were those that closed with negative student engagement, mostly associated with demotivating teaching behaviours. In particular, providing a one-dimensional instruction, referring to the test, offering negative feedback and asking controlling questions seemed to be related to students asking a question from wanting to know more. Moreover, providing negative feedback and calling students to account in a demotivating or motivating way (patterns 41, 42) preceded complaints by students.

Discussion

Considering the importance of positive engagement for students' current success in education and beyond, this study contributes to prior research by applying a microanalytic approach to

investigating patterns of specific motivating and demotivating teaching behaviours and, in turn, students' positive and negative engagement behaviours. The microanalytic perspective revealed some interesting findings that offer a situational perspective, thereby adding to the body of research within the context of SDT.

Baseline frequencies

Overall, the most often observed student behaviours were asking questions (positive and negative) and—to a much lesser extent—supplementing the teachers without an incentive (positive), and complaining (negative). Taking initiative was hardly ever observed. The low occurrence of the most proactive indicators of student engagement (supplementing the teacher and taking initiative) corresponds to prior research (e.g. Lawson & Lawson, 2013) indicating that compliant engagement is the most dominant form of engagement in educational contexts. Although asking questions certainly requires student activity, they could also be prompted by an incentive from the teacher. Providing unsolicited input and taking initiative indicate a stronger emphasis on students' proactive contribution in the lessons (Reeve, 2013; Reeve & Tseng, 2011). When students are proactively engaged (i.e. agentic engagement), this relates to positive student outcomes such as academic progress, skill development, and the attainment of high academic achievement, whereas only being passively engaged (i.e. accepting one's environment as it is (agentic disengagement)) could have a negative effect on students' academic progress (Jang et al., 2016a, b). Furthermore, proactive engaged students are able to generate high-quality motivation for themselves and recruit high-quality support from their teachers (Reeve, 2013). Our results may indicate a need to increase focus on fostering students' proactive and agentic, rather than only on compliant (positive) engagement.

In terms of teaching behavior, teachers were mostly observed to engage in motivating behaviours such as asking motivating questions, providing positive feedback, and calling students to account. Demotivating teaching behaviours such as calling students to account in a negative way and providing one-dimensional instructions were also frequently observed. Our results showed that teaching behaviours related to supporting students' autonomy, for instance, encouraging independent thinking and allowing them to make their own choices (and mistakes), were among those applied least often by teachers. This finding is in line with prior research (Haerens et al., 2013; Van den Berghe et al., 2013), specifically within the VET context (De Bruijn & Leeman, 2011). Increasing the use of such strategies, in combination with providing the optimal level of structure, could however prove to be particularly beneficial in increasing more proactive and agentic contributions of students within lessons (Amoura et al., 2015; Fitzpatrick et al., 2018; Jang et al., 2010; Jang et al., 2016a, b). We believe this is a hypothesis worth exploring in future research.

Patterns of (de)motivating teaching behaviours and student engagement

Concerning the patterns of student-teacher interactions, both the results of the lagged sequential analysis as well as the T-pattern analysis revealed similar findings. The sequential analysis showed that overall, motivating teaching behaviours were followed more often by positive than negative student engagement, and demotivating teaching behaviours were followed more often by negative student engagement—as compared to motivating teacher behaviours. Similarly, also the results of the T-pattern analysis showed that motivating teaching behaviours were related to students' positive engagement during classes. Asking motivating questions,

followed by students asking question from sheer interest (i.e. 'asks a question from wanting'), was by far the most salient pattern. In addition, and as might be expected, the T-pattern analyses showed a number of patterns in which demotivating teaching behaviours were associated with negative student engagement. In particular, providing negative feedback, controlling questions, and calling students to account in a demotivating way, were associated with students' negative engagement (e.g. student 'complains' or 'asks a question' from must). These results, supporting motivating teaching being associated with positive student engagement and demotivating teaching being associated with negative student engagement are generally in line with prior research (De Meyer et al., 2014; Van den Berghe et al., 2013).

