Effects of a training course on creation of an empowering motivational climate in physical education: a quasi-experimental study

Girard, Stéphanie (corresponding author)
Human Kinetics, Université du Québec à Trois-Rivières, Trois-Rivières, Canada
3351, boul. des Forges
C.P. 500
Trois-Rivières (Québec)
G9A 5H7
Stephanie.girard3@uqtr.ca

Desbiens, Jean-François
Department of Kinanthropology, Université de Sherbrooke, Sherbrooke, Canada

Hogue, Anne-Marie
Department of Kinanthropology, Université de Sherbrooke, Sherbrooke, Canada

Funding details: This work was supported by the Institutional Research fund of the Université du Québec à Trois-Rivières.

Effects of a training course on creation of an empowering motivational climate in physical education: a quasi-experimental study

Abstract

Background: Physical education (PE) teachers report needing additional support in terms of classroom climate and students' motivation (Verret et al. 2017). Professional development represents an opportunity to exchange on their practices with colleagues, become familiar with the latest research on effective motivational strategies, develop new skills and support transfer into practice.

Objective: This study aims to determine if participation in a 2-day training course (spread over 3 days) on how to create an empowering motivational climate impacted students' motivational variables (self-determined motivation, basic needs satisfaction, perception of motivational climate and PE effort as well as their intention to be physically active) and observed motivational climate.

Research design: Quasi-experimental study

Method: A total of 11 PE teachers (experimental group-EG = 6, control group-CG = 5) and their students (elementary = 107, secondary = 100) were recruited. Students completed questionnaires twice: once before the course and once after it was over. Teachers were filmed during two lessons: once before the start of training and once between the second and the last day of training, during a motivational strategy experiment planned by PE teachers on the second day of training. To analyze the data, we used non-parametric tests: the Wilcoxon-Mann-Whitney test and the Wilcoxon signed rank test for related samples. Two experts coded the videos (intrarater reliability = 90.6%; interrater reliability = 93.8%).

Findings: Results indicate that the teachers' training had no significant positive effect on students' motivation. In fact, it was surprising to observe a significant decline in students' perception of an empowering motivational climate and effort in the experimental group. However, scores were already quite high at the start of the year, remained high in the middle of the year and were similar for the two groups. Between both measurement points, the control group's amotivation increased and autonomy satisfaction decreased. This was not the case for students in the experimental group, suggesting that the training course might be effective in avoiding the detriment of students' motivation. PE teachers in the experimental group were more empowering during the integration phase of the lesson. Gaps and the overall rating of the lesson (motivational climate) were both more empowering in the experimental group, but did not reach statistical significance ($p = .066$), which is promising for future interventions.

Keywords: self-determination theory, achievement goal theory, professional development, teacher training, educational consultant

Introduction

Research in recent decades recognizes that a teacher-created motivational climate plays a critical role in the quality of students' motivation in physical education (PE) (Duda et al. 2014). However, many teachers report they have difficulties motivating students (Turcotte et al. 2018) and require additional support in terms of classroom climate and student motivation in PE (Verret et al. 2017). To help them meet these challenges, Quebec's school boards offer them the opportunity to participate in different types of ongoing professional development that differ in terms of characteristics, goals and duration. However, "many professional development initiatives appear ineffective in supporting changes in teacher practices and student learning" (Darling-Hammond, Hyler, and Gardner 2017, v). In their agreement on teacher education, the Association of Canadian Deans of Education (Association canadienne des doyens et doyennes d'éducation-ACDE 2017, 1) state that "professional engagement in teaching practice is a lifelong commitment [that] requires initial preparation and ongoing professional development." Considering that, in the field of education, the mere transmission of knowledge is insufficient to support changes in practice (Deppeler 2010), professional development that addresses "real" issues experienced in the field and establishes close links between theory and practice is recommended (Bourassa, Bélair, and Chevalier 2007; Anadón and Couture 2007; Castelli, Centeio, and Nicksic 2013). Therefore, action research, defined as a "family of practices of living inquiry that aims […] to link practice and ideas in the service of human flourishing" (Reason and Bradbury 2008, 1), represents a promising avenue of participative research to achieve common goals between teachers and scholars (Uwamariya and Mukamurera 2005). In doing so, it helps bring practice and

research closer together (Vanderlinde and van Braak 2010; Bourassa, Bélair, and Chevalier 2007). The present study aims to accompany PE teachers in their implementation of motivational strategies supported by scientific research to create a motivational climate sustaining students' motivation in PE.

Motivational theories

Theoretical support for the training course consisted of Duda's recent combination of self-determination (SDT; Deci and Ryan 2000; Ryan and Deci 2000) and achievement goal (AGT; Ames 1992) theories. Both theoretical frameworks take into account individual perceptions and recognize the influence of personal and environmental factors on motivation. In Duda's new conceptualization (Duda et al. 2018; Duda and Appleton 2016), the motivational climate can be empowering and/or disempowering depending on its capacity to meet individuals' needs. According to SDT, people in every culture engage in tasks or activities to satisfy three innate psychological needs: autonomy, competence and relatedness. *Autonomy* reflects their need to be responsible for their actions and be in charge of their own behaviour (Deci and Ryan 1985). *Competence* refers to the need to feel capable of using one's own skills to accomplish a given task (Deci and Ryan 1985). *Relatedness* reflects the need to have healthy relationships with others in an atmosphere of unity and mutual support (Ryan and Deci 2002). In situations that fulfil these needs, people tend to engage and persevere in tasks (Deci and Ryan 2000). In other words, the satisfaction of psychological needs helps sustain an individual's motivation, which can be self-determined or controlled. Identified and integrated regulations (two types of extrinsic motivation) are considered self-determined forms of motivation, because individuals have

internalized the external influences. External and introjected regulations are considered controlled forms of motivation because individuals are subject to external influences and internal pressures. Usually, intrinsic motivation (interest, enjoyment and satisfaction; Ryan and Deci, 2000) and self-determined forms of motivation are associated with positive outcomes (e.g. engagement, effort, perseverance), whereas amotivation (absence of motivation) and controlled forms of motivation are associated instead with negative repercussions (Van den Berghe et al. 2014).

To complete the conceptualization of the motivational climate, AGT provides a complementary view on competence-need satisfaction. According to this theory, achievement goals and motivational climate can be mastery- or performance-oriented (Ames and Archer 1988). In a mastery motivational orientation, competence is viewed in terms of self-oriented criteria: it is satisfied when individuals feel they can master the task and make personal progress based on their own ability (Ames 1992). In a performance motivational orientation, competence is evaluated with normative criteria: it is satisfied when individuals feel they can outperform others or a normative standard (Ames 1992; Ames and Archer 1988). A significant number of researchers in PE generally agree that, when it comes to sustaining students' motivation and engagement, it is preferable to create a mastery motivational climate that fosters students' competence and the pursuit of mastery goals rather than promote a performance motivational climate (Girard, Chouinard and St-Amand 2015; García-González et al. 2019; Girard, St-Amand and Chouinard 2019; Blais, Girard and Lemoyne 2020).

To create an empowering PE motivational climate that is beneficial to students (Cheon and Reeve 2013), teachers should focus on the implementation of motivational

strategies that sustain all three needs, while avoiding strategies that frustrate these needs. Specifically, motivational strategies to implement an empowering climate are subdivided into four dimensions (see Appendix A): autonomy support (e.g. *offering opportunities to make choices and to act according to their own will*), mastery (AGT; e.g. *emphasizing and recognizing personal progress and effort*), structure (SDT; e.g. *planning and teaching a lesson that enables students' to achieve the intended learning objectives*) and relatedness support (e.g. *providing a context where all students feel safe and believe they are an important part of the group*). For instance, to support the need for autonomy, teachers can provide a rationale for tasks, requests and constraints. To support the need for competence, teachers can emphasize and recognize effort and improvement (mastery) and offer expectations for learning (structure). To support the need for relatedness, teachers can adopt a warm communication style. A disempowering motivational climate also consists of four dimensions (see Appendix A): control (e.g., *using extrinsic rewards*), performance (AGT; e.g., *emphasizing and recognizing inferior and superior performance and ability*), chaos (SDT; e.g., *showing little consistency and coherence/being unpredictable*), and relatedness thwarting (e.g. *adopting practices that may lead to the exclusion of some students*). Although the efficacy of need-supportive motivational strategies is well documented in the scientific literature (De Meester et al. 2020; Haerens, Vansteenkiste, et al. 2018; Van den Berghe et al. 2016; Haerens, Krijgsman, et al. 2018; Mouratidis et al. 2017), teachers in the field still report having difficulties motivating students to, among other things, invest effort into a task, listen to teachers' instructions or assume classroom responsibilities (Aelterman et al. 2013).

