RUNNING HEAD: OBSERVED NEED SUPPORT

Observing Physical Education Teachers' Need-supportive Interactions in Classroom Settings

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Abstract

According to self-determination theory teachers can support students' psychological needs trough the provision of relatedness support, structure and autonomy support. The present study complements extant self-report and experimental studies on need-supportive dynamics by means of an observational study in physical education (PE). As observation schemes for need support are almost non-existent, our goal was to develop a valid and reliable observation tool to rate need-supportive teaching behaviours. Seventy four different PE lessons were coded every five minutes to assess how often each of 21 behaviours occurred during the course of a regular PE lesson. Factor analyses provided evidence for four interpretable factors, that is, relatedness support, autonomy support, and two dimensions of structure, that is, structure before and during the learning process. Relatedness support was observed most frequently and autonomy support was observed least frequently, indicating a necessity for teacher education programs to focus more explicitly on this dimension. Finally, reasonable evidence was obtained for convergence between observed need-supportive teaching behaviours and pupils' perceptions of need support. Overall, the observation scheme developed in this study seems to be a promising assessment tool for future research on observed need supportive teaching behaviours during PE.

Key words: need support, observation, teaching behaviour, motivation

Why are some pupils eager to learn, while others lack interest and are rather disengaged? Why do some teachers manage to inspire and vitalize their pupils while their colleagues fail to do so? For quite some time, researchers in the field of education and motivation have a strong interest in developing and testing theories that provide insights into these types of questions. The ultimate goal of such research is to formulate evidence-based recommendations for teachers on how to create a more optimally motivating learning climate.

During the past two decades, studies on teachers' interpersonal style and behaviour have increasingly been conducted from the perspective of Self-Determination Theory (SDT, Deci & Ryan, 2000; Ryan & Deci, 2000). The attractiveness of SDT for the practice of education lies in its claim that the support and satisfaction of students' psychological needs for autonomy, competence, and relatedness plays a pivotal role in the development and sustainment of learners' optimal motivation, their psychological and physical health. Numerous studies in the general classroom (e.g., Jang, Reeve, & Deci, 2010) and in the physical education (PE) classroom in particular (e.g., Standage, Duda, & Ntoumanis, 2005; 2006) have allowed for the formulation of empirically supported recommendations for teachers on how to nurture learners' psychological needs in the organization of their classrooms and in their interactions with pupils.

Yet, a majority of SDT based studies have relied on self-reports of learners' perceived need-supportive classroom practices. For SDT to become truly practically useful, self-reported studies and experimental studies need to be complemented with observation studies in which teachers' everyday teaching behaviors are observed and coded. This was precisely the aim of the present study, which examined whether the broad range of observed teaching behaviors during PE classes can be meaningfully and parsimoniously represented in terms of teachers' support for each of the three needs as discerned within SDT. Further, we examined

how frequently and when these need-supportive teaching behaviors were observed in the course of a regular physical education lesson and whether the observed need-supportive teaching would be perceived as such by the students themselves. By doing so, we hoped to gain theoretical insight as to which need-supportive behaviors correspond to which of the three psychological needs and to be able to generate practical knowledge as to how PE teachers could specifically and concretely nurture learners' psychological needs.

Need-Supportive Teaching Behaviors

In SDT, the needs for autonomy, competence, and relatedness are identified as fundamental psychological nutriments for individuals' optimal motivation and well-being. Parallel to these three needs, SDT specifies which social contexts contribute to (versus detract from) such need satisfying experiences.

Autonomy Support

Autonomy refers to the experience of being the initiator of one's own actions and to the experience of volition and psychological freedom when engaging in an activity (Assor, Kaplan, & Roth, 2002; Deci & Ryan, 2000). Accordingly, teacher autonomy support entails identifying, nurturing, and developing pupils' personal motivational resources, such as their interests, preferences, and personal goals (Reeve, 2009). To identify learners' personal motivational resources, teachers take the learners' frame of reference. This implies displaying a sincere interest in the learners' preferences and actively listening to them, so that the students' voice is heard. This form of empathy also involves acknowledging students' perspectives, problems and feelings, such as accepting their negative affect with regard to less interesting tasks (Reeve, Jang, Hardre, & Omura, 2002; Jang et al., 2010). For instance, when a warm-up exercise during a PE lesson causes irritation among pupils, a PE teacher might acknowledge the rather dull and monotonous character of the exercise instead of suppressing the learners' irritation thereby pushing them into the activity.

In addition to identifying pupils' interests and preferences, autonomy-supportive teachers also try to nurture these motivational resources (Reeve, 2009) through the provision of interesting, challenging, and relevant activities that are likely to attract students' curiosity (i.e., demonstration of intrinsic value) or by offering meaningful choices (Ntoumanis, 2001; Prusak, Treasure, Darst, & Pangrazi, 2004; Ward, Wilkinson, Graser, & Prusak, 2008). In PE for instance, when dance is on the program, teachers could nurture pupils' interests by selecting a popular type of dance (e.g., hip hop or break dance) or by allowing for pupils to choose the type of dance. Further, teachers can build pupils' autonomous self-regulation by creating opportunities for initiative taking (Reeve & Jang, 2006). This can be achieved in PE by allowing pupils to take the lead in the organization of a small activity such as a warm- up exercise or a larger event such as a tournament or dance show.

The type of instructions teachers use is also critical to nurture and develop inner motivational resources. In an autonomy supportive learning environment, teachers use non-controlling or inviting language (e.g.,, Simons, Dewitte, & Lens, 2003; Vansteenkiste, simons, Soenens, & Lens, 2004) and explain the personal relevance or potential interest and importance of the learning goals and activities, so that students understand why engaging in an activity is personally interesting and valuable for them (Deci, Eghrari, Patrick, & Leone, 1994; Reeve & Jang, 2006; Reeve et al., 2002; Reeve, 2009). For example, if the teacher did not explain why standing still and deep knee bending will be important in function of a good underarm return in volleyball, the pupils are unlikely to be motivated to follow these instructions in the warming up exercises because they do not truly understand why they should do the effort.

Structure

Next to the need for autonomy, the need for competence involves feelings of effectiveness when trying to master a task or exercise. The need for competence is assumed to

be nurtured in a well-structured environment. Structure probably represents the least understood and least systematically examined dimension of teaching style. As noted by Jang, Reeve and Deci (2010), structure has been studied in the classroom management literature as a way to establish order and minimizing misbehavior. According to SDT a structured learning environment is a context in which pupils feel competent because they know how to effectively achieve desired outcomes (Skinner & Belmont, 1993; Sierens, Vansteenkiste, Goossens, Soenens, & Dochy, 2009). Accordingly, one key feature of structure is the communication of clear and understandable guidelines and expectations (Farkas & Grolnick, 2010; Jang et al., 2010; Sierens, et al., 2009) so that students feel capable to start engaging in the learning task. Although this might sound self-evident, it may not always be the case. To optimally nurture feelings of competence it is critical that a PE teacher provides the desired amount of information and guidelines. When pupils already master the taught activity to a certain degree, for instance, because they exercise the sport during leisure time or because the teacher already provided the instructions during the prior PE class, they are less likely to benefit from the same set of instructions. Because unsolicited information is unlikely to strengthen pupils' competence, PE teachers need to adjust the provided information in light of the pupils' skill development. The repetitious provision of the same guidelines may even cause irritation among some pupils because the information is experienced as redundant and does not help them in achieving a new step in their skill development.

