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Effects of the *Learning how to motivate* training on pupils' motivation and engagement during pre-service physical education teachers' internship

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Introduction: Pre-service physical education (PE) teachers have concerns about how to sustain pupils' motivation. A training titled *Learning how to motivate* was designed to address these concerns.

Objectives: The aims of the study were (1) to compare the perceptions of high school pupils of pre-service PE teachers who had completed the training [experimental group (EG)] and pre-service PE teachers who had not completed the training [control group (CG)] about motivation; (2) to verify changes in the perceptions of EG and CG high school pupils with regard to motivational variables between the beginning and end of the internship; and (3) to compare observations of the motivational climate established by the pre-service PE teachers and of their pupils' engagement between EG and CG.

Methods: The study involves a sample of four French-Canadian pre-service PE teachers (EG = 2; CG = 2) and their high school pupils ($n = 89$) during the pre-service PE teachers' final internship. Data were collected using observations and questionnaires at the start (T1) and end (T2) of the internship.

Results: Findings revealed no significant differences between groups at T1. At T2, the EG exhibited higher levels of pupils' perceived dimensions of an empowering motivational climate than the CG. Notably, between T1 and T2, performance-approach goals decreased, and external regulation increased in the EG. As for the CG, pupils' perceived dimensions of an empowering motivational climate, competence satisfaction, and performance-approach goals decreased. Finally, there were some trends ($p \leq 0.15$) related to differences between the groups for observed motivational climate and pupils' engagement.

Conclusion: The training shows promise with regard to helping pre-service PE teachers apply theory to practice.

KEYWORDS

motivation, teacher education program, teacher training, motivational climate, physical education, professional development

1 Introduction

Physical education (PE) allows pupils to be active for a minimum of 1 h per week ([Loi sur l'instruction publique, 2024](#)). Although this is insufficient to meet one-hour daily activity guidelines ([Bull et al., 2020](#)), PE is acknowledged to be a crucial opportunity for many pupils to engage in physical activities ([Rocamora et al., 2019](#); [Kalajas-Tilga et al., 2020](#)). To this end,

it relies largely on PE teachers' responsibility to create an environment where pupils feel safe (Curran and Standage, 2017) and can develop ability while enjoying themselves (Castelli et al., 2017; Leo et al., 2020).

However, even though PE teachers' role is crucial, decline in students' engagement in PE upon entering high school has been observed (Noetel et al., 2023). This trend may be explained by teaching practices adopted by high school PE teachers (Diloy-Peña et al., 2021; Van Doren et al., 2021), highlighting the importance of providing them additional support in creating a supportive environment to foster pupils' motivation and engagement in PE. Indeed, continuous development training has proven effective in influencing teaching practices in PE with a view to sustaining motivation (Aelterman et al., 2014) and preventing its decrease (Girard et al., 2023a). In the same line, professional development is positively linked with pupils' motor skills development in PE (Honrubia Montesinos et al., 2023).

Nevertheless, the previous concern extends to pre-service PE teachers as well, who anticipate potential issues with pupils' lack of motivation and express a need to develop skills for planning and implementing motivational strategies (de Guise et al., 2024). Indeed, pre-service PE teachers feel they are not given enough explicit teaching during initial teacher training to deal effectively with pupils' lack of motivation and engagement toward physical activity and during PE (de Guise et al., 2024). To address this gap, a pilot study was conducted with pre-service PE teachers enrolled in a training course titled *Learning how to motivate* (de Guise and Girard, 2023). Results indicate that the training contributed to their intention to apply the motivational strategies learned during training. Furthermore, participants appreciated the training and mentioned its relevance to preparation for high school internships. In this regard, the present study aims to answer the following question: what impact does this training have, 1 year later, on students' motivation and engagement in PE during the last internship of pre-service PE teachers?