We did however also find patterns that go against these expected associations. The sequential analysis showed that demotivating teaching behaviours were frequently followed by positive student engagement, which was confirmed by the T-pattern analysis. Here we also found the unexpected patterns of demotivating teaching and positive student engagement, and between motivating teaching behaviour and negative student engagement. Calling students to account in a motivating way was found to be associated with negative student engagement whereas calling students to account in a demotivating was found to be associated with positive student engagement. Overall, classroom management (calling students to account) in a motivating or demotivating way was part of many of these contrasting patterns. Previous research has shown that the association of a particular teaching behaviour on student engagement very much depends on the general teaching style that a teacher has (Aelterman et al., 2014; Assor et al., 2002; Jang et al., 2016a, b; Niemiec & Ryan, 2009; Reeve, 2009). Teachers differ in their basic style, which could be generally motivating or demotivating, and this general style then moderates the relation of concrete teaching behaviours and student engagement. In other words, demotivating behaviours exhibited by teachers may have a less detrimental effect on student engagement when they are embedded in a generally motivating, supportive climate and teaching style, compared to when the general climate and teaching style is characterised as more demotivating and less supportive. Future research should investigate the interaction between the use of (de)motivating teaching behaviours from moment to moment, the teacher's general teaching style and student engagement.

Moreover, another unexpected result from the T-pattern analyses was that teachers use combinations of motivating and demotivating teaching behaviour, which were associated with positive student engagement. These results may indicate that when students do not respond in the preferred way, teachers have a tendency to switch to demotivating teaching, in order to prompt the desired reaction from students. For instance, when students do not respond to teachers' motivating way to call students to account, teachers start calling students to account in a more controlling way, probably to get students back in line. Prior research has revealed that there is a substantial number of teachers who believe that the use of motivating teaching behaviours is more challenging and time-consuming (Aelterman et al., 2014), or that their effectiveness is dependent on their perception of the abilities and motivation of the individual students (Domen et al., 2019). This may indicate that teachers combine both behaviours, either because they believe they will get the desired reaction quicker, or that combining these behaviours will engage a larger group of students. For future research, it would be interesting to investigate the exact use of these combinations of (de)motivating behaviours and investigate the nature of the reasons for switching between these different behaviours, for instance with video-stimulated recall interviews.

In sum, our results suggest that not all motivating teaching behaviour is followed by positive student engagement, and not all demotivating teaching behaviours is necessarily

followed by negative student engagement. We also found that teachers use a mix of motivating and demotivating teaching behaviours within those micro interaction patterns. Thus, in the context of educational practice, the theorized relationship between (de)motivating teaching behaviour and student engagement may be less predictable and deterministic than one may expect, and in fact may be much more nuanced and situation-dependent. There are different avenues to interpret this non-deterministic relation between (de)motivating teaching behaviour and student engagement, which we now try to outline.

First of all, a division into motivating and demotivating teaching behaviour may be too simplistic to capture the true nuances of observed teaching behaviours. Previous fine-grained research on motivating teaching showed at least eight subareas in the dimensions of (de)motivating teaching related to autonomy support, structure, control and chaos (Aelterman et al., 2019). Within these subareas, some behaviours lean more towards fostering students' motivation while others tend toward demotivation. For example, within autonomy support, asking supportive questions may show strong associations with structure while offering choice that may sometimes relate more with chaos. This fine-grained research suggests that the way teachers employ a certain type of (de)motivating behaviour can have a varying impact on student engagement from one instructional episode to the next, depending on: (a) the way this behaviour is expressed, (b) on the student-teacher relational context and (c) on the students' specific needs at the time (Aelterman et al., 2019; Assor et al., 2002; Domen et al., 2019).

Second, the nature and subject of the lesson, the nature of the task at hand, or the episode within the lesson will all partly determine which teaching behaviours teachers engage in (Jang, 2008; Reeve, 2016; Van den Berghe et al., 2016). Haerens et al. (2013), for instance, found that teachers provide more structure at the beginning of the lesson compared to the middle or end of the lesson. At the same time, students differ in their preferences, interests and motivations for certain subjects (Reeve, 2016). Also, some subjects are naturally more engaging than others, and some tasks are more repetitive and dull than others, hence making it harder to engage students. All factors that are influencing students' engagement above and beyond the concrete behaviours of their teachers were not taken into account in the current study.

Third, the nature of interaction is transactional. This implies that the level at which the students are working, the teachers' perception of their students and student behaviour, may equally influence the teachers' behaviours toward their students (Pelletier et al., 2002; Pelletier & Sharp, 2009; Hornstra et al., 2015). Fourth, teaching practices do not occur in a vacuum (Niemiec & Ryan, 2009). Teachers are embedded in the (social) context of their school, that is they have to comply with a curriculum and performance standards and have to fit into a collegial team (Pelletier et al., 2002). All these more distal factors are likely influencing the very concrete behaviours that teachers enact in their everyday lessons.