Next to structure provided before the learning activity, structure can also be provided during the ongoing learning activity (Jang et al., 2010). During the ongoing learning process, rules and expectations are supposed to be applied consistently and promoted in a way that expresses teachers' confidence in the students' ability (Grolnick & Ryan, 1989). The teacher proceeds with instructions like "well done" and "by the end of this class everyone of you will be able to play underarm reception in the 2 on 2 game situation". Structure also gets

manifested when teachers provide positive feedback (Koka & Hein, 2005; Mouratidis, Vansteenkiste, Lens, & Sideridis, 2008, Sierens et al., 2009), provide adequate help and support (Jang et al., 2010), and optimally challenging tasks (Sierens et al., 2009). The latter strategies are assumed to satisfy pupils' need for competence because they create opportunities for pupils to feel effective and successful when engaging in a task. In gymnastic classes for instance, PE teachers can implement a number of exercise stations with each station having a different level of difficulty. This type of differentiation allows for pupils to choose at which level of difficulty they will practice, to determine their individual standards, and to proceed at their own pace.

Relatedness support

The third need distinguished within SDT is the need for relatedness. Relatedness refers to the extent to which people have positive and mutually satisfying relationships and experience a sense of closeness, trust, or friendship in relationships with others. The need for relatedness has been identified in many other theoretical frameworks, including attachment theory (Bowlby, 1988), and is probably the most widely accepted of the three needs (Baumeister & Leary, 1995; Ryan & Deci, 2000). Relatedness is said to be nurtured in a warm, involved, and friendly environment, where socialization figures take the child's perspective and express genuine concern and unconditional regard (Sheldon & Filak, 2008). In a relatedness-supportive environment the teacher is empathic and cares sincerely about the individual child. This implies that the teacher creates a climate in which children feel safe and concerned about, independent of their competence levels. Relatedness-supportive teachers try to understand when and why children are afraid or distressed and take their feelings into account (Cox & Williams, 2008; 2009; Soenens, Duriez, Vansteenkiste, & Goossens, 2007). For instance, when children are afraid of deep water in swimming classes, the teacher will

show sincere concern for the individual child and its emotions by providing adapted exercises so that he/she can proceed more gradually from the un-deep towards deep water.

Research on Need-Supportive Teaching

Dozens of studies in SDT literature have examined the manifold benefits of teacher need support. Especially the concept and correlates of (teacher) autonomy support has been studied extensively (Reeve, 2009), while far less attention has been paid to the dimension of (teacher) structure or relatedness support. Generally speaking, two strands of work can be distinguished, that is, experimental and self-report studies. The present research aims at complementing these two research lines by conducting an observational study. None of these three single research lines allow for the "ultimate" acceptance versus rejection of SDT-based hypotheses as each research line has its own pros and cons. A conjoined consideration of the empirical evidence obtained across these three research lines might, however, enrich our understanding of need-supportive dynamics.

In experimental studies, one or two need-supportive components are typically isolated and experimentally varied (Vansteenkiste, Williams, & Resnicow, in press). For instance, choice (e.g., Patall, Cooper, & Robinson, 2008) and positive feedback (e.g., Vallerand & Reid, 1984) have been found to predict increased intrinsic motivation and engagement. While experimental studies allow for the inference of causal conclusions, a lot of these studies have been conducted in laboratory rather than in real-life settings, which hampers their ecological validity. Especially, in the more specific domain of PE, experimental real life studies are scarce (but see Mouratidis et al., 2008 for an exception). Further, experimental studies do not answer the question to what extent different need-supportive teaching practices co-occur and, hence, can be grouped. This is because need-supportive components are not jointly assessed but randomly distributed across experimental conditions. In contrast, the direct assessment of students' perceived need support through self-reports – the second line of research within

SDT – allows one to examine to what extent different need-supportive practices co-vary. Many researchers have created composite scores of perceived teacher need support not distinguishing between the three dimensions of need support (e.g., Standage et al., 2005, 2006; Zhang, Solmon, Kosma, Carson, & Gu, 2011) and in other studies the assessment of need support was limited to autonomy support (e.g., Soenens & Vansteenkiste, 2005. Composite scores of perceived need support have been found to predict positive outcomes such as autonomous learning motivation, positive affect, concentration and physical activity (e.g., Standage et al., 2006; Zhang et al., 2011). Specific assessments of perceived teacher autonomy support have also been found to relate positively to autonomous learning motivation (e.g., Soenens & Vansteenkiste, 2005), self-regulated learning (e.g., Vansteenkiste, Zhou, Lens, & Soenens, 2005), achievement (Jang, Reeve, Ryan, & Kim, 2009), vitality and effort (Taylor & Lonsdale, 2010), and interest and enjoyment (Black & Deci, 2000). Such findings have been obtained among samples varying in age, cultural orientation, and gender distribution (Reeve, 2009; Jang et al., 2009).

We argue that observational studies including a micro-analysis of teachers' need-supportive behaviors during PE classes compliments previously conducted experimental and self-reported studies for a number of reasons. First, observation studies can provide new information about the validity of the distinction between need-supportive practices. Research based on self-reports did not always provide clear-cut evidence for a distinction between the three dimensions of need-support (Vansteenkiste, Niemiec, & Soenens, 2010). Observation data allow to further examine the distinction between three need-supportive dimensions. Some teaching practices might relate to more than one dimensions as they nurture several needs. For instance, empathy (i.e., teachers' ability to take the students' perspective) could represent a feature of both autonomy support (Reeve, 2009) and relatedness support (Sheldon

& Filak, 2008) and rationale provision may represent a feature of both autonomy support (Assor et al., 2002) and structure (e.g., Farkas & Grolnick, 2010).

Second, observation studies have high ecological validity as real classes are registered and teachers' real-life need-supportive behaviors are mapped out by developing a coding system. This allows one to gain insight in the frequency with which certain need-supportive behaviors occur during an entire class. In principle, it is possible that some need-supportive practices are studied intensively in the laboratory but rarely occur in daily life. Also, it is possible that some need-supportive dimensions or practices might be more salient at the beginning of the class, while others are more relevant towards the middle or the end of a class. Finally, by closely observing and coding PE teachers' need-supportive practices, richer insights might be gained in the way need support gets manifested in the context of PE.

A third advantage of observation studies is that they allow examining the convergence between the objectively rated need-supportive practices and the subjectively experienced need support. From a motivational perspective, especially the perceptions of need support are likely to carry the effect on outcomes. Yet, it remains an open question to what extent expert ratings of a PE teacher as being highly need-supportive are perceived as such by the pupils. Although there exists substantial within-classes variability in the perception of the teacher practices (e.g., Stornes, Bru, & Idsoe, 2008), one would hope that the average rated need support converges at least moderately with the average need support perceived by the students. A final reason why the development of a coding system is important is because it sets the stage for intervention studies which involve training PE teachers to adopt a more need-supportive teaching style. The effectiveness of such training modules could then be evaluated by examining whether a change in observed (in addition to teacher perceived) need support can be noticed.