Effective professional development

Professional development is a process in which practitioners appreciate their strengths and limitations and consolidate and update knowledge relevant to their profession (Viens, Dubé, and Guay 2019; Castelli, Centeio, and Nicksic 2013). To achieve a sustainable change in educational practice, it must be anchored in teachers' daily practice and provide support (Viens, Dubé, and Guay 2019; Feyfant 2013). A paper reviewing 35 studies on professional teacher development that had a positive impact on teachers' pedagogical practices and students' outcomes identified seven features of effective professional development: 1) content focus, 2) active learning, 3) collaboration between participants, 4) provision of models of effective practice, 5) coaching and expert support, 6) feedback and reflection, and 7) sustained duration (Darling-Hammond, Hyler, and Gardner 2017). Professional development specific to PE teachers should challenge their practices with theoretical support, provide interaction and collaboration opportunities, encourage individual and collective reflection, and be delivered by a competent professional who recognizes and understands what is involved in teachers' day-to-day work (Armour and Yelling 2010; Armour and Makopoulou 2012; Castelli, Centeio, and Nicksic 2013; Aelterman et al. 2013). To this end, the educational consultant plays a key role in supporting PE teachers, while taking into account their school reality. As exemplified by Castelli et al. (2013) and applied in the present study, the focus of professional development should be content-specific (e.g., comparing and contrasting the effects of different motivational strategies) and aligned with teachers' goals (e.g., motivating students) about students' outcomes (e.g., motivation, effort and intention).

Consistent with previous research on intervention studies to train teachers to become more need-supportive (Aelterman et al. 2013; Su and Reeve 2011; Aelterman et al. 2016; Sparks et al. 2017), effective training should rely on theoretical foundations and empirical evidence presented in brief group sessions (max. 3h) using different types of media, provide opportunities to experiment and practice in the field and be delivered in a need-supportive way. To this end, and as required in action-research, participants should be involved in the training process (autonomy-support). In addition, the trainer (e.g., educational consultant-EC) should plan activities that will help teachers assimilate motivational strategies (competence-support: structure), provide useful feedback during experiments in the field (competence-support: mastery), and provide opportunities for teachers to come together to discuss and share personal experiences (relatedness-support).

Objectives

There are relatively few intervention studies to date on teachers' training to develop need-supportive motivational strategies in PE (Aelterman et al. 2013; Sparks et al. 2017), and the few there are present certain limitations: omission of a baseline measurement, absence of a control group, reliance on students perceptions only, and omission of some dimensions of the motivational climate (Aelterman et al. 2014). In keeping with researchers' recommendations (two-measurement times, presence of a control group, objective measure of teachers' practices, all dimensions of the motivational climate) (Haerens et al. 2013; Legg, Newland, and Bigelow 2018; Van den Berghe et al. 2014;

Tessier, Sarrazin, and Ntoumanis 2010), the present study contributes to the broadening of that knowledge base.

The aims are twofold: (1) to verify if attending a 2-day training course on how to create an empowering motivational climate affects students' perception of motivational climate, satisfaction of needs, motivation, effort and intention to be physically active, and (2) to verify if the training affects observed motivational climate in PE. In the present study, we featured effort and intention as students' outcomes because they are an indication of students' engagement (Hastie et al., 2020; Leo et al., 2020; Skinner, Kinderman, and Furrer, 2009).

Hypotheses

Our first hypothesis was that students in the experimental group would report higher perception of an empowering motivational climate, satisfaction of needs, self-determined motivation, effort and intention to be physically active, and would report lower controlled motivation and amotivation at the second measurement time. Our second hypothesis was that during the second observation, teachers from the experimental group would be more empowering and less disempowering.

Methods

Participants and procedure

The project based on a quasi-experimental design received approval from the university's ethical board. All PE teachers from one service centre received an invitation to subscribe to the guided training and the research project at the start of the school year. Some

teachers were not interested in the training session but were willing to participate in the research project; these teachers joined the control group (see Figure 1 for details).

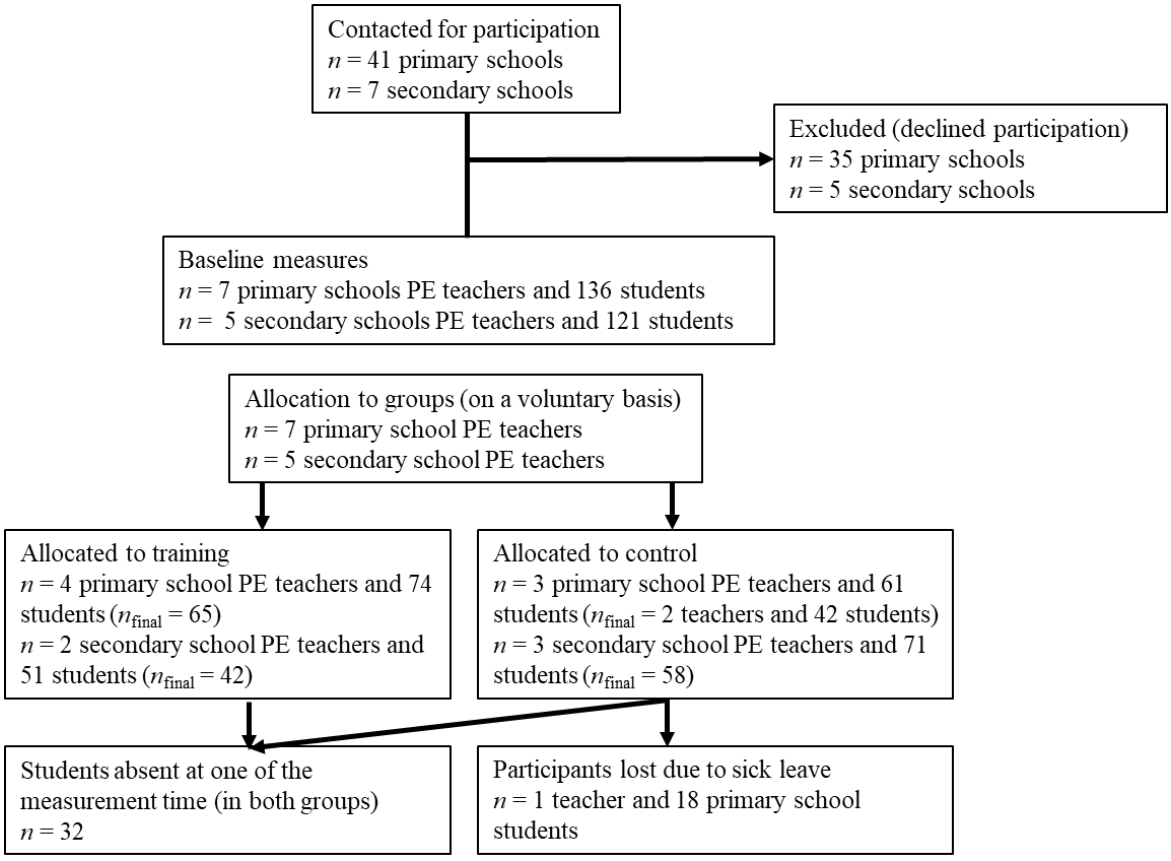

Figure 1. Intervention flowchart. PE = physical education

Thus, we used a mixed non-probabilistic sampling (criterion/intentional and intentional random sampling) to recruit 12 PE teachers. Even though using a non-probabilistic sampling might result in a sort of bias, this choice was made in respect with the educational consultant, and his employer, wishes to respect teachers willingness to invest according to their reality and availability. As seen in Table 1, it appears that teachers from the experimental group were less experienced and had less seniority than teachers from the control group. In our view, the fact that teachers in the beginning of

their career were more willing to take part in professional development than their most experienced counterparts is representative of the school reality.

Table 1. Characteristics of teachers in both groups

	Age (years)	**Experience in teaching (years)**	**Seniority in the school (years)**
Experimental group			
Teacher 2	27	3	1
Teacher 3	46	19	16
Teacher 7	52	15	3
Teacher 8	41	9	0
Teacher 9	27	3	3
Teacher 10	27	2	2
Control group			
Teacher 1	37	10	8
Teacher 5	33	9	6
Teacher 6	44	21	21
Teacher 11	50	24	24
Teacher 12	43	N/A	3

Note. N/A = data not available

In September, the EC met with all volunteer PE teachers to obtain their written consent to participate in the project and provide them with an informational letter and consent form to distribute to the students[1] and parents. After the first measurement point, one primary teacher from the control group went on sick leave, giving a final sample of 11 PE teachers (men = 7; women = 4; M_{age} = 38.9[9.28]; range = 26.84-51.82; $M_{experience}$ = 11.50[7.92]; range = 2-24). The final student sample consisted of 207 participants (see Figure 1 for details). Students' gender and age are available in the results section (see Table 2).

[1] Teachers had to choose a group of students that they found difficult to motivate.

Development and delivery of training

The need to develop a training session on how to motivate students to learn in PE and adopt physical activity is based on an initiative of the *Fédération des éducateurs et éducatrices physiques enseignants du Québec* (FÉÉPEQ). To address the need to support high school PE teachers in creating an empowering motivational climate, the research team developed, in collaboration with educational consultants in PE[2], a 2-day training course (spread over 3 days) based on previous research on ongoing professional development in PE (Aelterman et al. 2013; Su and Reeve 2011; Darling-Hammond, Hyler, and Gardner 2017). Therefore, it's important to note that the training was designed for a wider audience and imported into our specific context in order to study the effects of its first delivery.