1.1 Theoretical framework of the training

The 3-h training course was inspired by continuous development training (Aelterman et al., 2013; Girard et al., 2023a) and builds on two well-known motivational theories in the contexts of sport and PE: self-determination theory (SDT; Ryan and Deci, 2020; Deci and Ryan, 1985) and achievement goal theory (AGT; Ames and Archer, 1988; Elliot et al., 2010).

1.1.1 Self-determination theory

According to SDT, an environment (or motivational climate) that nurtures individuals' motivation and engagement must satisfy three basic psychological needs: autonomy (need to feel responsible for one's own actions), competence (need to feel success can be achieved based on one's own ability) and relatedness (need to feel connected to others, respected and considered). In other words, the more the environment makes it possible to sustain these three needs in terms of autonomy support (e.g., providing meaningful choices, acknowledging interests and opinions, etc.), structure (e.g., providing clear explanations and expectations, ensuring consistency, offering help, etc.), and relatedness support (e.g., ensuring respect and inclusion, using a warm communication style, demonstrating care and concern, etc.), the more individuals will be motivated to engage. Specifically, there are six types of motivation existing on a continuum (Ryan and Deci, 2020):

amotivation; four types of extrinsic motivation divided into controlled (external regulation and introjected regulation) and self-determined (identified regulation and integrated regulation) forms of motivation; and intrinsic motivation. Amotivation refers to the absence of motivation to engage in a task. The two controlled forms of extrinsic motivation refer to external pressures to act: external regulation focuses on compliance and reactance, while introjected regulation focuses mainly on approval from others. In short, with these types of motivation, individuals feel pressured to act and may, in the absence of these pressures, abandon the behavior. With self-determined forms of extrinsic motivation, on the other hand, individuals act to reach their own goals and because they attach importance to the task (identified regulation) or because it is congruent with their personality and values (integrated regulation). Finally, individuals who are intrinsically motivated undertake a task for their inherent satisfaction and the enjoyment they derive from it. Thus, the satisfaction of the three psychological needs results in self-determined (identified regulation, integrated regulation, intrinsic motivation) forms of motivation, which are linked to positive outcomes such as effort and engagement (Van den Berghe et al., 2014; Ryan and Deci, 2020). Indeed, in the PE context, it has been recognized that sustaining pupils' psychological needs positively impacts their intention to engage and participate in physical activity outside of PE (Gairns et al., 2015; Vasconcellos et al., 2020; White et al., 2021). In fact, measuring students' effort in PE and their intention to be physically active is important because they are significant determinants of behavior (Hagger et al., 2005; Ajzen et al., 2018; Conner and Norman, 2022). Moreover, previous studies have indicated that motivation in a context, such as PE, can translate into another context, such as leisure time (Girard et al., 2019; Blais et al., 2020; Kalajas-Tilga et al., 2020).

1.1.2 Achievement goal theory

According to AGT, individuals engage in a task based on different types of achievement goals depending on how they define their competence and how the environment (or motivational climate) encourages them to do so (Ames and Archer, 1988; Blais et al., 2020). According to the trichotomous model (Elliot and Church, 1997), individuals can pursue three distinct types of goals: (1) mastery, (2) performance-approach, and (3) performance-avoidance. In pursuing mastery goals, individuals evaluate their competence with self-referenced criteria and seek progress and a sense of improved ability derived from their own efforts, which leads to higher engagement (Papaioannou et al., 2012; Girard et al., 2019; Blais et al., 2020). Individuals are more inclined to pursue mastery goals when they perceive a mastery motivational climate, that is, one which recognizes and encourages effort, progress, and improvement. In a performance motivational climate, on the other hand, results take precedence over process, and success is acknowledged when one outperforms others. In these instances, competence is evaluated in terms of comparison to others. When pursuing performance-approach goals, individuals perceiving themselves as more competent than others invest effort to demonstrate their superior abilities. Conversely, in a situation where they perceive themselves as less competent, they may pursue performance-avoidance goals; they then adopt avoidance behaviors leading to negative outcomes such as fewer positive attitudes toward PE, or negative affects and the use of self-handicapping strategies (Papaioannou et al., 2012; Blais et al., 2020).