Finally, the students' and teachers' own well-being, stress levels but also cultural norms, values and habits are also known to influence the behaviours that one is likely to engage in, as well as the way certain behaviours of others are perceived and interpreted (Abaciolo et al., 2020). Thus, although our research revealed important insights into the temporal organization of teacher-student micro interactions, thereby contributing to the current literature, we have to acknowledge the complexity of the association between (de)motivating teaching behaviour and student engagement and the variety of factors that may influence and underlie the observable behaviours. If we truly want to understand the underlying mechanisms driving teachers' and students' behaviours and how they influence each other, we will have to move

beyond the 'black-box' approach presented here and combine these quantitative observational methods with more contextualized and qualitative approaches (Abaciolo et al., 2020).

Strengths, limitations and directions for future research

A definite strength of this study is the microanalytic approach that offers a new perspective on the situational dependency of teachers' use of motivating teaching in their daily educational practice. This approach further adds to SDT research with insights on the specific use and association between (de)motivating teaching and positive or negative student engagement. Obviously, the present study was subject to several limitations, which also delineate avenues of exploration for future research.

The coded student engagement, however, represents the behaviour of an entire class of 15–30 students. As the coded behaviours were not linked to individual students, the coded student engagement may represent the behaviour of just three students with a very active engagement in the lesson or a whole class of engaged students. In other words, it was not investigated if it was the same students that showed active engagement within each class. As research indicates, there are individual differences in students' engagement (Shernoff et al., 2016), students differ in the quality of their motivation in class (Cents-Boonstra et al., 2018; Hayenga & Corpus, 2010; Ratelle et al., 2007; Vansteenkiste et al., 2009), and teachers differentiate their behaviour based on their expectations of students' motivation, abilities and background characteristics (Domen et al., 2019). An interesting avenue for future research would be to examine the interactions of students observed with different degrees of engagement, with the same teacher. Such line of research would further recommendations for teachers to better foster the engagement of an entire class.

In addition to not knowing whether the same students were active in every lesson, more passive compliant forms of engagement (e.g. paying attention, responding to teachers prompts) or disengagement (e.g. staring out the window) were not coded, nor were any of the invisible aspects of student engagement (e.g. students' perception on their cognitive and emotional engagement). It could be that groups of students show different profiles in class: while one group is actively involved, a second group of students could be more passively engaged, while a third group of students checked out altogether and the fourth group is actively disturbing the lessons with negative engagement. This calls for observing additional types of student engagement of the individual students in combination with using self-reports, in order to gather information on their cognitive/emotional engagement. Combining more extensive observations and self-reports of student engagement could lead to more in-depth profiles of the variety of student engagement per lesson, which would be specifically interesting to investigate with regards to their relation to motivating teaching.

Although, with regard to motivating teaching, we found that autonomy support and structure were related to students' positive engagement, we did not code any behaviours related to relatedness support. Within SDT, motivating teaching is operationalized as teacher's behaviours divided into three separate dimensions corresponding to the three basic needs of students: autonomy, relatedness and competence. Yet, in observing concrete teaching behaviours, behaviour often represents a mix of these teaching dimensions. Although not coded, our informal impression of the data reveals that autonomy support and structure were often provided with a warm tone of the teacher showing empathy and responsiveness, which corresponds to relatedness support. Similarly, although providing choice is considered to be autonomy supportive, it may not be when it lacks any structure or guidelines and is delivered

in a cold and distant manner. Relatedness support in fact may function as a sort of emotional climate that moderates the effects of concrete autonomy and competence supportive behaviours (Sparks et al., 2016). Prior research already showed that strong positive relations may exist between the three basic needs (Jang et al., 2009; Reinboth et al., 2004; Taylor & Ntoumanis, 2007). It is very likely that it is exactly the right balance in satisfying students' needs that makes some concrete behaviours more motivating than others. We encourage future studies to dive into the complex interplay of various teaching dimensions and how they affect students' engagement.

Last, recent research shows strong support for the idea of a more reciprocal relationship between (de)motivating teaching behaviour and students' engagement (Matos et al., 2018; Reeve, 2013; Van den Berghe et al., 2015). Our results seem to further support this reciprocal relationship, suggesting that students' engagement also affects teachers' behaviour. Yet, in our exploration of the interaction patterns, the specifics of coherent micro interactions were not included, with a clear starting point and end. In contrast, the start of the pattern was an arbitrary starting point, which does not necessarily correspond to the natural interaction sequence. Therefore, it was not possible to investigate who actually started a coherent micro-interaction (the teacher or the student), how many behaviours were part of that interaction and when that interaction ended. Therefore, within future research, it would be a valuable addition to differentiate within the coding between different student-teacher interactions (start and end). This will further increase the understanding of the complexity and reciprocal associations between (de)motivating teaching and student engagement within daily interactions.