In addition, researchers met with ECs from across the province of Québec (Canada) in April (two days) and September (two days) 2018 to make sure the training met their needs and expectations. Finally, because "teachers are more likely to accept and internalize the message brought during the training when their basic needs are met" (Aelterman et al., 2013, p. 66), the trainers (educational consultant and lead researcher) applied motivational strategies for creating an empowering motivational climate.

[2]The development of pedagogical and technological tools used for the training session was funded by Québec en Forme and carried out by two educational consultants and one PE teacher from the *Réseau pour le développement des compétences des élèves par l'intégration des technologies* (Récit, C.S. de Saint-Hyacinthe). In total, more than 30 videos describing the implementation of the proposed motivational strategies and different technological tools applicable in PE are available on a website, along with a trainer's guide and a power point presentation for each day of training that can be modified as needed. The idea was to provide a turnkey training that educational consultants could then appropriate and adapt to the reality of their respective environments. After conducing the research project, all training material was presented in April 2019 to more than 50 educational consultants in the province of Quebec.

The first day of training occurred in mid-November 2018. The objectives were to understand what supports students' motivation to learn, promote the implementation of empowering motivational strategies and examine one's practice with regard to the concepts presented. The second half-day of training took place in mid-December 2018. The objectives were to examine one's practice with regard to experiences since the last training course, identify signs of student engagement, choose the target of the experiment (who? what?) and plan its implementation (how? when?). The third half-day of training occurred in mid-March 2019. The objectives were to continue examining one's practices with regard to the implementation of experiments, assume the planning of the preparation and integration phases[3] of the lesson based on the new concepts and tools presented (e.g. an instructional communication tool), and decide on how to integrate them into practice. Figure 2 presents the timeline of the training course and data collection.

2018				2019		
September	***October***	***November***	***December***	***February***	***March***	***April***
1st contact with the participants (meeting or phone calls; EG-CG)	1st teachers' observations 1st students' questionnaire (EG-CG)	Part 1: full day training (EG) Theoretical and empirical evidences, video analysis, exchanges, teamwork	Part 2: ½ day training (EG) Theoretical and empirical evidences, choosing and planning an experimentation	2nd teachers' observations (EG-CG) with feedback from the EC on their experimentation	Part 3: ½ day training (EG) Exchanges and practice analysis, problem solving and exploring solutions	2nd students' questionnaire (EG-CG)

Figure 2. Timeline of the training and data collection (EG = experimental group; CG = control group; EC = educational consultant)

[3] These phases (preparation, realization, integration and gaps) refer to the lesson's different pedagogical aims (Ministère de l'Éducation, du Loisir et du Sport, 2006). See the observed measures section for a detailed definition of each phase.

Measures

Students completed the same questionnaire at the two-measurement point: October 2018 and April 2019. They responded on a 7-point Likert scale from 1 (*strongly disagree*) to 7 (*strongly agree*). The Cronbach alphas presented here are those of the original scales.

Basic psychological needs. The competence scale used by Standage, Duda, and Ntoumanis (2003) is from the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, and Tammen 1989) and consists of five items (α = .80; ex. Since the beginning of the school year, in my PE classes, I think I am pretty good at this activity.). The autonomy scale (Standage, Duda, and Ntoumanis 2003) consists of five items (α = .81; ex. Since the beginning of the school year, in my PE classes, I have some choice in what I want to do.). To measure relatedness satisfaction, the acceptance scale used by Standage, Duda, and Ntoumanis (2003) is from the *Échelle du sentiment d'appartenance sociale* (Richer and Vallerand 1998) and consists of five items (α = .89; ex. With the other students in PE classes, I feel heard.).

Perceived motivational climate. Appleton et al. (2016) used three scales to measure empowering climate dimensions in PE. The mastery climate scale consists of nine items (α = .81; ex. My PE teacher made sure students felt successful when they improved.). The autonomy-support scale consists of five items (α = .64; ex. My PE teacher gave students choices and options.). The relatedness support scale consists of three items (α = .48; ex. My PE teacher could really be counted on to care, no matter what happened.). Given the low internal consistency of two of the three dimensions, the authors of the scale decided to create a unique variable: empowering motivational climate (α = .90).

Motivation. The scales for students' motivation came from the Behavioral Regulations in Physical Education Questionnaire (BREPQ; Aelterman et al. 2012) and the BREQ-3 (Markland and Tobin 2004; Wilson et al. 2006) for the integrated regulation subscale. As in the Aelterman et al. (2012) study, three subscales were used to measure motivation: autonomous motivation (α = .89; intrinsic motivation, integrated and identified regulations), controlled motivation (α = .82; introjected and external regulations) and amotivation (α = .80). The intrinsic motivation includes four items (ex. Since the beginning of the school year, I put effort in this PE class because I get pleasure and satisfaction from participating.). The integrated regulation includes four items (ex. Since the beginning of the school year, I put effort in this PE class because it is consistent with my values.) The identified regulation includes four items (ex. Since the beginning of the school year, I put effort in this PE class because it is personally important to me.). The introjected regulation includes four items (ex. Since the beginning of the school year, I put effort in this PE class because I would feel guilty if I didn't.). The external regulation includes four items (ex. Since the beginning of the school year, I put effort in this PE class, because I felt the pressure of others to participate.). The amotivation scale includes four items (ex. Since the beginning of the school year, I think this PE class is actually a waste of time.).

Effort. The effort scale comes from the Intrinsic Motivation Inventory (IMI; McAuley, Duncan, and Tammen, 1989) and consists of five items (α = .84; Since the beginning of the school year, in my PE classes, I put a lot of effort.)

Intention. The intention scale comes from the French validation of the intention to be physically active scale (Dupont et al. 2009) and consists of four items (α = .75; Outside PE classes, I like to play sport.).

Observed measures

We filmed two PE lessons for both groups of teachers (EG and CG): one in October 2018 (before the start of training) and one in February 2019 (just before the last day of training, during experimentation). Prior to coding the observation, we identified temporal boundaries specific to all phases of the lesson (Ministère de l'Éducation, du Loisir et du Sport, 2006): preparation, realization, integration and gaps. The preparation phase consisted of welcoming the students, providing instructions related to the task, and warm-up. The realization phase consisted of all other learning activities when the teacher actively supervises the student's engagement in the proposed tasks. The integration phase consisted of feedback on the lesson with students. The gaps consisted of all transitions between learning activities, teams' constitution, and the installation or storage of equipment. The duration (in minutes) of the preparation phase varied from 11:36 to 37:18, the realization phase from 11:51 to 43:45, the integration phase from 0:52 to 10:39 and, finally, the time accorded to gaps varied from 3:11 to 23:49 (see Appendix B for detailed results).

Observed motivational climate. The observation grid used to analyze the motivational climate consisted of 33 empowering motivational strategies (autonomy support = 7; mastery = 8; structure = 7; relatedness support = 11) and 13 disempowering strategies (control = 3; performance = 3; chaos = 3; relatedness thwarting = 4) that were inspired by

previous observation grids (Haerens et al. 2013; Smith et al. 2015). Each dimension of the empowering and disempowering climate was coded on an 8-point scale ranging from 0 (not at all) to 7 (very strong), for each phase of the lesson. In previous studies, observers used coding intervals of 5 or 15 minutes (Haerens et al. 2013; Smith et al. 2015). However, in the present study, after identifying temporal bounds for each phase of the lesson, the observers used one grid for each phase, changing the observation grid used for each at the beginning of a new temporal bound[4]. Only at the end of the lesson did observers attribute a score for each dimension of the empowering and disempowering motivational climate for each phase of the lesson. The median score of dimensions in each phase of the lesson was then calculated. To obtain a score for the course as a whole, we used the median score of the median scores of the four phases of the lesson. The lead researcher analyzed all video sessions. To assess intrarater reliability (90.6%), he coded one lesson from each group twice and five days apart. To assess interrater reliability, a second observer from the research team who had not been in contact with the participants coded all the videos of the first measurement point and reached an interrater score of 93.8%. Specifically, the two observers coded together until this proportion of agreement was reached. Nevertheless, in order to ensure the best possible validity, they chose to continue coding together all the videos from Time 1. In our opinion, this also explains why the intrarater reliability score (which was calculated at the beginning of the process) is lower than the interrater score: the lead observer improved during the process. The

[4] During the training, it was important for the educational consultant to consider the different phases of the lesson when planning experimentation with teachers in respect with their pedagogical practices. Given that phases of the lesson are iterative, meaning that it is possible to have multiple preparation and realization phases in the same lesson, to get a score for each phase, it was not appropriate to code only according to time interval as in previous studies.

intra- and inter- rater reliability scores were calculated using the following formula (Fortin and Gagnon, 2016, 295):

$$P_0 = \frac{number\ of\ agreements}{total\ number\ of\ observations}\ x\ 100$$

Finally, to take into account the proportion of agreements attributable to chance, we also calculated Cohen's kappa (*k*; Cohen, 1960). According to Landis and Koch (1977), values under 40% are considered weak, values between 40 and 60% represent a moderate agreement, values between 60 and 80% a substantial agreement, and values over 80% an excellent agreement. In our case, values for both intrarater (k = 92.4%) and interrater (k = 87.6%) scores were excellent.