In spite of the advantages of observation studies, only few studies have attempted to develop observation schemes of need-supportive dimensions. Reeve et al. (2004) and Tessier et al. (2008) developed observational schemes to code autonomy-supportive behaviors in the domains of general education and PE, respectively (Reeve, Jang, Carrell, Jeon, & Barch, 2004; Tessier, Sarrazin, & Ntoumanis, 2008), while Jang and colleagues (2010) also rated teachers' provision of structure. The present study aims to move this line of research forward by (a) using observations of need-supportive teaching behaviors playing onto all three needs (rather than just autonomy and competence) and (b) examining the factorial validity of the rated need-supportive practices in the domain of PE.

The Present Study

The overall aim of the present study was to develop a valid and reliable observation tool, called the System for Observing Need-supportive Interactions in Physical Education (SONIPE). We developed a broad pool of need-relevant behaviors comprising all three needs and used this observation scheme as a guide to observe and rate videos of a PE class. We pursued three broader aims. First, we examined the factor structure of the rated need-supportive teaching behaviors. On the basis of SDT, we expected to find evidence for at least three factors mapping onto each of the three needs. Yet, we were open to the possibility that more than three factors might emerge, which would indicate that some dimensions are multifaceted. For instance, autonomy support might be multifaceted as it has been described as involving the identification, nurturance and development of inner preferences, interests and values (Reeve & Jang, 2006). Also structure has been divided into structure provided before the learning activity (such as clarifying expectations and learning goals) and during the learning activity (such as providing strong guidance, positive feedback and encouragements (Jang, et al., 2010). Also, we were interested to see where a number of specific teaching behaviors that have been described as characteristics of more than one dimension (e.g.,

empathy and provision of a rationale) would load. To further substantiate the obtained factor structure, we added ratings of teachers' global autonomy support, structure, and relatedness support to the factor analyses to examine whether these overall ratings would load on their respective factors. Finally, we examined the scales' internal consistency, together with intrarater and interrater reliability.

Once the underlying factor structure behind these behaviors was established, a second aim was to examine the prevalence and change of these observed need-supportive dimensions during an entire class period. For instance, while the clarification of expectations might especially be prevalent at the beginning of the class, these practices might be observed less towards the middle and the end of a PE class period.

Because previous studies have shown that actual teaching behaviors do not necessarily translate into perceptions of the same teaching behaviors (e.g., Skinner, Furrer, Marchand, & Kindermann, 2008), a third aim was to investigate relationships between observed need-supportive teaching behaviors and the perceptions of need support by the pupils. Given that low but significant correlations between observations and perceptions are found in other domains such as family functioning and parenting (e.g., Lorenz, Conger, Xu, 2007), we hypothesized to find at least moderate relationships between observed and perceived need support.

Methods

Procedure

After being contacted by telephone, principals of 43 secondary schools agreed to participate in the present study. PE teachers of these 43 schools were contacted and informed about the study and the planned measurements, resulting in a sample of 74 PE teachers that gave approval to participate in the study by means of informed consent forms. In Flanders (Belgium), PE is a compulsory subject in secondary schools taught by specialized teachers for

two 50-minute lessons each week including time for transportation and clothing. In some schools the two 50-minute lessons are combined into one single 100-minute lesson.

Teachers were asked to give their scheduled PE lessons. For the present study, data were gathered in one planned lesson either on ball games (e.g. volleyball, basketball) or on artistic sports (e.g. dance, gymnastics). Two weeks before the assessment, all pupils received an informed consent form to be signed by their parents. The informed consent form explained the study purposes and asked for parents' authorization for their child to be videotaped and to participate in the study by means of filling out the questionnaire. Pupils who did not return a signed informed consent form did not participate in the observed lesson.

PE classes were videotaped using digital camcorders. The camcorder was positioned on a fixed spot in the gymnasium in such a way as to capture a maximum view of the ongoing class. Additionally, teachers were equipped with a small microphone fixed on their shirt. At the end of each lesson, ten minutes were reserved for teachers and pupils to be able to fill out the questionnaire. The present study is part of a larger research project of which the goal is to investigate motivational dynamics in a large sample of teachers and pupils. The study protocol was approved by the Ethical Committee of Ghent University.

Participants

The sample of the present study consisted of 74 teachers (M = 37.5; SD = 10.8 years), of which 62.2% were male. Teachers had on average 14.4 (SD = 11.1) years of teaching experience. Fifty one percent of the teachers had a bachelor degree and 49% had a master's degree in PE. The classes consisted of on average 14.4 (SD =4.6) pupils. Of the participating classes 30% were only boys' classes, 15% were only girls' classes and 55% were co-educational classes. More than half of the classes (i.e., 56%) followed an academic track , 22% followed a technical track, and 21% followed a vocational track. All grades of secondary school were equally represented in the sample, with 31.5%, 32.3% and 36.2% being

represented in 7th and 8th, 9th and 10th, and 11th and 12th grade. A sample of 910 out of 1229 pupils (mean age 15.19 ± 1.89, 53.9% boys) returned a signed informed consent form, were present at the day of measurement, and accurately filled out the Teacher as Social Context Questionnaire (TASC; Belmont, Skinner, Wellborn, & Connell, 1988).

Measures

Observation tool. The System for Observing Need-supportive Interactions in Physical Education (SONIPE), a paper and pencil observation tool, was developed to assess need-supportive teaching behavior. The observation tool consists of a broad range of 21 possible need-supportive behaviors of which some were assumed to be autonomy-supportive behaviors (e.g., "The teacher asks questions about interests, values, or problems") and others were hypothesized to reflect structure (e.g., "The teacher gives clear verbal instructions") or relatedness support (e.g. "The teacher uses pupils' first name"). The items were selected based on an extensive review of the existing literature regarding characteristics of need-supportive teaching (e.g. Reeve et al., 2004; Reeve & Jang, 2006; Tessier et al., 2008; Vansteenkiste et al., 2005). An expert panel, consisting of a mix of researchers specialized in the field of self-determination theory, observational measures and PE, gathered during three consecutive panel meetings to observe and code video-tapes of PE classes. After group discussion, individual items of the observation tool were further revised, refined and elaborated and meaningful examples for each of the observed behaviors were added. During the final expert group meeting each of the experts separately coded two PE classes using the revised list of teaching behaviors. Problems or doubts raised during the coding process were registered and discrepancies in interpretation of different teaching behaviors were discussed, which led to a final refinement in the observed behaviors and the addition of some more illustrative examples.

The 21 need-supportive behaviors were coded every five minutes using a 4-point frequency scale, ranging from 0 (*never observed*) to 1 (*sometimes observed*), to 2 (*often observed*) to 3 (*observed all the time*). We choose a 5-minute interval above a 3-minute or 10-minute interval because a meaningful and sufficiently large amount of teaching behavior occurs during 5-minute units. An average of 7.5 (*SD*=2.8) intervals per lesson was coded for each of the 21 behaviors. In total, 11655 five-minute intervals were coded for the purpose of the present study. In addition to this micro-analytical coding, the observers also scored their general impression of the teachers' provided autonomy support, structure, and relatedness support using the same 4-point scale at the end of the class. In doing so, they based themselves on the operational definitions of these three teaching dimensions as found in the literature (Reeve, 2006). The complete observation tool can be found in Appendix 1.