1.1.3 Empowering and disempowering motivational climates

Building on the work of many authors in sport (Duda, 2013; Smith et al., 2015; Appleton et al., 2016; Solstad et al., 2020; Angelo et al., 2023) and in PE (Milton et al., 2018; Girard et al., 2023a; Vlachos and Papaioannou, 2023), the present study combined both conceptualizations of AGT and SDT to define the dimensions of an empowering and a disempowering motivational climate. Like the initial proposition of Duda (2013) in sport, Milton et al. (2018) proposed five dimensions in PE: three empowering [autonomy supportive, task involving (mastery climate), and socially supportive] and two disempowering [controlling and ego involving (performance climate)]. Recently, Vlachos and Papaioannou (2023) extended the model to seven dimensions in the context of PE: four empowering [autonomy support, task involving (mastery climate), relatedness support, and structure] and three disempowering [controlling, ego involving (performance climate) and relatedness thwarting]. To our knowledge, one study conducted in PE (Girard et al., 2023a) used an observational instrument considering eight dimensions of the motivational climate: four empowering [autonomy support, competence support – mastery (AGT), competence support – structure (SDT), and relatedness support] and four disempowering [control, performance (AGT), chaos (SDT), and relatedness thwarting].

To create an empowering motivational climate, the scientific literature offers a few lists classifying motivational strategies potentially able to satisfy each basic psychological need in different domains, such as education (Ahmadi et al., 2023), sport (Smith et al., 2015), health (Teixeira et al., 2020), and PE (Haerens et al., 2013; Girard et al., 2023a). In the context of the present study, the *Learning how to motivate* training (see Table 1), created specifically for pre-service PE teachers, discusses 19 motivational strategies (Ahmadi et al., 2023; Girard et al., accepted, 2024) categorized in four dimensions of an empowering motivational climate (Girard et al., 2023a; Vlachos and Papaioannou, 2023): autonomy support (5 strategies; e.g., *Provide reasons for pedagogical choices, constraints, tasks, and organizational decisions*), competence support (SDT) through structure (three strategies; e.g., *Give clear instructions about the content and structure of the lesson*), competence support (AGT) through a mastery climate (5 strategies; e.g., *Allow students to progress according to their strengths and challenges*) and relatedness support (6 strategies; e.g., *Be involved in students' lives outside PE hours*).

1.2 Study aims

To verify the impact of the training on pre-service PE teachers' practice during their final high school internship as well as on pupils' motivation and engagement, the aims of the study are threefold: (1) to compare the perceptions of high school pupils during the final internship of pre-service PE teachers who had completed the training [experimental group (EG)] and pre-service PE teachers who had not completed the training [control group (CG)] with regard to perceived motivational climate, basic psychological needs' satisfaction, motivation, achievement goals, effort and intention to be physically active at the beginning and end of the internship; (2) to verify changes in the perceptions of EG and CG high school pupils with regard to the same motivational variables between the beginning and end of the internship; and (3) to compare observations of the motivational climate

established by the pre-service PE teachers and of their pupils' engagement between EG and CG. The consideration of both subjective (pupils) and objective (observers) points of view represents a strength of the study and aligns with the recommendations of Hastie et al. (2022).

Drawing on previous research involving in-service PE teachers, our hypotheses suggest that the psychological needs of the EG pupils will be better sustained than those of the CG at the end of the internship (Girard et al., 2023a). Furthermore, we hypothesize that pre-service PE teachers who followed the training will be more inclined to create an empowering motivational climate than those from the CG (Aelterman et al., 2014; Girard et al., 2023b).

2 Materials and methods

This study is the final phase of a larger-scale project (FRQSC 2020-NP-266901) and was approved by the institution's ethics board. The first phase of the project consisted in a quantitative approach allowing the researchers to document French-Canadians pre-service PE teachers' beliefs about motivational strategies. The second phase involved individual and group interviews enabling the researchers to better understand pre-service PE teachers' needs during their initial training and their perceptions about motivational concepts. Then, a pilot training was created based on the results that were obtained in the previous phases of the project.