Analyses

Preliminary analyses. Since the measurement instruments came from several sources, exploratory factor analyses were used to verify the validity of the factors and remove less reliable items[5]. Fidelity was estimated using three internal consistency estimators: the greater lower bound (GLB), the omega when a factor is composed of less than five items and the ordinal Cronbach alpha. A threshold for acceptability was established at .80 as recommended by Bourque et al. (2019). The latter coefficient is reported to allow comparability with other studies despite considerable criticism. Descriptive statistics

[5] For the three needs, factorial analysis suggests withdrawing the reverse item from the competence scale and two items from the autonomy scale. As for the dimensions of the empowering motivational climate, they were combined into one variable after six items of the mastery scale and one item of the autonomy support scale were withdrawn. For types of motivation, three factors were identified: self-determined motivation, controlled motivation and amotivation. To obtain the three factors, one item was withdrawn from the intrinsic motivation scale, two items from the identified regulation scale and two other items from the introjected regulation scale. As regards effort and intention, one item was withdrawn from both scales.

were calculated for each of the variables at both measurement times as well as for both groups.

Main analyses. Before proceeding with the analysis, we screened data for normality. Because 11 out of 18 variables displayed non-normal and asymmetric distributions, and given the low number of teachers, we used non-parametric tests. First, to perform a comparison between each of the two groups (experimental and control) based on scale scores at T1 and at T2, the Wilcoxon-Mann-Whitney test was used (Siegel and Castellan, 1988). Then, to compare the values between each of the measurement times (T1 and T2) for the experimental group and then for the control group, we used the Wilcoxon signed rank test for related samples (Siegel and Castellan, 1988).

Results

Table 2 presents the internal consistency measures of each subscale after performing factor analyses. All values are acceptable with the exception of need for autonomy at both measurement times, which is slightly below the recommended threshold (between .70 and .80).

Table 2. Internal consistency of scales

Variables (selected items)	GLB	Ordinal omega	Ordinal Cronbach's alpha
Autonomy T1 (3 items)	.70	.73	.73
Autonomy T2 (3 items)	.75	.74	.73
Competence T1 (4 items)	.85	.83	.83
Competence T2 (4 items)	.90	.88	.88
Relatedness T1 (5 items)	.94	.92	.92
Relatedness T2 (5 items)	.92	.91	.91
Motivational climate T1 (10 items)	.97	.95	.95
Motivational climate T2 (10 items)	.93	.92	.92
Self-determined motivation T1 (9 items)	.94	.93	.93
Self-determined motivation T2 (9 items)	.96	.95	.95
Controlled motivation T1 (6 items)	.84	.85	.84
Controlled motivation T2 (6 items)	.83	.86	.85
Amotivation T1 (4 items)	.78	.86	.85
Amotivation T2 (4 items)	.80	.88	.88
Effort T1 (4 items)	.74	.80	.79
Effort T2 (4 items)	.87	.85	.84
Intention T1 (3 items)	.76	.81	.81
Intention T2 (3 items)	.83	.87	.86

Note. GLB = *greater lower bound*; T1 = time 1; T2= time 2

Descriptive Statistics

Table 3 presents the proportion of boys and girls, mean age of each group (experimental and control) and education level (primary and secondary).

Table 3. Students' age and gender according to groups (experimental and control) and school levels (primary and secondary)

Groups	Gender		Age
	G	B	
	***N* (%)**	***N* (%)**	***M* (*SD*)**
Total sample	110 (53.1)	97 (46.9)	12.53 (1.51)
Experimental group (total)	57 (53.3)	50 (46.7)	12.27 (.90)
Control group (total)	53 (53.0)	47 (47.0)	12.80 (1.93)
Experimental group (primary)	39 (60.0)	26 (40.0)	11.68 (.42)
Experimental group (secondary)	18 (42.9)	24 (57.1)	13.20 (.62)
Control group (primary)	24 (57.1)	18 (42.9)	11.09 (.69)
Control group (secondary)	29 (50.0)	29 (50.0)	14.06 (1.54)

Note. G = girls; B = boys

Table 4 presents the mean and standard deviation for the full sample and for each group.

Table 4. Mean, standard deviation and significant differences between the two-measurement times

	Total sample *M* (*SD*)	**EG *M* (*SD*)**	**CG *M* (*SD*)**
Autonomy T1	4.03 (1.61)	3.93 (1.60)	4.14 (1.63)
Autonomy T2	3.86 (1.60)	3.97 (1.60)	3.73 (1.59)*
Competence T1	5.60 (1.17)	5.65 (1.13)	5.55 (1.22)
Competence T2	5.51 (1.36)	5.56 (1.40)	5.46 (1.32)
Relatedness T1	5.33 (1.53)	5.41 (1.63)	5.24 (1.41)
RelatednessT2	5.38 (1.44)	5.55 (1.39)	5.21 (1.49)
Motivational climate T1	6.10 (.88)	6.12 (.98)	6.08 (.75)
Motivational climate T2	5.83 (1.23)	5.81 (1.30)*	5.86 (1.15)
Self-determined motivation T1	5.53 (1.33)	5.64 (1.35)	5.42 (1.31)
Self-determined motivation T2	5.42 (1.51)	5.53 (1.51)	5.31 (1.51)
Controlled motivation T1	2.86 (1.41)	2.85 (1.44)	2.87 (1.38)
Controlled motivation T2	2.98 (1.50)	3.10 (1.68)	2.86 (1.29)
Amotivation T1	1.94 (1.20)	1.93 (1.22)	1.95 (1.18)
Amotivation T2	2.10 (1.35)	1.92 (1.22)	2.29 (1.46)**
Effort T1	6.10 (.92)	6.17 (.88)	6.03 (.96)
Effort T2	5.86 (1.20)	5.81 (1.25)**	5.91 (1.15)
Intention T1	5.69 (1.52)	5.96 (1.32)	5.41 (1.66)
Intention T2	5.53 (1.57)	5.65 (1.67)	5.40 (1.46)

Note. *$p < .05$ ** $p < .01$; EG = experimental group; CG = control group

Non-parametric tests for students' motivational variables

The Wilcoxon-Mann-Whitney test was used to determine whether the scores for the experimental group differed significantly from those of the control group at each measurement time. Only three differences were found to be significant: the self-determined motivation of students in the experimental group was higher than that of students in the control group at Time 1 ($p = .046$); students' amotivation in the control group was higher than that of students in the experimental group at Time 2 ($p = .023$);

and students' intention to be physically active in the experimental group was higher than that of students in the control group at Time 1 (p = .015).

The Wilcoxon signed rank test values show four significant differences: the control group's need for autonomy decreases at time 2 (p = .02), the experimental group's perception of an empowering motivational climate decreases at time 2 (p = .013), the control group's amotivation increases at time 2 (p = .005), and the experimental group's effort decreases at time 2 (p = .003).

Non-parametric tests for observed motivational climate

The Wilcoxon-Mann-Whitney test was used to verify whether the scores for the experimental group differed significantly from those of the control group at each measurement time. There were no statistically significant differences, suggesting that both groups were equivalent at both measurement times.

The Wilcoxon signed rank test values show one significant difference between both measurement times in the experimental group for the integration phase (p = .042); this is more empowering at time 2. Gaps and the empowering motivational climate almost reached statistical significance (p = .066) in the experimental group, meaning they were higher at time 2.

Discussion

To train teachers to create an empowering motivational climate in their PE classes, the present study aimed to verify if attending a 2-day training course affects students' perception of motivational climate, satisfaction of needs, motivation, PE effort, intention

to be physically active, and observed motivational climate in PE. Our first hypothesis was disproved by our results, suggesting that the teacher's training did not positively affect students' motivation. In fact, it was surprising to observe a significant decline in students' perception of an empowering motivational climate and effort in the experimental group. It's important to note, however, that scores for these variables were already quite high at the start of the year (empowering climate T1 = 6.12; effort T1 = 6.17), remained so in the middle of the year (empowering climate T2 = 5.81; effort T2 = 5.81) and were similar for the two groups, although the difference was not significant in the control group. In fact, results revealed only a few differences between the two groups at both measurement times. Early in the study, students' self-determination and intention to be physically active were higher in the experimental group than in the control group, while students' amotivation in the control group was higher at the end of the school year compared with the other group. Specifically, the control group's amotivation increases and autonomy satisfaction decreases between both measurement points. This was not the case for the students from the experimental group, suggesting that the training course might have a buffering effect against the natural decrease of students' motivation.

Previous studies report a significant decrease in students' motivation in PE across the primary-secondary school transition (Ntoumanis, Barkoukis, and Thøgersen-Ntoumani 2009; Ullrich-French and Cox 2013; Warburton and Spray 2008). Accordingly, we expected low scores on motivational variables (e.g., satisfaction of needs, motivational climate, self-determined motivation, effort and intention) and higher scores for controlled motivation and amotivation at the start of the school year, at least for teenagers. However, our results reflect the opposite, with the exception of autonomy.