Teacher and child background characteristics. Teacher and child background characteristics, including age, gender, diploma and years of teaching experience (in the case of the teachers) were measured by means of a questionnaire. Further, the pupils answered one additional question, asking whether the videotaped lesson differed from other lessons taught by the same teacher on a 5-point scale ranging from 1 (*totally disagree*) to 5 (*totally agree*). Fifty seven of the 74 classes (77%) had an average score lower than 3, indicating that most pupils did not perceive strong differences between the observed lesson and previous lessons taught by the same teacher.

Perceived need support. Pupils' perceived need support was measured by means of a slightly adapted version of the short version of the Teacher as Social Context Questionnaire (TASC; Belmont et al., 1988). The Dutch version of this questionnaire has been validated in previous research (Sierens et al., 2009). For the purpose of the present study, adaptations to the context of PE were made, which involved including the stem "During the previous PE lesson…" and replacing specific references to academic subjects. For instance, the item "My

teacher gave me lots of choices about how I do my schoolwork" was changed into "My teachers gave me lots of choices on how to deal with the exercises". As two of the negatively worded items in the relatedness support scale (i.e., "The teacher just did not understand me" and " I could not count on my teacher when I need him/her") reduced the internal consistency of the scale, these were removed. For the same reason, two items were removed from the structure scale ("The teacher acted differently, every time I did something wrong" and "My teacher kept changing how he/she acted towards me.") and the autonomy support scale ("My teacher is always getting on my case about how I engage in exercises during the lesson" and "It seemed like my teacher was always telling me what to do"). This resulted in an internally consistent scale for 'perceived relatedness support' (e.g. "My teacher really cared about me", α =0.78), 'perceived structure' (e.g., "The teacher explained his expectations to me"; α =0.76), and 'perceived autonomy support' (e.g., "My teacher explained how I can use the things we learned in PE, α =0.78), each consisting of six items.

Results

Plan of Analyses

To examine the factor structure of the observed 21 proposed need-supportive teaching behaviors (Aim 1), exploratory factor analyses (EFA) using principal component analyses were conducted. Factor analyses were conducted on the aggregated 5-minute interval scores, divided by the number of five-minute intervals per PE lesson period. Next to the Scree test (Cattell, 1966), Monte Carlo parallel analyses were conducted to determine the number of factors to be retained, which is said to represent the most accurate method for this purpose (e.g., Henson & Roberts, 2006). Promax with Kaiser Normalization for nonorthogonal rotation was used to allow retained factors to be correlated. As recommended (e.g., Henson & Roberts, 2006) both factor pattern coefficients and factor structure coefficients were reported.

Factor composite scores were created by multiplying the rating for each practice by its corresponding loading on the factor and summing these 21 values. To determine internal consistency of the retained factors, internal consistencies, as indexed by Cronbach's alpha, were calculated. For these analyses, items with factor pattern coefficients greater than 0.30 were considered as sufficiently high.

To establish the construct validity for the retained factors, factor analyses including the 21 need-supportive practices were repeated after adding the three global ratings of autonomy support, structure and relatedness support. We then inspected whether these global ratings loaded appropriately on the retained factors.

Next, three trained observers independently coded 30 identical videotapes of PE lessons to assess inter-rater reliability, whereas one observer coded the same twenty lessons twice two weeks apart to assess intra-rater reliability. Intrarater and interrater reliabilities were calculated by means of intraclass correlation coefficients (ICC), thereby using a two-way random model. Although limits for levels of reliability are fairly arbitrary, values below .50 are considered as poor, whereas values from .50 to .75 and above .75 are considered as moderate and good, respectively (Portney & Watkins, 2009, p.82). Finally, correlations between factor composite scores were calculated by means of Pearson r correlations.

To examine the prevalence of the rated need-supportive dimensions during the course of a PE lesson period (Aim 2), repeated measures ANOVA's were conducted. Prior to these calculations, the first two 5-minute and final two 5-minute intervals of each lesson period were aggregated to create scores for the beginning and the end of the lesson, respectively. Aggregated scores for the middle of the lesson were created by summing the ratings of the remaining 5-minute intervals, which could vary from one to eleven depending on the lesson length.

To examine the convergence between rated teacher need support and pupil perceived need support (Aim 3) we made use of MLwiN version 2.20 (Rasbash, Steele, Browne, & Goldstein, 2009). The data were conceptualized as a two-level hierarchical model, consisting of 910 pupils at Level 1 and 74 classes (or teachers) at Level 2. A baseline variance components model (Rasbash et al., 2009) or intercept-only model (Hox, 2010) was used to evaluate how much of the variation in perceived need support was situated at the class (i.e., Level 2) versus the pupil level (i.e., Level 1). It was then examined whether the variation in need support as observed by external raters was related to the variation in perceived child need support at the class level. All quantitative explanatory variables were mean centered before they were entered in the multiple predictor models.

Results

Aim 1: Development of an Observation Tool

Monte Carlo Parallel analyses with 21 variables and 100 replications supported a solution with four factors. Consistent with this, the Scree plot indicated a clear drop in eigenvalues between the fourth and the fifth factor (i.e. from 2.09 to 1.17). Together, the four retained factors explained 57.6% of the variance in the observed need-supportive teaching behaviors. Table 1 presents item communalities (h^2) together with the factor pattern and factor structure coefficients. Communalities ranged between 0.37 and 0.79. As for the factor loadings, 20 out of the 21 items had a minimal factor loading of .30 after Promax rotation. Only one item (i.e., 'The teacher encourages pupils to persist') did not significantly load on any of the retained factors and was removed from further analyses.

Four teaching practices (i.e., "The teacher is enthusiastic and eager"; "The teacher takes the perspective of the pupils into account and is empathic"; "The teacher puts effort and energy into the lesson"; "The teacher is physically nearby the pupils") loaded exclusively high on the first factor which explained 18.7 percent of the variance. Given the content of these

items this first factor was labeled as ‘Relatedness Support’. Three other items had cross-loadings, with two items (i.e., “The teachers pays attention to what the pupils are saying”; “The teacher applies differentiation”) loading on the first and fourth factor and one item (i.e., “The teacher asks the pupils questions about interests, problems, values or wishes) loading on the first, third and fourth factor.

The second factor, explaining 15.1 percent of the variance, consisted of five practices, four of which loaded exclusively high on this factor (i.e., “The teacher provides variation between or within exercises”; “The teacher gives clear verbal instructions”; “The teacher demonstrates the tasks himself and serves as a 'model' for the pupils”; “The teacher gives an overview of the content and structure of the lesson”). Given the content of these items, this factor was labelled as ‘Structure before the Learning Process’. One item (i.e., “The teacher offers the pupils a rationale for tasks and exercises”) had a cross-loading on the second and the third factor.

Next, six teaching practices (i.e., “The teacher offers help during exercises”; “The teacher offers pupils (apart from instruction) new guidelines, tips and advice during the exercises”; “The teachers addresses pupils by their first name when the opportunity occurs”; “The teacher provides positive feedback”; “The teacher monitors if the pupils consequently live up to the (verbal) instructions” and “The teacher uses pupils as positive role models”) loaded exclusively high on the third factor, which explained 13.8 percent of the variance. Because these practices refer to the provision of guidance and support during the learning process, this factor was labelled ‘Structure during the Learning Process’. As noted, one teaching practice (i.e., ‘The teacher offers the pupils a rationale for tasks and exercises’) loaded on this factor as well as on the factor ‘Structure Prior to the Learning Process’.