2.1 Participants and procedures

The pilot training was offered for the first time at the end of the third year (out of four) of initial training to four pre-service PE teachers from the Université du Québec à Trois-Rivières (Québec, Canada) in May 2022. Of the four, two agreed to take part in this study during their final high school internship (10 weeks) (at the end of the fourth year of initial training during the winter 2023 session) as the EG (women = 1; men = 1). Two other pre-service PE teachers, who did not receive the training, took part in the study as the CG (women = 1; men = 1). All consented in writing to take part in the project. Figure 1 presents all the procedures to recruit participants. Specifically, to take part to the present study, the inclusion criteria were: (1) to have completed the questionnaire of phase 1; (2) to have indicated in the phase 1 questionnaire that they were interested in participating in subsequent phases; (3) to be a student at the Université du Québec à Trois-Rivières (Québec, Canada); (4) to be in their fourth (and last) year of initial training; and (5) to do their last internship in high school during their last semester. For the experimental group, one inclusion criterion was added, which was to have participated in the pilot training in the spring of their third year of initial training. For the control group, it was the same inclusion criteria, however, participation in the pilot training was an exclusion criterion from the experimental group (see Figure 2).

With the approval of school administrations and assistance of cooperative teachers (those supervising the pre-service teachers' internship), the project and its objectives were presented to pupils by a research team member. This process aimed to facilitate informed, voluntary, and written consent. For pupils under the age of 14, cooperative teachers contacted parents via email to relay project details and electronic consent was obtained. Participants were informed they could withdraw from the project at any time. In

TABLE 1 Describing the *Learning how to motivate* training using the template for intervention description and replication (TIDieR).

Brief name		Learning how to motivate
Why		In-service PE teachers often face challenges in maintaining students' motivation, while pre-service PE teachers anticipate these difficulties. The "Learning How to Motivate" training was designed to help pre-service PE teachers address these challenges effectively. <i>Theoretical underpinning:</i> The training was elaborated using the Empowering motivational climate (based on SDT and AGT) framework, which is define in the introduction of the paper. It was adapted from a training that is already giving to in-service PE teachers.
What		
	Materials	<i>For trainers:</i> The training consisted of a PowerPoint presentation and covered both theoretical and practical concepts, including a list of 19 motivational strategies that can be applied in PE classes. <i>For learners:</i> <ul style="list-style-type: none"> • A diagnostic task to assess participants' initial knowledge and track their learning progress. • Videos explaining theoretical concepts and demonstrating each motivational strategy. • Teaching scenarios where pre-service teachers responded to potential real-life situations. Feedback was provided on whether their responses were optimal or how they could improve their reactions (teaching scenarios are available upon request). All materials for trainers and learners are available on a website: www.uqtr.ca/apprendre-a-motiver
	Procedures	The training lasted 3 h. Participants were encouraged to ask questions and engage throughout the session. At the beginning, participants completed the diagnostic task to assess their prior beliefs and knowledge. The training was delivered through a lecture format, interspersed with questions to ensure comprehension. First, the theoretical concepts were explained. Then, 19 motivational strategies were presented to give participants useful keys to sustain students' motivation. All videos were shown during the session. At the end, participants retook the diagnostic task, and their initial answers were discussed to indicate how the training improved their understanding. The teaching scenarios were completed as additional work after the session.
Who		One trainer (second author), with expertise in both Self-Determination Theory (SDT) and Achievement Goal Theory (AGT) and experienced in teaching to pre-service PE teachers, delivered the training.
How		The training was conducted online via Zoom with four participants.
Where		Participants attended from locations where they felt most comfortable.
When and How Much		The training was held once for a duration of 3 h in May 2022. It was scheduled based on the availability of all four participants.
Tailoring		The answers obtained in the diagnostic task were used to orient what the trainer would most emphasize during the training.
Modifications		The training was offered as planned (but was initially inspired by the <i>Motiver pour mieux apprendre</i> training offered in professional development with experienced PE teachers; Girard et al., 2023a).
How Well		
	Planned	A researcher, specialized in the theoretical framework, supervised the development of all the material. The training was based on the <i>Motiver pour mieux apprendre</i> training, co-created with the main author. The trainer rehearsed the session twice with other pre-service PE teachers before delivering it to the study participants. Since the training was conducted via Zoom, the session was recorded, and the assisting researcher reviewed the recording to ensure fidelity of implementation.
	Actual	The quality of the training was monitored and confirmed by the main author.