Supplementary analyses[6] revealed that scores were higher among elementary students, but the fact remains that teenagers reported being motivated, which does not appear consistent with our stated concerns about their motivation to engage in PE classes. In a previous study aimed at sustaining primary school children's motivation in PE, students' lack of motivation was not reflected in their answers either (Girard and Blais 2019). Perhaps self-reported questionnaires are not enough to capture the essence of students' motivation and perceptions. Focus groups and interviews would definitely offer better insights into their actual motivation in PE and should be considered in future studies. However, if one wishes to use questionnaires with students, their administration should be done in a way that truly accompanies them in the process (e.g., the researcher should read each question out loud, ask students if they need any clarification before answering the next question and so on). As well, it may be relevant to observe student engagement and compare these observations with teachers' perceptions. For instance, a teacher experiencing difficulty in classroom management (motivating students to behave) might perceive this group of students as demotivated to learn, which may not necessarily be so. We believe that such was the reality of some teachers[7] in our experimental group: they had a great need of support for classroom management, and this may have hindered their capacity to support students' motivation. Although the two are closely linked, they require the deployment of distinct strategies, which a teacher cannot easily deal with all at once. Another hypothesis explaining the absence of significant changes in students' motivational variables may be that changing students' perceptions takes time. Because

[6] These results are available in Appendix C.

[7] Between the two observations in class, the entire school team (teachers, special educator, psychoeducator, school principal) was mobilized to better supervise and ensure a formal follow-up of the management of behavioural problems of one of the groups of students.

training started in November and was spread over the entire school year, students were already familiar with the teacher-induced motivational climate, and this may have biased their observation of changes, as was the case in a previous study (Aelterman et al. 2014). Likewise, changing practices is certainly a difficult and gradual process for teachers. When things go wrong, it may be easier for them to fall back on old practices than rely on new strategies. A verification of these hypotheses would require more follow-up.

Results only partly support our second hypothesis: PE teachers who participated in the training course were more empowering during the integration phase of the lesson. In the context of our intervention, this result is important since the integration phase was identified as the most ambiguous part of the lesson and the one on which teachers spent the least amount of time. In other words, although PE teachers knew about the existence and importance of this phase, they realized that almost no time was allotted to it during lessons or with regard to planning. In fact, although an effective integration phase can be brief and very meaningful for students' learning, careful preparation is needed for this to occur. Put differently, effective integration is not only a matter of duration (it could be long and completely irrelevant), but also of quality, relevance and consistency with the preparation and realization phases of the lesson. This result is quite interesting when put in relation with a previous study focusing on the first 15 minutes of the lesson and its impact on students' motivation and (dis)engagement (preparation phase and beginning of the realisation phase; Van den Berghe et al. 2016). Indeed, these authors put forward the fact that teachers' practices vary during the course of a lesson, depending on the pedagogical focus and on students' response. Even though we did not assess students' engagement throughout the lesson, based on their results, we can state that teachers'

pedagogical choices during each phases of the lesson vary accordingly to students' motivation and engagement. Therefore, the moment of the lesson might have a specific role in regard of sustaining students' motivation. In this line of thinking, our results endorse their recommendation that " […] intervention studies and workshops might be developed in the context of continuous development programs, for example targeting certain critical moments during the lesson" (Van den Berghe et al. 2016, 666).

As for the other phases, gaps and the overall rating of the lesson, although not statistically significant, were both more empowering in the experimental group, which is promising for future interventions. Our choice to conduct our observations according to the different phases of the lesson (preparation, realization, integration and gaps) also allowed us to appreciate the time allotted to each of them. Although this was not the aim of the study, the amount of time spent on these different phases was very surprising. In contrast to the short duration of the integration phase, the time accorded to gaps appeared, in several cases, to be excessively high. Specifically, of the 21 integration phases that were observed, 18 lasted less than 5 minutes (see Appendix B). Considering that this phase is an opportunity to make students aware of their learning and achievement, to verbalize what and how they have learned, to identify difficulties they encountered and/or overcome and to discuss the possible reinvestment of their learning in others contexts (Ministère de l'Éducation, du Loisir et du Sport, 2006), it is difficult to imagine that all this can be done effectively in less than 5 minutes. As for gaps, considering that PE lessons are only 55 minutes in primary schools and 75 minutes in secondary schools, the time spent on transitioning between activities and managing equipment should be as short as possible (Siedentop 1999; Desbiens et al. 2008, 2009). Doing so, the rest of the lesson

can be devoted to students' learning accordingly to each phases of the lesson (preparation, realization and integration; Ministère de l'Éducation, du Loisir et du Sport, 2006; Siedentop, 1994). We believe that spending to much time on gaps, sometimes unnecessarily, or spending not enough time questioning students on what they learned during the lesson can both be detrimental to the motivational climate. For example, some preliminary analyses of our data (Spearman correlations) showed that time allowed for gaps was negatively associated with relatedness support (r_s = - .62, p = .058) and positively with control (r_s = .68; p = .030), while time accorded to the integration phase was positively associated with autonomy support (r_s = .70; p = .024), structure (r_s = .93; p = .000) and mastery (r_s = 74; p = .015). This aspect certainly merits consideration in future research, as discussed in previous studies (e.g. Desbiens et al. 2014).

Limitations and suggestions for future research

A few limitations are to be considered. First, as explained in the method section, teachers were not randomly assigned to the control or experimental groups. This may have affected our results in that the observed differences could be explained by the initial differences rather than by the intervention. For example, the control group consisted of more experienced teachers. Therefore, they could have more experience in maintaining a motivational style until the end of the school year in comparison with less experienced teachers from the experimental group who might find it difficult to maintain a motivation style as the school year progresses. However, considering the respectful, voluntary and free collaboration with individuals from the community, this type of study is often characterized by omitting to randomly assign groups and recruitment of only a few

participants (Legg, Newland, and Bigelow 2018; Su and Reeve 2011). Next, the second observation occurred between the two last training days, during an observed experiment with feedback from the educational consultant. Teachers may plausibly have refined their creation of the motivational climate subsequent to receiving feedback and participating in the last day of training, which was adapted to their needs. We were aware of this limitation prior to the study. However, because our resources allowed us to film teachers only twice during the school year and our aim was to work collaboratively with practitioners, we decided, together with the EC, that it would be more rewarding to film the teachers as they implemented their experiment. This would allow them to receive feedback before the end of the training and observe themselves, if they wished, during the training. A third time measurement point closer to the end of the school year would surely offer interesting results. Furthermore, a single observation might not be enough to capture the extent of change in the application of motivational strategies for creating an empowering motivational climate, as was reported in previous studies (Legg, Newland, and Bigelow 2018; van der Lans et al. 2016). This might be explained by the performative nature of teachers' work and the fact that children are children, i.e., their behaviors and attitudes vary from one lesson to another depending on a whole range of factors that are often beyond the teacher's control. To capture the essence of the motivational climate, even though there is no consensus on the minimum number of sessions required to get a good overview of the reality, like other researchers (Desimone, 2009; Taylor et al., 1999), we believe that observing at least three different lessons at each measurement time could provide a better insight of the motivational climate, as often recommended, but not always feasible, in experimental studies (Fortin and Gagnon,

2016). From our point of view, this bias is even greater when the sample is small. Finally, in order to reduce the time taken by students to complete the questionnaires as requested by PE teachers, some subscales were not considered in the study: the intimacy subscale of the *Échelle du sentiment d'appartenance sociale* (Richer and Vallerand, 1998), the structure dimension of the perceived motivational climate (not avaiblable in Appleton et al., 2016) as well as the disempowering dimensions of the motivational climate (Appleton et al., 2016), and the frustration of the basic psychological needs.

Despite the efforts invested in the study design and in the examination and improvement of the validity of the measurement instruments, the results obtained are, to say the least, both disappointing and confusing. Some of the methodological issues identified above must be considered carefully as possible and partial explanations, but Fleitz (2004) believes that other factors must be taken into account. He reminds us of the importance of carefully documenting and analyzing five main components that influence trainees' relationship to the training experience: 1) their mental representations of their job; 2) the professional and socio-affective motivations that incited them to take the training course in the first place; 3) the course content; 4) the way the course is delivered and 5) implementation through practice.

Fleitz (2004) asserts that educational consultants and researchers should be more aware of trainees' relationship to the training experience so as to better interpret the changes or lack of changes in teaching practices subsequent to ongoing professional development. Accordingly, we believe the next training course would benefit from more opportunities for discussion between teachers, an element highly appreciated by our participants. For example, training could start by allowing teachers even more time to

share their past experiences of trying to motivate students and exchange regarding their beliefs and perceptions about students' motivation. The educational consultant can then refer to these discussions to debate teachers' ideas during training.

Fleitz also insists on the importance of accompanying PE teachers as they attempt to make changes in their teaching practices. He views ongoing professional development as an invitation to more systematically document important issues, such as those presented above, and to refine the way PE teachers are supported in their efforts to innovate in this context. Although heeding this recommendation as regards time and resources is not always possible given the reality of the teaching profession, increasing the number of observations and the degree of feedback from educational consultants relative to the implementation of an empowering motivational climate is sure to lead to improved results. Indeed, the PE teachers in our study were eager to receive feedback on their practices, clearly a major step in the right direction.