Finally, two items (i.e., “The teacher offers choice to all pupils”; “The teacher gives pupils the opportunity to practice independently and to solve problems on their own, without

interfering") loaded exclusively on the fourth factor, which explained 9.9 percent of the variance. Given their content, this factor was labelled 'Autonomy support'. Two other items (i.e., "The teacher asks questions about interests, problems, values or wishes" and "The teacher applies differentiation") also loaded significantly on this factor and had cross-loadings on the factors 'Structure during the Learning Process' and 'Relatedness support', respectively.

The labeling of the factors was largely confirmed after adding the global ratings of relatedness support, structure and autonomy support to the factor analyses. Overall ratings of relatedness support and autonomy support loaded significantly on the retained relatedness support (i.e., 58) and autonomy support (i.e., 69) factors, respectively. Overall ratings of structure loaded exclusively high (i.e., 0.52) on the factor 'Structure prior to the Learning Process', but did not load on the factor 'Structure during the learning process'. In contrast, global ratings of relatedness support yielded a cross-loading (i.e., 36) on the latter factor.

Table 2 presents the internal consistencies, intrarater and interrater reliabilities for each of the retained factors. As can be noticed, each of the retained factors were sufficiently internally consistent (all α's above .59). Intra-rater reliabilities of all retained factors were good (all ICC's$\geq$0.82). Interrater reliabilities were of variable quality, being good for structure before the learning process and autonomy support, moderate for structure during the learning process and poor for relatedness support.

Finally, the correlations between the factor composite scores are presented in Table 3. As can be noticed, none of the observed need support dimensions were significantly related, except for the negative association between structure during the learning process and autonomy support.

Aim 2: Prevalence of Rated Need-Supportive Practices

A repeated measures ANOVA with pairwise comparisons indicated that across the entire class period, relatedness support (M = 1.31; SD =0.47) was observed significantly more

compared to structure before the learning process (M = 0.92; SD =0.38), structure during the learning process (M = 0.99; SD =0.32) and autonomy support (M = 0.67; SD =0.31). In addition, autonomy support was observed significantly less than structure before and during the learning process (Overall F (1, 73)=42.14, all $p \leq 0.001$).

The repeated measures ANOVA (see Figure 1) furthermore provided evidence for a significant linear time effect for structure before the learning process ($F(1,69)$=73.31, $p \leq 0.001$) and structure during the learning process ($F(1,69)$=11.28, $p \leq 0.001$), but not for relatedness ($F(1,69)$=3.11, *ns*) and for autonomy support ($F(1,69)$=0.26, *ns*). Structure before the learning process was most prominent in the beginning of the lesson and decreased in the flow of the lesson. For structure during the learning process the quadratic trend also appeared significant ($F(1,69)$=29.02, $p \leq 0.001$). Figure 1 illustrates that structure during the learning process was most visible in the middle part of the lesson.

Aim 3: Convergence between Observed and Perceived Need Support

Before examining the degree of convergence between the rated and perceived need support, we examined whether significant between-class level variance in perceived need support was found. This was the case for all the three dimensions of perceived need support, with, respectively, 11.8%, 13.6% and 15.2% of the variance in perceived relatedness support, ($\chi^2(1)=13.4$, $p \leq 0.001$), perceived structure, ($\chi^2(1)=14.7$, $p \leq 0.001$), and perceived autonomy support, ($\chi^2(1)=16.4$, $p \leq 0.001$), being situated at the between class level. We then proceeded by predicting these class-differences in perceived need support based on the observed class-differences in need support (see Table 4). There was a significant relationship between observed and perceived relatedness support. Similarly, a significant positive relationship between observed and perceived autonomy support was found. However, neither for observed structure before the learning process, nor for observed structure during the learning process a significant relationship with perceived structure was found. Surprisingly, a significant positive

relationship between observed relatedness support and perceived structure was found. In a follow-up analysis we investigated whether the different dimensions of structure as observed structure before and during the learning process would be more closely related to similar dimensions in the perceptions of the pupils. Results revealed a trend towards a significant relationship between observed structure before the learning process and perceived communication of expectations (β=0.04, SE = 0.02, $\chi^2(1)$=2.83, p=0.09). No significant relationships were found between observed structure during the learning process and the amount of perceived help as reported by the pupils.

Discussion

The present study aimed at enhancing our understanding of need-supportive dynamics in PE by complementing existing experimental and self-reported work on need-supportive teaching behaviors with an observational study. We had three main purposes. First, as observation schemes for need-supportive teaching behaviors in PE are almost non-existent (see Tessier et al., 2008 for an exception), a first purpose of the present study was to develop a valid and reliable observation tool comprising a broad range of possibly need-supportive teaching behaviors. Second, the prevalence of observed need-supportive teaching behaviors was inspected and the fluctuations throughout the course of a regular PE lesson were mapped out. Finally, relationships between observed teaching behaviors and pupils' perceived need support were investigated.

Development of an Observation Tool

Based on an extensive literature review and three expert panel meetings a broad list of 21 hypothesized need-supportive teaching behaviors was generated. In total, 74 PE classes were videotaped and each of these 21 behaviors were coded during 5-minute intervals. Factor analyses on the aggregated observed practices provided evidence for four factors which could be directly linked to theoretically proposed need-supportive dimensions within SDT, that is,

autonomy support, structure, and relatedness support. Interestingly, observed structure was found to be multifaceted, with one factor relating to structure before the lesson and another factor relating to structure during the lesson.

The relatedness support factor comprised two sets of observed behaviors. Behaviors like being empathic, asking questions, and paying attention to what the pupils have to say are perhaps most indicative of teachers' relatedness support. These behaviors reflect a positive, friendly and warm teacher-pupil interaction in which the teacher tries to take the child's perspective. Interestingly, this dimension of relatedness support may not only be emotional but also more physical in nature, as the one item that tapped into physical closeness to the teacher also loaded on this factor. A second set of items reflected teaching behaviors such as being enthusiastic and eager and putting effort and energy into the lesson. Apparently, in the context of PE, being energetic and enthusiastic lines up with warm, mutually satisfying teacher-pupil interactions. Also in academic settings, enthusiasm has been identified as an essential feature of a motivational teaching style (Patrick, Hisley, & Kempler, 2000). The labeling of this factor was justified by the fact that the global assessment of relatedness support significantly loaded on this factor. Although the observed behaviors formed an internally consistent scale and the intra-individual reliability was high, the interrater reliability was poor and, hence, deserves further empirical attention. The dimension of relatedness support inherently refers to an emotional appreciation of the teaching style with some of the practices in the relatedness support dimension being less straightforward (i.e., "The teacher takes the perceptive of the pupils into account, is empathic.") and therefore more subject to the observers' interpretation of the situation.

Further, consistent with Reeve and Jang's (2006) description of structure as a multifaceted concept, two facets of structure were identified which differed based on the timing of the lesson (i.e., beginning vs. middle of the lesson) the structure was provided.