total, 109 of pre-service PE teachers' pupils completed the questionnaires. However, 20 pupils were withdrawn from the sample for missing one of the two measurement times (Time 1 = 6; Time 2 = 14) as displayed in Figure 2.

As presented in Table 2, the final sample consists of 89 pupils: one group of pupils per pre-service PE teacher ($n = 89$; girls = 34; boys = 52; other = 3; EG = 39; CG = 50).

2.2 Measures

For the first two objectives, pupils completed a questionnaire at the start (Time 1 = February) and conclusion (Time 2 = April) of the pre-service PE teachers' internship regarding their perception of the motivational climate, the satisfaction of their basic psychological needs, their achievement goals, their motivation, their effort in PE and their intention to be physically active. For the third objective, one to three lessons (depending on the constraints of participants' internship

schools) were filmed for a total of 7 videos and then analyzed by two coders based on two observational grids: one for motivational climate (Girard et al., 2023a) and the other for pupils' engagement (Reeve et al., 2004; Aelterman et al., 2012).

2.2.1 Pupils' questionnaire

The pupils' questionnaire (duration ≈ 20 min) consisted of 89 items to measure students' perception of the motivational climate, basic psychological needs' satisfaction, achievement goals, motivation, effort, and intention to be physically active (see next subsections). All scales had been used in previous studies. The internal consistency values (Cronbach's alphas and McDonalds' Omega; McNeish, 2018) presented next were calculated with our own sample and were all deemed acceptable (≥ 0.70), except for one variable (autonomy satisfaction) which displayed lower values (≥ 0.63). Participants responded on a 7-point Likert scale (1 = *strongly disagree*; 7 = *strongly agree*). At Time 1, pupils were asked to consider their experience in PE since the start of the school year to obtain an overview of the

variables prior to the start of pre-service PE teachers' internship. At Time 2, pupils were asked to consider their experience during the pre-service PE teacher's internship.

2.2.1.1 Perceived motivational climate

Because some of the scales to measure the empowering motivational climate proposed by Milton et al. (2018) had borderline values of internal consistency (e.g., autonomy support: $\alpha=0.67$; five items; e.g., *My PE teacher gives pupils choices and options*; task involving: $\alpha=0.86$; nine items; e.g., *My PE teacher makes sure pupils feel good when they tried their best*; social support: $\alpha=0.65$; 3 items; e.g., *My PE teacher listens openly and does not judge pupils' personal feelings*) and because the task involving scale focused only on the competence support according to AGT (mastery climate), we combined these items with those used by Mastagli et al. (2022). Specifically, these items were separated in three subscales: autonomy support (five items; e.g., *The teacher encouraged us to say what we liked about the activities and content proposed*), relatedness support (three items, one of which was reversed; e.g., *The teacher was warm and affectionate with us*), and competence support (seven items) based on AGT (e.g., *The teacher proposed several exercises to take into account the differences in pupils' level of mastery task*) and SDT (e.g., *The teacher gave us detailed and adapted instructions so that everyone understood*). In doing so, internal consistency for each dimension reached better values with our sample (autonomy support T1: $\alpha=0.91$, $\omega=0.91$ and T2: $\alpha=0.90$, $\omega=0.91$; competence support T1: $\alpha=0.90$, $\omega=0.90$ and T2: $\alpha=0.95$, $\omega=0.95$;