Conclusion

In conclusion, even though the training was not as effective as expected, our results provide new insights on the importance of considering each phases of the lesson. They also add to the body of evidence that creating an empowering motivational climate is desirable, but requires time and support to observe effects on teachers' practice and on students' motivation.

References

Aelterman, N., M. Vansteenkiste, L. Van den Berghe, J. De Meyer, and L. Haerens. 2014. "Fostering a need-supportive teaching style: intervention effects on physical education teachers' beliefs and teaching behaviors." *Journal of Sport & Exercise Psychology* 36 (6):595-609. doi: 10.1123/jsep.2013-0229.

Aelterman, N., M. Vansteenkiste, H. Van Keer, J. De Meyer, L. Van den Berghe, and L. Haerens. 2013. "Development and evaluation of a training on need-supportive teaching in physical education: Qualitative and quantitative findings." *Teaching and Teacher Education* 29:64-75. doi: 10.1016/j.tate.2012.09.001.

Aelterman, N., M. Vansteenkiste, H. Van Keer, and L. Haerens. 2016. "Changing teachers' beliefs regarding autonomy support and structure: The role of experienced psychological need satisfaction in teacher training." *Psychology of Sport and Exercise* 23:64-72. doi: 10.1016/j.psychsport.2015.10.007.

Aelterman, N., M. Vansteenkiste, H. Van Keer, L. Van den Berghe, J. De Meyer, and L. Haerens. 2012. "Students' objectively measured physical activity levels and engagement as a function of between-class and between-student differences in motivation toward physical education." *Journal of Sport & Exercise Psychology* 34:457-80.

Ames, C. 1992. "Achievement goals and the classroom motivational climate." In *Student perceptions in the classroom*, edited by Dale H. Schunk and Judith L. Meece, 327-48. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Ames, C., and J. Archer. 1988. "Achievement Goals in the Classroom: Students' Learning Strategies and Motivation Processes." *Journal of Educational Psychology* 80 (3):260-7. doi: 10.1037/0022-0663.80.3.260.

Anadón, M., and C. Couture. 2007. "La recherche participative, une préoccupation toujours vivace." In *La recherche participative, Multiples regards*, edited by M. Anadón, 1-7. Québec: Presses de l'Université du Québec.

Appleton, P. R., N. Ntoumanis, E. Quested, C. Viladrich, and J. L. Duda. 2016. "Initial validation of the coach-created Empowering and Disempowering Motivational Climate Questionnaire (EDMCQ-C)." *Psychology of Sport & Exercise* 22:53-65. doi: 10.1016/j.psychsport.2015.05.008.

Armour, K. M., and K. Makopoulou. 2012. "Great expectations: Teacher learning in a national professional development programme." *Teaching and Teacher Education* 28 (3):336-46. doi: 10.1016/j.tate.2011.10.006.

Armour, K. M., and M. R. Yelling. 2010. "Continuing professional development for experienced physical education teachers: towards effective provision." *Sport, Education and Society* 9 (1):95-114. doi: 10.1080/1357332042000175836.

Association canadienne des doyens et doyennes d'éducation-ACDE. 2017. "Accord sur la formation initiale à l'enseignement." http://csse-scee.ca/acde/wp-content/uploads/sites/7/2018/05/Accord-on-Teacher-Education.pdf

Blais, D., S. Girard, and J. Lemoyne. 2020. "Contribution des buts d'accomplissement en éducation physique sur la pratique d'activités physiques : comparaison entre classes spéciales et classes ordinaires." Revue canadienne de l'éducation 43 (1): 87–120.

Bourassa, M., L. Bélair, and J. Chevalier. 2007. "Les outils de la recherche participative." *Éducation et francophonie* XXXV (2):1-11.

Bourque, J., D. Doucet, J. LeBlanc, J. Dupuis, and J. Nadeau. 2019. "L'alpha de Cronbach est l'un des pires estimateurs de la consistance interne : une étude de simulation." *Revue des sciences de l'éducation* 45 (2). doi: 10.7202/1067534ar.

Castelli, D. M., E. E. Centeio, and H. M. Nicksic. 2013. "Preparing Educators to Promote and Provide Physical Activity in Schools." *American Journal of Lifestyle Medicine* 7 (5):324-32. doi: 10.1177/1559827613490488.

Cheon, S. H., and J. Reeve. 2013. "Do the benefits from autonomy-supportive PE teacher training programs endure?: A one-year follow-up investigation." *Psychology of Sport & Exercise* 14 (4):508-18. doi: 10.1016/j.psychsport.2013.02.002.

Cohen, J. 1960. "A Coefficient of Agreement for Nominal Scales." *Educational and Psychological Measurement* 20 (1):37-46. doi: 10.1177/001316446002000104.

Darling-Hammond, L., M. E. Hyler, and M. Gardner. 2017. "Effective Teacher Professional Development." In. Palo Alto, CA: Learning Policy Institute.

De Meester, A., F. Van Duyse, N. Aelterman, G.-J. Muynck, and L. Haerens. 2020. "An experimental, video-based investigation into the motivating impact of choice and positive feedback among students with different motor competence levels." *Physical Education and Sport Pedagogy*:1-18. doi: 10.1080/17408989.2020.1725456.

Deci, E. L., and R. M. Ryan. 1985. *Intrinsic motivation and self-determination in human behavior*. New York: Plennum Press.

———. 2000. "The "What" and "Why" of Goal Pursuits: Human Needs and the Self-Determination of Behavior." *Psychological Inquiry* 11 (4):227-68. doi: 10.1207/S15327965PLI1104_01.

Deppeler, J. 2010. "Professional learning as collaborative inquiry : working together for impact." In *Teacher Education for Inclusion*, edited by C. Forlin, 180-97. Abingdon, Royaume-Uni: Routledge.

Desbiens, J.-F., S. Lanoue, C. Spallanzani, J.-S. Tourigny, S. Turcotte, M. Roy, and J.-P. Brunelle. 2008. "Une analyse des comportements perturbateurs survenus durant des cours d'éducation physique et à la santé enseignés par des stagiaires." STAPS 3: 73–88. doi:10.3917/sta.081.0073.

Desbiens, J.-F., S. Lanoue, S. Turcotte, J.-S. Tourigny, and C. Spallanzani. 2009. "Perception de la fréquence d'apparition des comportements perturbateurs par des stagiaires en enseignement de l'éducation physique et à la santé (ÉPS)." Nouveaux cahiers de la recherche en éducation 12 (2): 179–193.

Desbiens, J.-F., C. Spallanzani, S. Turcotte, M. Roy, S. Lanoue, and J.-S. Tourigny. 2014. "A Multi-ReferencedAnalysis of the Quality of Learning Climate in Health and Physical Education Student Teaching." Sport Science Review 23 (5–6): 175–204. doi:10.1515/ssr-2015-0001.

Desimone, L. M. 2009. "Improving Impact Studies of Teachers' Professional Development: Toward Better Conceptualizations and Measures." *Educational Researcher* 38 (3):181-99.

Duda, J. L., and P. R. Appleton. 2016. "Empowering and Disempowering Coaching Climates: Conceptualization, Measurement Considerations, and Intervention Implications." In *Sport and Exercise Psychology Research: From Theory to Practice*, edited by M. Raab, P. Wylleman, R. Seiler, A.-M. Elbe and A. Hatzigeorgiadis, 373-88. London, UK: Elsevier.

Duda, J. L., P. R. Appleton, J. Stebbings, and I. Balaguer. 2018. "Towards more empowering and less disempowering environments in youth sport." In *Sport psychology for young athletes*, edited by C. J. Knight, C. G. Harwood and D. Gould. New York, NY: Routledge.

Duda, J. L., A. Papaioannou, P. R. Appleton, E. Quested, and C. Krommidas. 2014. "Creative adaptative motivational climates in sport and physical education." In *Routledge companion to sport and exercice psychology: Global perspectives and fundamental concepts*, edited by A. Papaioannou and D. Hackfort, 544-58. New York: Routledge/Taylor & Francis Group.

Dupont, J.-P., C. Ghislain, G. Philippe, and C. Delens. 2009. "Validation de la traduction française de l'intention to be physically active scale." *Science et motricité* 68 (3). doi: 10.3917/sm.068.0027.

Feyfant, A. 2013. "L'établissement scolaire, espace de travail et de formation des enseignants." *Dossier de veille de l'IFÉ* 87:2-15.

Fortin, M.-F., and J. Gagnon. 2016. *Fondements et étapes du processus de recherche : Méthodes quantitatives et qualitatives*. 3rd ed. Chenelière Éducation.

García-González, L., J. Sevil-Serrano, A. Abós, N. Aelterman, and L. Haerens. 2019. "The role of task and ego-oriented climate in explaining students' bright and dark motivational experiences in Physical Education." *Physical Education and Sport Pedagogy* 24 (4):344-58. doi: 10.1080/17408989.2019.1592145.

Girard, S., and D. Blais. 2019. "The Impact of a Physical Education Teacher's Initiative on Grade 4 Students' Motivation." Physical & Health Education Journal 85 (1): 1.

Girard, S., R. Chouinard, and J. St-Amand. 2015. "Climat motivationnel et buts de maîtrise en éducation physique : rôle modérateur du sexe et du sentiment de compétence." Revue phénEPS / PHEnex Journal 7 (1): 1–20.