Practical implications

The results of this study indicate that motivating teaching behaviour increases the likelihood of positive student engagement. The findings could have implications on multiple levels, for instance, in interventions for existing teachers, teacher education and the curriculum (cf. designing lessons). With regard to teaching, this study showed that the motivating behaviours that related to active contribution of students (i.e. providing choice, offering a rationale and encourage independent thinking) seemed to be the least applied. More variety in motivating behaviours could help promote positive and proactive engagement among students. Intervention studies on applying motivating teaching and more motivating elements in curricula based on SDT (Su & Reeve, 2011) showed promising results in terms of supporting teachers and student teachers in the use of motivating teaching behaviours. These could be effective both for existing teachers and for future teachers within the teacher education.

In addition, the results of this study show an urgent need for teachers' flexibility as our research also implies that the impact of motivating teaching behaviours is dependent on the context (Assor et al., 2002). In a class with students with an interest in creative subjects, a teacher may need less and different motivating teaching behaviours than in a class with a lot of students with an utter dislike of creative subjects. Therefore, a practical implication of this research is that teachers need to be flexible in their use of motivating teaching behaviours and not get discouraged if a well-designed attempt misses its target. Discussing the contextual factors that could influence the impact of motivating teaching behaviour, could be an important addition to interventions.

With regard to curriculum design and lesson planning, research has showed promising approaches to fostering agentic student engagement. For instance, teaching in students'

preferred ways (Jang et al., 2016a, b), supporting teachers to become more aware of students' classroom needs (and concomitant adaptions to the lesson plan) could foster a more productive classroom environment. In addition, Fitzpatrick et al. (2018) introduced the Negotiated Integrated Curriculum initiative, which increases students' agentic engagement by involving them in curricular decision-making. These are just some examples of beneficial ways in designing lesson plans and curricula that can foster students' initiative in learning and thereby stimulate their active contribution during lessons.

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Publisher's note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Miriam Cents-Boonstra. Behavioural Science Institute, Radboud University, Postbus 9104, 6500 HE Nijmegen, The Netherlands. Graafschap College, J.F. Kennedylaan 49, 7001 EA, Doetinchem, The Netherlands m.centsboonstra@pwo.ru.nl

Current themes of research:

Classroom observation, motivating teaching behaviours and student engagement.

Most relevant publications:

Cents-Boonstra, M., Lichtwarck-Aschoff, A., Denessen, E., Haerens, L., & Aelterman, N. (2018). Identifying motivational profiles among vet students: Differences in self-efficacy, test anxiety and perceived motivating teaching. *Journal of Vocational Education & Training*, 1-23, 1-23. doi:10.1080/13636820.2018.1549092

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Anna Lichtwarck-Aschoff. Behavioural Science Institute, Radboud University, Postbus 9104, 6500 HE Nijmegen, The Netherlands. a.lichtwarck-aschoff@pwo.ru.nl

Current themes of research:

Clinical and interventions science

Most relevant publications:

Cents-Boonstra, M., Lichtwarck-Aschoff, A., Denessen, E., Haerens, L., & Aelterman, N. (2018). Identifying motivational profiles among vet students: Differences in self-efficacy, test anxiety and perceived motivating teaching. *Journal of Vocational Education & Training*, 1-23, 1-23. doi:10.1080/13636820.2018.1549092

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Mayra Mascareño Lara. Faculty of Behavioural and Social Sciences, University of Groningen, Grote Rozenstraat 3, 9712 TG Groningen, The Netherlands m.n.mascareno.lara@rug.nl

Current themes of research:

Classroom interactions, student engagement, learning processes, diversity in the classroom.

Most relevant publications:

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Eddie Denessen. Behavioural Science Institute, Radboud University, Postbus 9104, 6500 HE Nijmegen, The Netherlands. Department of Education and Child Studies, Leiden University, Postbus 9555, 2300 RB Leiden, The Netherlands e.denessen@pwo.ru.nl

Current themes of research:

Educational inequalities, teacher expectations, differentiation in schools and classrooms, parental involvement in education.

Most relevant publications:

Van den Bergh, L., Denessen, E., Hornstra, L., Voeten, M., & Holland, R. W. (2010). The implicit prejudiced attitudes of teachers: Relations to teacher expectations and the ethnic achievement gap. American Educational Research Journal, 47(2), 497-527.

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