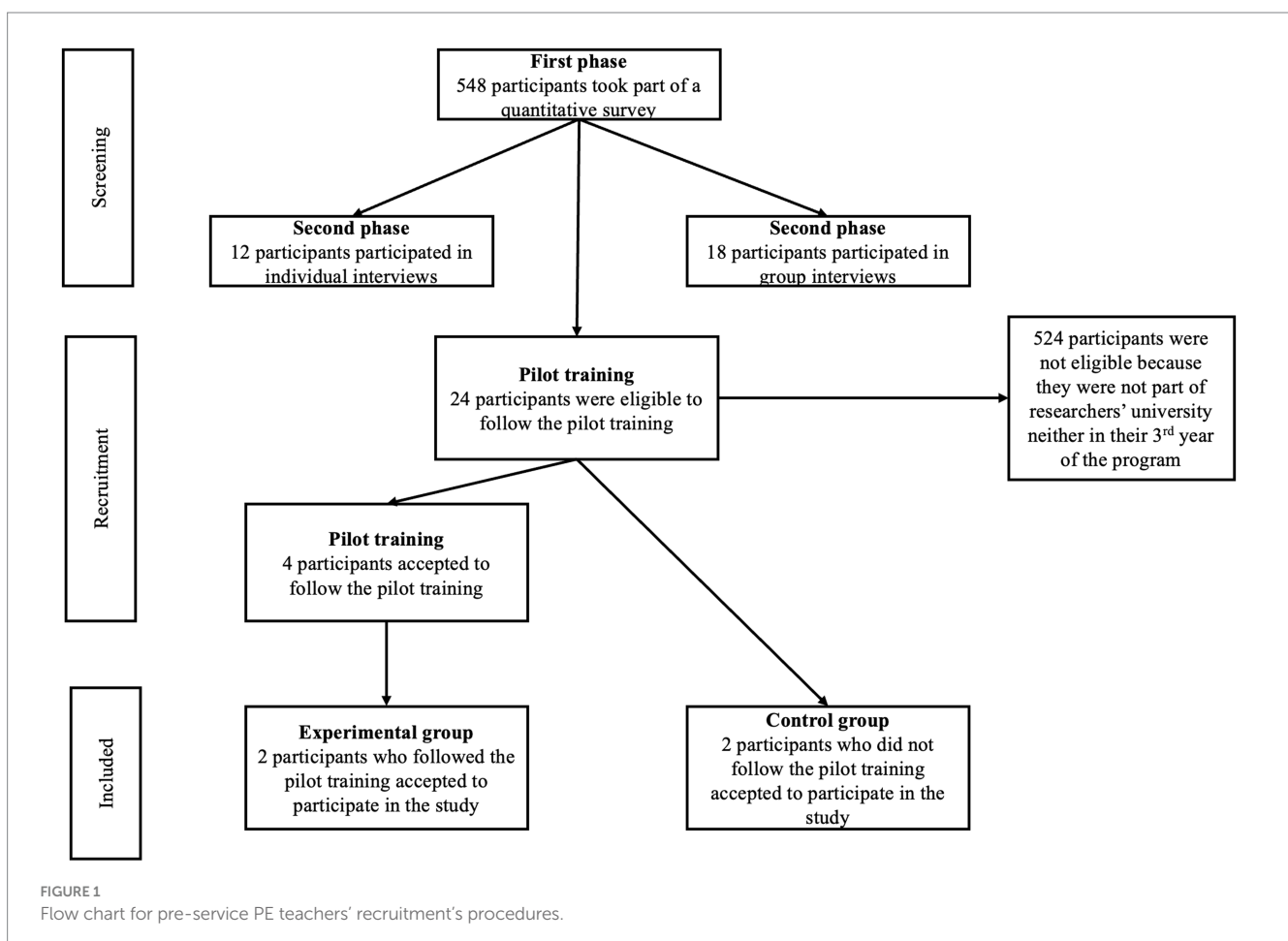
relatedness support T1: $\alpha=0.78$, $\omega=0.80$ and T2: $\alpha=0.87$, $\omega=0.87$). Besides, even if neither of these questionnaires used a specific scale to measure competence support regarding structure (SDT), which explains its absence in the results section, Mastagli et al. (2022) introduced some items specific to structure in the competence support dimension. Therefore, using a combination of these two questionnaires allows to get closer to the combination of SDT and AGT perspectives on competence support. Moreover, this variable was part of the observational grid, which allows for a more detailed analysis of the competence support through structure according to SDT.