Structure before the learning process consisted of practices such as giving clear verbal instructions, demonstrating activities, and providing an overview of the lesson, which were also identified in previous research (Farkas & Grolnick, 2010; Jang et al., 2010; Sierens et al., 2009). A clear explanation of the planned exercises is a prerequisite for pupils to build a sense of competence. If pupils don't know what is expected from them, they are unable to meet these expectations and will fail to develop new skills. For one structure-related behavior, that is, providing variation, we did not have clear expectations about whether it would load positively or negatively on the structure factor. Perhaps, variation in PE exercises increases organizational complexity which, in turn, requires clearer instructions and demonstrations. Alternatively, variation relates to foreseeing different pathways or opportunities for pupils to realize the learning goals at their own pace (Farkas & Grolnick, 2010). Teachers who provide clearer instructions and demonstrations from a competence-supportive perspective would then also be more inclined to provide more variation.

Structure during the learning process involved practices such as helping the pupils, giving advice and guidelines, providing positive feedback, and monitoring whether pupils live up to the instructions, which were also identified in previous studies (Koka & Hein, 2005; Mouratidis et al., 2008, Sierens et al., 2009). While overall ratings of structure significantly loaded on the component of structure during the learning process, this was not the case for structure during the learning process. Perhaps, when rating the overall level of structure, external observers primarily thought of the amount of clear expectations and instructions that were provided.

Both dimensions of structure were found to be unrelated to each other. Apparently, teachers who gave clear directions and instructions before the learning activity did not necessarily provide strong guidance during the ongoing learning activity. Although such findings confirm the assumption that structure is a multifaceted construct (Reeve & Jang,

2006), the null-relation between both raises the question whether they really belong to the same overarching construct. Farkas and Grolnick (2010) also reported low to moderate correlations between different facets of parental structure. Separately, each facet of structure formed an internally consistent scale with a high intra-individual reliability. The interrater reliability was good for structure before the learning process and moderate for structure during the learning process.

Finally, an autonomy-supportive factor was retained which consisted of practices like asking questions and paying attention to what the pupils are saying. Such practices allow teachers to identify pupils' values, interests and preferences. Further, provided choice and opportunities to practice independently also loaded on this factor. These behaviors are considered autonomy-supportive teaching behaviors because they stimulate self-regulation and initiative and are assumed to nurture inner motivational resources. This factor also formed an internally consistent scale with good intra-individual and inter-rater reliability.

Although these four meaningful factors could be retained, a number of interesting cross-loadings emerged which deserve some more in-depth discussion. First, the practice of "asking questions about wishes, values interests or problems", was found to cross-load on relatedness support, autonomy support and structure during the learning process. Possibly, this item tapped into different dimensions of need support because, depending on the type of question asked, the teacher behavior appeals to different needs. Questions about interests, wishes or values may be more closely related to autonomy support (e.g., *"do you not like this exercise?"*) whereas questions about feelings may be more relevant for relatedness support (e.g., *"are you not feeling well today?*), and questions about problems (e.g., "*would you pass or score in this situation?"*) can be considered as a practice to enhance structure. Thus, in future research this item might better be broken down into three different subcomponents to examine the herein suggested possibility.

Second, differentiation loaded equally high on relatedness support and autonomy support but, not on the structured facets. This is rather surprising because differentiation involves providing optimal challenge and taking into account inter-individual differences in competence and standards for success (Cox & Williams, 2008). However, through differentiation a teacher also implicitly expresses his concern for the individual child so that children might feel better understood. Moreover, differentiation allows pupils to direct themselves towards an exercise level of their own choice, which would nurture their feelings of autonomy.

Third, offering a rationale for tasks and exercises yielded cross-loadings on both facets of structure, but failed to load on autonomy support. In that respect, one could argue that the results are supportive of the assumption that offering a rationale for tasks and exercises is in essence (or in practice) a component of structure. As suggested by Farkas and Grolnick (2010), providing a rationale, independently of the content or tone, nurtures the need for competence because it clarifies how an individual might increase his or her competence on an important task or explains how a task fits into the overall lesson plan. A rationale will then only foster a sense of autonomy if students believe it is a meaningful and personally relevant reason to put effort in the activity and if it is delivered in an autonomy supportive way (Jang, 2008; Farkas & Grolnick, 2010, Deci et al., 1994; Reeve et al., 2002). Likely, in the context of PE, rationales rather deal with the way how different exercises logically follow each other such that pupils gradually build their competencies.

Prevalence of Rated Need-Supportive Practices

To our knowledge, this is the first study to examine the frequency of occurrence of observed relatedness support, structure and autonomy support during both the entire course and specific parts (beginning, middle, end) of a PE lesson.

Relatedness support was the most frequently observed dimension. In line with expectations, structure before the learning process was more prominent at the beginning of the lesson, while structure during the learning process reached its peak towards the middle of the lesson. Autonomy support was the least frequently observed dimension. Teachers seldom asked questions, rarely provided choice to their pupils, hardly ever provided opportunities to practice independently. Also, although applying differentiation is strongly recommended in PE teacher education programs, this practice was not often observed. In PE, a small number of intervention studies already illustrated that teachers are capable of teaching in a more autonomy supportive way by listening to the pupils (Mandigo et al., 2008), or by providing opportunities for self-initiative (Mandigo et al., 2008; Murcia, Lacarcel, & Alvarez, 2010) and choice (Ward et al., 2008; Prusak et al., 2004). These findings indicate the need for PE teacher education programs and continuous professional development (CPD) programs to include a module for teachers on how to learn to teach in an autonomy supportive way. However, the focus should not only be on autonomy support as the observations revealed that there is room for teachers to be more need-supportive on each of the need-relevant dimensions. Similar findings have been obtained in self-reported studies (e.g., Mouratidis, Vansteenkiste, Sideridis, & Lens, 2011).

Relation between Observed and Pupil Perceived Need Support

From a motivational perspective, especially the perceptions of need-support are likely to carry the effect of needs on outcomes. Taken as a whole, the findings provide reasonable evidence for the idea that observed need-supportive teaching behaviors are perceived as such by the pupils.

Although the pattern of results generally suggested significant relationships between observations and perceptions of need support, no significant relationships between observed and perceived structure were found, whereas an interesting relation between observed

relatedness support and perceived structure was obtained. When teachers adopted a more empathic, enthusiastic and warm teaching style, pupils perceived more structure. Farkas and Grolnick (2010) already suggested that moderate levels of involvement are needed for parents to be able to provide structure. Perceived structure was assessed through the Teacher as Social Context Questionnaire, by means of items such as ”The teacher showed me how to independently solve problems”, “The teachers only proceeded if I managed to effectively engage in the exercises”, and “The teacher showed me how to solve problems, when I did not manage to do it on my own”. It is possible that these items indirectly capture a teachers’ empathy for the individual child through expressing sincere concerns for the progress they make. Also, in the TASC-items no distinction was made between structure before and during the learning process. When relating structure before the learning process to perceived communication of expectations, a marginal significant relation was found. Future studies can try to capture different dimensions of structure in pupils’ self-report, as well as in observational measures to assess relationships between both.