Girard, S., J. St-Amand, and R. Chouinard. 2019. "Motivational Climate in Physical Education, Achievement Motivation, and Physical Activity: A Latent Interaction Model." Journal of Teaching in Physical Education 38 (4): 305–315. doi:10.1123/jtpe.2018-0163.

Haerens, L., N. Aelterman, L. Van den Berghe, J. De Meyer, B. Soenens, and M. Vansteenkiste. 2013. "Observing Physical Education Teachers' Need-Supportive Interactions in Classroom Settings." *Journal of Sport & Exercise Psychology* 35:3-17.

Haerens, L., C. Krijgsman, A. Mouratidis, L. Borghouts, G. Cardon, and N. Aelterman. 2018. "How does knowledge about the criteria for an upcoming test relate to adolescents' situational motivation in physical education? A self-determination theory approach." *European Physical Education Review* 25 (4):983-1001. doi: 10.1177/1356336x18783983.

Haerens, L., M. Vansteenkiste, A. De Meester, J. Delrue, I. Tallir, G. Vande Broek, W. Goris, and N. Aelterman. 2018. "Different combinations of perceived autonomy support and control: identifying the most optimal motivating style." *Physical Education and Sport Pedagogy* 23 (1):16-36. doi: 10.1080/17408989.2017.1346070.

Hastie, P. A., A. Stringfellow, J. L. Johnson, C. E. Dixon, N. Hollett, and K. Ward. 2020. "Examining the concept of engagement in physical education." Physical Education and Sport Pedagogy:1-18. doi: 10.1080/17408989.2020.1861231.

Landis, J. R., and G. G. Koch. 1977. "The Measurement of Observer Agreement for Categorical Data." *Biometrics* 33 (1):159-74. doi: 10.2307/2529310.
Legg, E., A. Newland, and R. Bigelow. 2018. "Somebody's Eyes are Watching: The Impact of Coaching Observations on Empowering Motivational Climates and Positive Youth Development." *Journal of Park and Recreation Administration* 36 (4):90-106. doi: 10.18666/jpra-2018-v36-i4-8885.
Leo, F. M., A. Mouratidis, J. J. Pulido, M. A. López-Gajardo, and D. Sánchez-Oliva. 2020. "Perceived teachers' behavior and students' engagement in physical education: the mediating role of basic psychological needs and self-determined motivation." *Physical Education and Sport Pedagogy*:1-18. doi: 10.1080/17408989.2020.1850667.
Markland, D., and V. Tobin. 2004. "A modification of the Behavioral Regulation in Exercise Questionnaire to include an assessment of amotivation." *Journal of Sport and Exercise Psychology* 26:191-6.
McAuley, E., T. Duncan, and V. V. Tammen. 1989. "Psychometric Properties of the Intrinsic Motivation Inventory in a Competitive Sport Setting: A Confirmatory Factor Analysis." *Research Quarterly for Exercise and Sport* 60 (1):48-58. doi: 10.1080/02701367.1989.10607413.
Ministère de l'Éducation, du Loisir et du Sport. 2006. "L'évaluation des apprentissages au secondaire – Cadre de référence." Gouvernement du Québec.
Mouratidis, A., A. Michou, N. Aelterman, L. Haerens, and M. Vansteenkiste. 2017. "Begin-of-school-year perceived autonomy-support and structure as predictors of end-of-school-year study efforts and procrastination: the mediating role of autonomous and controlled motivation." *Educational Psychology* 38 (4):435-50. doi: 10.1080/01443410.2017.1402863.
Ntoumanis, N., V. Barkoukis, and C. Thøgersen-Ntoumani. 2009. "Developmental trajectories of motivation in physical education: Course, demographic differences, and antecedents." *Journal of Educational Psychology* 101 (3):717-28. doi: 10.1037/a0014696.
Reason, P., and H. Bradbury. 2008. *The Sage handbook of action research: Participative inquiry and practice*. 2nd ed. Thousand Oaks, CA: Sage Publications.
Richer, S. F., and R. Vallerand. 1998. "Construction et validation de l'échelle du sentiment d'appartenance sociale (ÉSAS)." *Revue Européenne de Psychologie Appliquée/European Review of Applied Psychology* 48 (2):129-37.
Ryan, R. M. , and E. L. Deci. 2000. "Self-determination theory and the facilitation of intrinsic motivation, social-development, and well-being." *American Psychologist* 55 (1):68-78. doi: 10.1037110003-066X.55.1.68.
Ryan, R. M., and E. L. Deci. 2002. "An Overview of Self-Determination Theory: An Organismic-Dialectical Perspective." In *Handbook of Self-Determination Research*, edited by E. L. Deci and R. M. Ryan, 3-33. Rochester, NY: University of Rochester Press.
Siedentop, D. 1999. Apprendre à enseigner l'éducation physique Gaëtan Morin Éditeur.
Siegel, S., and N. J. Castellan, Jr. 1988. Nonparametric statistics for the behavioral sciences, 2nd ed, Nonparametric statistics for the behavioral sciences, 2nd ed. Mcgraw-Hill Book Company.

Skinner, E. A., T. A. Kindermann, and C. J. Furrer. 2009. “A Motivational Perspective on Engagement and Disaffection: Conceptualization and Assessment of Children’s Behavioral and Emotional Participation in Academic Activities in the Classroom.” Educational and Psychological Measurement 69: 493–525. doi:10.1177/ 0013164408323233.

Smith, N., D. Tessier, Y. Tzioumakis, E. Quested, P. Appleton, P. Sarrazin, A. Papaioannou, and J. L. Duda. 2015. "Development and Validation of the Multidimensional Motivational Climate Observation System (MMCOS)." *Journal of Sport & Exercise Psychology* 37:4-22. doi: 10.1123/jsep.2014-0059.

Sparks, C., C. Lonsdale, J. Dimmock, and B. Jackson. 2017. "An Intervention to Improve Teachers' Interpersonally Involving Instructional Practices in High School Physical Education: Implications for Student Relatedness Support and In-Class Experiences." *Journal of Sport & Exercise Psychology* 39 (2):120-33. doi: 10.1123/jsep.2016-0198.

Standage, Martyn, Joan L. Duda, and Nikos Ntoumanis. 2003. "A model of contextual motivation in physical education: Using constructs from self-determination and achievement goal theories to predict physical activity intentions." *Journal of Educational Psychology* 95 (1):97-110. doi: 10.1037/0022-0663.95.1.97.

Su, Y.-L., and J. Reeve. 2011. "A meta-analysis of the effectiveness of intervention programs designed to support autonomy." *Educational Psychology Review* 23 (159e188). doi: http://dx.doi.org/10.1007/s10648-010-9142-7.

Taylor, B., P. Pearson, K. Clark, and S. Walpole. 1999. " Beating the odds in teaching all children to read." In CIERA Report 2-006. University of Michigan: Ann Arbor.

Tessier, Damien, Philippe Sarrazin, and Nikos Ntoumanis. 2010. "The effect of an intervention to improve newly qualified teachers’ interpersonal style, students motivation and psychological need satisfaction in sport-based physical education." *Contemporary Educational Psychology* 35 (4):242-53. doi: 10.1016/j.cedpsych.2010.05.005.

Turcotte, S., F. Berrigan, S. Beaudoin, C. Gignac, L. Bessette, D. Bezeau, J. Chevrier, et al. 2018. "Revue de littérature sur les facteurs facilitants et les obstacles visant l’intégration de l’activité physique au secondaire (volet 2). Rapport de recherche déposé aux membres du comité des offres de services au milieu scolaire de la Table sur le mode de vie physiquement actif." https://www.usherbrooke.ca/chaire-kino-quebec/fileadmin/sites/chaire-kino-quebec/Documents/Rapports_de_recherche/Rapport_Volet_2_UdeS.pdf

Ullrich-French, S., and A. E. Cox. 2013. "Normative and intraindividual changes in physical education motivation across the transition to middle school: A multilevel growth analysis." *Sport, Exercise, and Performance Psychology* 3 (2):132-47. doi: 10.1037/spy0000005.

Uwamariya, A., and J. Mukamurera. 2005. "Le concept de « développement professionnel » en enseignement : approches théoriques." *Revue des sciences de l'éducation* 31 (1):133-55. doi: 10.7202/012361ar.

Van den Berghe, L., G. Cardon, I. Tallir, D. Kirk, and L. Haerens. 2016. "Dynamics of need-supportive and need-thwarting teaching behavior: the bidirectional relationship with student engagement and disengagement in the beginning of a

lesson." *Physical Education and Sport Pedagogy* 21 (6):653-70. doi: 10.1080/17408989.2015.1115008.

Van den Berghe, L., M. Vansteenkiste, G. Cardon, D. Kirk, and L. Haerens. 2014. "Research on self-determination in physical education: key findings and proposals for future research." *Physical Education and Sport Pedagogy* 19 (1):97-121. doi: 10.1080/17408989.2012.732563.

van der Lans, R. M. , W. J. C. M. van de Grift, K. van Veen, and M. Fokkens-Bruinsma. 2016. "Once is not enough: Establishing reliability criteria for feedback and evaluation decisions based on classroom observations." *Studies in Educational Evaluation* 50:88–95. doi: 10.1016/j.stueduc.2016.08.001.