2.2.1.2 Basic psychological needs' satisfaction

To measure the satisfaction of pupils' needs, we used the same three scales as Standage et al. (2003). The scale included five items for autonomy satisfaction (T1: $\alpha=0.72$, $\omega=0.69$ and T2: $\alpha=0.68$, $\omega=0.63$; e.g., *In my PE lessons, I have a say regarding what skills I want to practice*), five items for competence satisfaction (T1: $\alpha=0.79$, $\omega=0.80$ and T2: $\alpha=0.88$, $\omega=0.89$; e.g., *In my PE lessons, I think I am pretty good*), and also five items for relatedness satisfaction (T1: $\alpha=0.91$, $\omega=0.91$ and T2: $\alpha=0.90$, $\omega=0.91$; e.g., *In my PE, with other pupils, I feel supported*).

2.2.1.3 Achievement goals

To measure pupils' achievement goals, we used three scales from Riou et al. (2012). The scale consists of three items for mastery goals (T1: $\alpha=0.91$, $\omega=0.91$ and T2: $\alpha=0.87$, $\omega=0.87$; e.g., *In my PE lessons, my goal is to progress as much as possible*), three items for



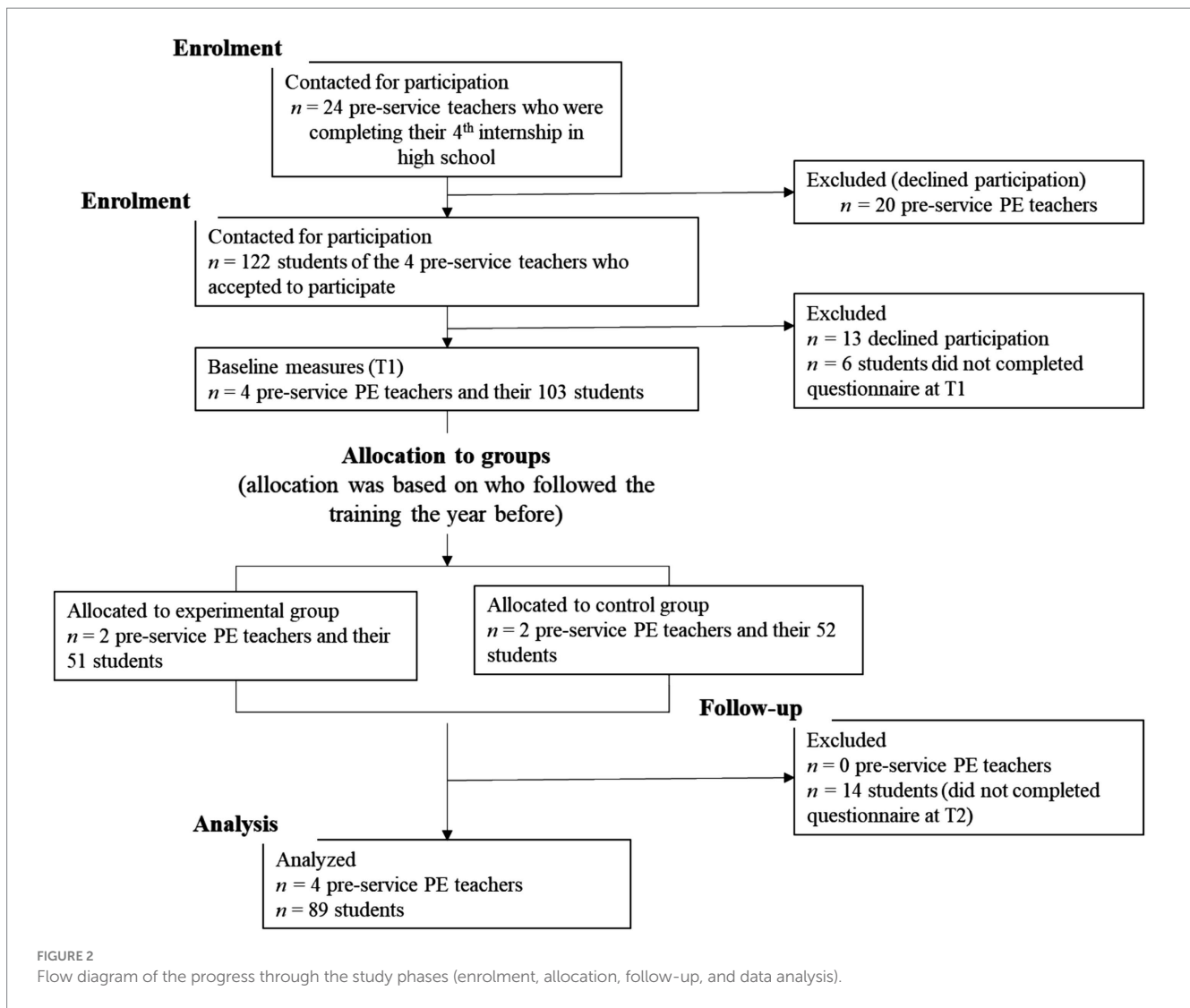


TABLE 2 Pupils' age and gender according to group (experimental and control).

Groups	Gender			Age M (SD)
	G N (%)	B N (%)	O N (%)	
Total sample	34 (38.2)	52 (58.4)	3 (3.4)	14.79 (1.24)
Experimental group (total) Secondary 1 and 3	19 (48.7)	19 (48.7)	1 (2.6)	14.15 (1.14)
Control group (total) Secondary 2 and 4	15 (30.0)	33 (4.0)	2 (4.0)	15.28 (1.09)

G, girls; B, boys; O, other.