As perceptions of need support are related to pupils’ need satisfaction (Standage et al., 2005, Taylor & Lonsdale, 2010), optimal motivation and positive behavioral and affective outcomes (Black & Deci, 2000; Jang et al., 2009, Standage et al., 2006), our findings imply that a more frequent implementation of the identified strategies will lead to better educational outcomes. Future intervention studies can confirm this hypothesis. The findings of the present study are quite promising given that studies applying observations in domains such as the family (e.g., Lorenz et al., 2007) or experimental studies (Reeve & Tseng, 2011) have revealed discrepancies between rated observable behaviors and self-reported perceptions of these behaviors even when experimentally manipulated.

Although observed and perceived need support were related to each other, these relations were far from perfect and a number of reasons can be forwarded to explain this.

First, when filling out the perceived need support questionnaires at the end of the PE class, the students may have had teachers' general need-supportive style in mind rather than the style they relied on during the past lesson. Thus, the perception of teachers' global teaching style may have colored their answers on the lesson-specific questionnaires, reducing the chance for convergence between observed and perceived need-support. Second, the hierarchical model analyses indicated that the amount of the variance in perceived need support at the between-person level largely outweighs the variance at the between-class level. Said differently, there exists substantial heterogeneity in the pupils' perceptions of the teacher within a single class, although they were exposed to the same teacher. This further reduces the probability to find convergence with the observed need-supportive behaviors as these were coded at the class level. To overcome this problem, it would have been more desirable if raters had coded individual teacher-pupil interactions. Indeed, the rating of class-level need support ignores the fact that the teacher can interact differently with different (groups of) pupils in the classroom which oversimplified the complexity of teacher-pupil interactions. The present study was furthermore conducted in a real life setting such as the PE lesson, which makes it even harder for pupils' perceptions to reflect teachers' actual behaviors because their perceptions might be confounded by other events that happened during the course of action.

Limitations

In interpreting the findings of the present study, some potential methodological limitations need to be taken into consideration. First, only need-supportive behaviors were assessed. In follow-up research a similar system for observing need thwarting behaviors will be developed to widen the exploration of dysfunctional motivational dynamics in PE. Another limitation relates to the exclusive inclusion of PE as a subject of the lessons. Extrapolation of the findings to a wider range of subjects would strengthen the conclusions. A third limitation is the low interrater reliability for relatedness support. This suggests that observer bias may

have occurred, despite the expert panel meetings and training sessions organized for the raters. Fourth, for the present study, we mainly focused on specific teacher practices or behaviors per se. The findings on practices such as asking questions or providing a rationale suggest that further refinement of the coding system might be needed, thereby separating the content of the practice and the style of communicating the practice (e.g., controlling versus autonomy supportive way of asking a question). In addition, paralinguistic or nonverbal factors that determine the emotional meaning of a certain behavior might be important to include in the measurement (e.g., Reeve & Tseng, 2011).

Future directions

In the present study, prevalence of need-supportive practices in a real life setting such as PE was mapped out. Future studies across other target groups (e.g., other cultures, age groups) and in other subjects can move this line of research forward. Second, future studies can provide more in-depth insights into fluctuations in each of the need-supportive dimensions, in relation to pupils' need satisfaction and motivation in the flow of a series of lessons taught by the same teacher. This allows gaining insight into the motivational outcomes of the identified need-supportive dimension. As for the two facets of structure, for instance, observing a series of lessons on the same topic would allow to investigate whether some lessons typically require more structure before the learning activity (e.g., the first lesson on a new topic), while others require more guidance during the ongoing activity (e.g., the final lesson on a topic). Finally, in intervention studies, the observation scheme developed in the present study, will be of additional value to evaluate an intervention's effectiveness because observations allow to observe 'real' changes in need-supportive teachers practices after exposure to an intervention on need-supportive strategies (e.g., Reeve et al., 2004).

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Figure Captions

Figure 1

Prevalence of Observed Need-Supportive Teaching Behaviors over an Entire Lesson Period

Table 1

Factor Loadings of Pattern Matrix and Structure Matrix of the Observed Need-supportive Teaching Behaviors Rotated to the Promax Criterion

		Relatedness support	Structure		Autonomy support	h^2
	M±SD		Before	During		
... is enthusiastic and eager	1.71 ± 0.71	**.86**/.85	.01/.06	-.01/.11	-.24/-.21	.79
… takes the perspective of pupils into account, is empathic	1.66 ± 0.82	**.83**/.84	-.06/-.02	.09/.16	.20/.21	.76
… puts effort and energy into the lesson	1.69 ± 0.84	**.78**/.78	.27/.32	-.10/.01	-.29/-.25	.76
… is physically nearby the pupils	1.84 ± 0.68	**.74**/.77	.08/.11	.19/.25	.18/.18	.66
… pays attention to what the pupils are saying	1.20 ± 0.70	**.66**/.64	-.36/-.32	-.16/-12	**.34**/.39	.68
... provides variation between or within exercises	1.22 ± 0.66	-.05/.01	**.78**/.77	.05/.00	.09/.07	.61
... gives clear (verbal) instructions	2.01 ± 0.64	.11/.16	**.76**/.77	.22/.24	-.32/-.35	.77
…demonstrates the tasks himself, is a 'model' for the pupils	0.82 ± 0.75	.10/.10	**.63**/.65	-.33/-.33	-.10/-.07	.54
…gives an overview of the content and structure of the lesson	0.26 ± 0.25	-.03/-.00	**.60**/.60	.02/-.02	.05/.04	.37
… offers the pupils a rationale for tasks and exercises	0.32 ± 0.28	.03/.11	**.46**/.44	**.44**/.40	.21/.16	.41
... uses pupils as positive role models	0.20 ± 0.28	-.51/-.44	.15/.11	**.50**/.41	.18/.10	.47
... offers help during exercises	1.19 ± 0.60	-.09/.01	.13/.09	**.78**/.75	.12/.02	.60
…offers pupils (apart from instruction) new guidelines, tips and advice during the	0.57 ± 0.41	-.01/.08	-.06/-.08	**.69**/.70	-.09/-.17	.51
…addresses pupils by their first name when the opportunity occurs	1.89 ± 0.83	-.04/.00	-.40/-.42	**.62**/.65	-.17/-.23	.61
... provides positive feedback	1.21 ± 0.70	.10/.12	-.44/-.45	**.54**/.60	-.30/-.35	.64
… monitors if the pupils consequently live up to the (verbal) instructions	1.67 ± 0.73	.20/.27	.28/.28	**.51**/.55	-.20/-.26	.46
… asks the pupils questions about their interests, problems, values or wishes	0.85 ± 0.46	**.36**/.42	.01/.01	**.49**/.49	**.34**/.29	.49
.... offers choice to all pupils	0.26 ± 0.30	.08/.11	.02/.01	.05/-.03	**.76/.**75	.58
…gives pupils the opportunity to practice independently and to solve problems on their own, without interfering	0.82 ± 0.63	-.02/-.00	-.20/-.21	.00/-.08	**.70**/.70	.53
...applies differentiation	0.20 ± 0.31	**.45**/.46	.13/.15	-.04/-.05	**.45**/.47	.44
...encourages pupils to persist	0.99 ± 0.65	.15/.13	-.34/-.33	.14/-.23	-52/-53	.44
Initial Eigenvalues		3.93	3.17	2.90	2.09	
% of variance		18.7%	15.1%	13.8%	9.9%	

Note. Factor Pattern Coefficients greater than .30 are indicated in bold type. h^2 = communality coefficient.