Vanderlinde, R., and J. van Braak. 2010. "The gap between educational research and practice: views of teachers, school leaders, intermediaries and researchers." *British Educational Research Journal* 36:299e316. doi: 10.1080/01411920902919257.

Verret, C., J. Grenier, L. Massé, and G. Bergeron. 2017. "Enquête provinciale sur les pratiques inclusives en enseignement de l'éducation physique et à la santé : Rapport provincial primaire et secondaire. ." Montréal, Québec: Université du Québec à Montréal. https://inclusion-eps.uqam.ca/diffusion/

Viens, C., F. Dubé, and M.-H. Guay. 2019. "Accompagner des accompagnateurs." *Éducation & Formation* e-315:83-98.

Warburton, V., and C. Spray. 2008. "Motivation in physical education across the primary-secondary school transition." *European Physical Education Review* 14 (2):157-78. doi: 10.1177/1356336x08090704.

Wilson, P.M., W.M. Rodgers, C.C. Loitz, and G. Scime. 2006. "'"It's who I am…really!" The importance of integrated regulation in exercise contexts." *Journal of Biobehavioral Research* 11:79-104.

Appendix A. Observation grid (inspired from Smith et al. 2015; Haerens et al. 2013)

Empowering motivational climate (preparation/realization/integration/gaps)

0 = not at all	*2 = low*	*4 = moderate*	*6 = strong*
1 = very low	*3 = moderately low*	*5 = moderately strong*	*7 = very strong*

Autonomy support: 0 1 2 3 4 5 6 7

1. *Acknowledges students' interests, feelings and perspective.*
2. *Provides rationale for requests and constraints.*
3. *Explains tasks and exercises' importance, utility and significance.*
4. *Provides meaningful choice to students.*
5. *Gives pupils the opportunity to practice independently and to solve problems on their own, without interfering.*
6. *Encourages initiative taking.*
7. *Provides opportunity for students input (e.g. give their opinion, make changes to tasks, make suggestions, etc.).*

Competence support (mastery): 0 1 2 3 4 5 6 7

1. *Demonstrates the tasks himself and/or uses students as positive "role model".*
2. *Provides tasks adapted to the multiple abilities of the students.*
3. *Provides variation between or within exercises.*
4. *Emphasizes task-focused positive competence feedback.*
5. *Emphasizes/recognizes effort and/or improvement.*
6. *Uses cooperative learning.*
7. *Applies differentiation.*
8. *Emphasizes effort and engagement in the learning process rather than student performance.*

Competence support (structure): 0 1 2 3 4 5 6 7

1. *Gives an overview of the content and structure of the lesson.*
2. *Gives clear (verbal) instructions.*
3. *Offers expectations for learning.*
4. *Monitors if students consequently live up to the (verbal) instructions.*
5. *Offers help and gives tips and advice during activities.*
6. *Reviews with students the overall lesson content and structure.*
7. *Questions students on what they have learned during the lesson.*

Relatedness support: 0 1 2 3 4 5 6 7

1. *Ensures all students are included and respected in the group.*
2. *Is enthusiastic and eager.*
3. *Puts effort and energy into the facilitation and conduct of the lesson.*
4. *Adopts a warm communication style.*
5. *Engages in noninstructional conversation with students.*
6. *Pays attention to what students are saying.*
7. *Shows care and concern for students.*
8. *Addresses pupils by their first name when the opportunity occurs.*
9. *Is empathic.*
10. *Is physically and psychologically close to students.*
11. *Shows unconditional regard towards all students.*

Disempowering motivational climate (preparation/realization/integration/gaps)

0 = not at all	*2 = low*	*4 = moderate*	*6 = strong*
1 = very low	*3 = moderately low*	*5 = moderately strong*	*7 = very strong*

Control: 0 1 2 3 4 5 6 7

1. *Uses controlling strategies (e.g. make all decisions, threat to punish, etc.)*
2. *Uses extrinsic rewards (e.g. promises, rewards, consequences, etc.).*
3. *Relies on authority in response to students complaints/requests.*

Performance: 0 1 2 3 4 5 6 7

1. *Emphasizes/recognizes inferior/superior performance and ability.*
2. *Encourages rivalry between students.*
3. *Emphasizes errors and/or performance.*

Chaos: 0 1 2 3 4 5 6 7

1. *Gives few or no explanations or they are imprecise.*
2. *Leave students to themselves during the task.*
3. *Demonstrates little consistency and coherence/is unpredictable.*

Relatedness Thwarting: 0 1 2 3 4 5 6 7

1. *Uses strategies/activities allowing the exclusion of certain students.*
2. *Restricts opportunities for interactions and conversation "with" and "between" students.*
3. *Is distant from students.*
4. *Uses sarcasm.*

Appendix B. Duration in minutes of each phases of the lesson

	Time 1				Time 2			
	P	**R**	**I**	**G**	**P**	**R**	**I**	**G**
Experimental group								
Teacher #2	0:16:27	0:23:58	0:02:30	0:12:02	0:18:42	0:31:09	0:02:09	0:09:04
Teacher #3	0:14:10	0:29:58	0:03:43	0:04:51	0:22:32	0:19:45	0:05:35	0:07:10
Teacher #7	0:20:05	0:23:19	0:02:42	0:20:54	0:20:03	0:24:03	0:07:00	0:23:49
Teacher #8	0:22:08	0:24:11	0:04:01	0:03:11	0:24:22	0:30:10	0:01:59	0:10:08
Teacher #9	NA	NA	NA	NA	0:35:30	0:21:39	0:01:47	0:20:41
Teacher #10	0:16:24	0:30:12	0:01:38	0:11:46	0:17:57	0:35:21	0:01:49	0:04:53
Control group								
Teacher #1	0:37:18	0:11:51	0:02:07	0:04:29	0:24:27	0:15:54	0:02:53	0:10:00
Teacher #5	0:14:12	0:25:18	0:03:12	0:07:30	0:17:14	0:23:39	0:02:47	0:07:57
Teacher #6	0:11:36	0:43:45	0:02:12	0:10:19	0:17:43	0:36:46	0:01:44	0:18:44
Teacher #11	0:16:02	0:39:40	0:00:52	0:11:21	0:20:22	0:30:52	0:01:52	0:12:58
Teacher #12	0:14:19	0:30:22	0:10:39	0:10:34	0:31:05	0:28:55	0:01:26	0:12:33

Note. NA = Not available (due to a camera technical problem); P = preparation; R = realization; I= integration; G = gaps

Appendix C. Mean, standard deviation and significant differences according to school level and gender at each measurement time

	P *M* (*SD*)	S *M* (*SD*)	G *M* (*SD*)	B *M* (*SD*)
Autonomy T1	4.47 (1.60)	3.56 (1.50)***	4.10 (1.60)	3.95 (1.63)
Autonomy T2	4.33 (1.59)	3.35 (1.45)***	3.98 (1.51)	3.71 (1.69)
Competence T1	5.75 (1.25)	5.45 (1.19)*	5.46 (1.17)	5.76 (1.17)*
Competence T2	5.63 (1.53)	5.26 (1.43)**	5.33 (1.27)	5.72 (1.44)**
Relatedness T1	5.65 (1.25)	5.00 (1.46)***	5.41 (1.41)	5.23 (1.65)
RelatednessT2	5.67 (1.42)	5.09 (1.42)***	5.33 (1.39)	5.45 (1.51)
Motivational climate T1	6.39 (.80)	5.78 (.85)***	6.21 (.73)	5.97 (1.01)
Motivational climate T2	6.33 (.91)	5.30 (1.30)***	5.91 (1.12)	5.75 (1.35)
Self-determined motivation T1	5.84 (1.29)	5.21 (1.30)***	5.49 (1.32)	5.58 (1.35)
Self-determined motivation T2	5.80 (1.33)	5.01 (1.58)***	5.35 (1.52)	5.51 (1.50)
Controlled motivation T1	2.87 (1.45)	2.85 (1.36)	2.76 (1.25)	2.98 (1.57)
Controlled motivation T2	3.01 (1.54)	2.96 (1.47)	2.73 (1.34)	3.27 (1.63)*
Amotivation T1	1.79 (1.10)	2.10 (1.28)*	1.94 (1.16)	1.94 (1.25)
Amotivation T2	1.79 (1.15)	2.43 (1.47)***	2.08 (1.24)	2.13 (1.47)
Effort T1	6.26 (.91)	5.93 (.90)***	6.07 (.88)	6.14 (.97)
Effort T2	6.11 (1.11)	5.60 (1.25)**	5.83 (1.19)	5.90 (1.21)
Intention T1	6.14 (1.24)	5.22 (1.64)***	5.56 (1.53)	5.84 (1.50)
Intention T2	5.84 (1.42)	5.21 (1.66)**	5.41 (1.51)	5.68 (1.63)

Note. *$p < .05$ ** $p < .01$ *** $p < .001$; P = primary school; S = secondary school; G = girls; B = boys