Table 2

Internal Consistencies, Intrarater and Interrater Reliability as Indexed by Intraclass Coefficients for Each of the Factor Composite Scores

	Internal consistency (α)	Intrarater reliability (N = 20)	Interrater reliability (N = 30)
Relatedness support	0.83	0.82	0.06
Structure			
Before the learning process	0.69	0.97	0.81
During the learning process	0.70	0.92	0.49
Autonomy support	0.59	0.97	0.83

<0.50=poor, >0.50<0.75=moderate, >0.75=good

Table 3

Correlations between Factor Composite Scores

	2	3	4
1. Relatedness support	0.11	0.15	0.03
2. Structure before the learning process		-0.21	-0.11
3. Structure during the learning process			-0.30**
4. Autonomy support			1.00

**$p \leq 0.01$

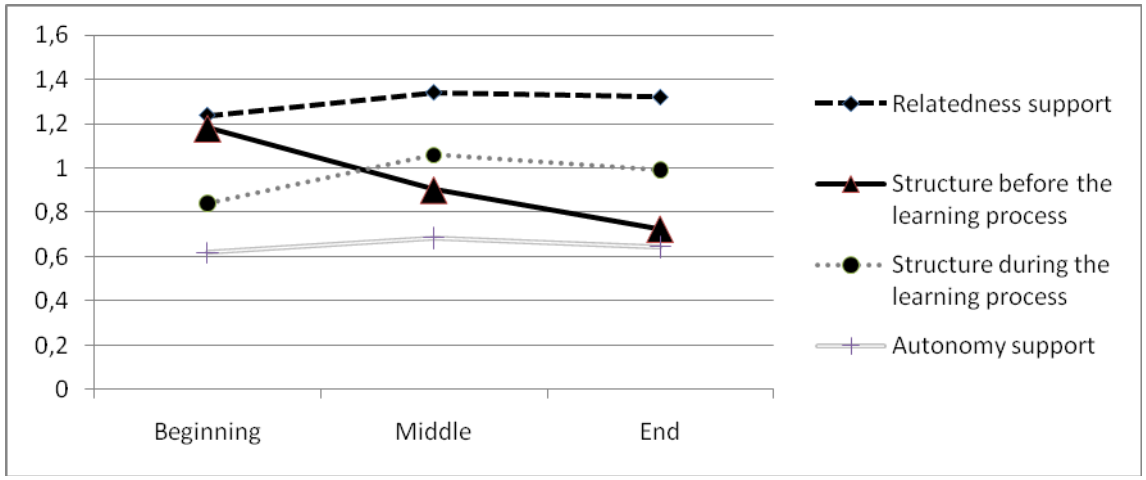
Table 4

Relationships between Observed Need-supportive Behaviours and Pupil Perceived Need Support

	Perceived relatedness support		Perceived structure		Perceived autonomy support	
FIXED PART - OBSERVATIONS	β (SE)	χ2(1)	β (SE)	χ2(1)	β (SE)	χ2(1)
Relatedness support	0.03 (0.01)	5.35*	0.03 (0.02)	3.84*	0.02 (0.02)	1.23
Structure before learning process	-0.01 (0.02)	0.13	0.02 (0.02)	0.49	-0.02 (0.02)	0.74
Structure during learning process	-0.01 (0.02)	0.29	0.00 (0.03)	0.02	0.01 (0.03)	0.21
Autonomy support	0.02 (0.03)	0.50	0.02 (0.02)	0.35	0.07 (0.04)	4.06*
RANDOM PART intercept-only model	σ2 (SE)					
Class level variance	0.06 (0.02)	13.44***	0.08 (0.02)	14.73***	0.10 (0.02)	16.41***
Pupil level variance	0.45 (0.02)		0.51 (0.03)		0.53 (0.03)	
RANDOM PART multiple predictor model	σ2 (SE)					
Class level variance	0.05 (0.02)		0.07 (0.02)		0.08 (0.02)	
Pupil level variance	0.45 (0.02)		0.51 (0.03)		0.53 (0.03)	
Test of significance						
Reference model	1932.41	6.21**	2037.04	5.20*	2093.64	6.93**
Deviance (-2LL)	1926.20		2031.84		2086.71	

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

Figure 1


1,6
1,4
1,2
1
0,8
0,6
0,4
0,2
0
Beginning
Middle
End
Relatedness support
Structure before the learning process
Structure during the learning process
Autonomy support

Appendix 1. The System for Observing Need-supportive Interactions in Physical Education (SONIPE)

The teacher…				
Minutes	**0-5**	**5-10**	**10-15**	**…**
1.… ask questions about interests, problems, wishes or values (e.g., which exercises do you find hard to engage in?, how would you like the lesson to be built?, did you understand the explanation?)				
2.… offers choice to the students (e.g., choice in the order of the exercises, choice in materials: in baseball pupils can choose between a tennis racket or a bat to hit the ball)				
3.… offers the opportunity to experience problems, to practice independently, to experiment, to exercise and to solve problems on their own, without interfering (e.g., before pupils get an explanation about the lay-up they first get the opportunity to practice, pupils engage in exercises without being told what to pay attention to).				
4. … offers the pupils a specific explanation, rationale for rules, tasks or exercises (e.g, this is important because…, placing one foot in front of the other helps because it will improve your balance, don't bounce with the ball during the instruction so that everyone is capable of hearing me which will allow to start with the exercises faster). Emphasizing the importance of an exercise is also part of this practice.				
5. … gives an overview of the content and structure of the lesson (e.g., formulates lesson goals, explains how different exercises fit into the entire lesson)				
6. … gives clear verbal instructions				
7. … monitors if the pupils consequently live up to the (verbal) instructions (e.g.,, pupils perform exercises as instructed)				
8. … uses variation between and within exercises				
9. …applies differentiation (e.g.,, the teacher provides exercises with a different degree of difficulty taking into account the possibilities of different (groups of) pupils.				
10. …offers pupils (apart from instruction) new guidelines, tips and advice (e.g.,, "you can try to do X or Y.) Remark: only code this practice if the teachers provides new information, new elements that were not addressed in the overall instruction.				
11. … offers positive feedback (e.g, "well done", "you played really well")				

12. … encourages pupils to persist (e.g., “come on, you can do it”). Remark: code this item quantitatively, independent of the content of the way the encouragement is delivered				
13. … uses pupils as positive role models				
14. … offers help during exercises				
15.…addresses pupils by their first name when the opportunity occurs. Remark: Code the proportion of using and not using the first name when the opportunity occurs.				
16.…is physically nearby the pupils				
17....is enthusiastic and eager				
18....puts effort and energy into the lesson				
19.…takes the perspective of pupils into account, is empathic (e.g., the teachers uses age-adapted language, the teachers ask the pupils if they are managing)				
20.…pays attention to what the pupils are saying (how well is the teachers capable of listening to the pupils)				
21…demonstrates the tasks himself, serves as a 'model' for the pupils				
Total impression of need support				
To what degree was the teacher autonomy supportive?				
To what the degree did the teacher offer structure?				
To what degree was the teacher relatedness supportive?				