performance-approach goals (T1: $\alpha=0.92$, $\omega=0.92$ and T2: $\alpha=0.92$, $\omega=0.92$; e.g., *In my PE lessons, my goal is to perform better than others*) and three items for performance-avoidance goals (T1: $\alpha=0.76$, $\omega=0.76$ and T2: $\alpha=0.67$, $\omega=0.71$; e.g., *In my PE lessons, my aim is to avoid performing worse than others*).

2.2.1.4 Motivation

Two questionnaires were used to measure all six types of motivation: the Behavioral Regulations in PE Questionnaire (BREPQ; Aelterman et al., 2012), which consists of five scales, and the BREQ-3 for the integrated regulation scale (Markland and Tobin, 2004; Wilson

et al., 2006). The scale consists of four items for amotivation (T1: $\alpha=0.91$, $\omega=0.91$ and T2: $\alpha=0.87$, $\omega=0.87$; e.g., *I do not see the point of this PE class*), four items for external regulation (T1: $\alpha=0.86$, $\omega=0.86$ and T2: $\alpha=0.84$, $\omega=0.85$; e.g., *I put effort in this PE class because I otherwise get criticized*), four items for introjected regulation (T1: $\alpha=0.74$, $\omega=0.75$ and T2: $\alpha=0.73$, $\omega=0.75$; e.g., *I put effort into this PE class because I would feel guilty if I did not*), four items for identified regulation (T1: $\alpha=0.91$, $\omega=0.91$ and T2: $\alpha=0.90$, $\omega=0.90$; e.g., *I put effort into this PE class because I value the benefits of this PE class*), four items for integrated regulation (T1: $\alpha=0.92$, $\omega=0.92$ and T2: $\alpha=0.90$, $\omega=0.90$; e.g., *I put effort into this PE class because it is*

consistent with my values), and four items for intrinsic motivation (T1: $\alpha=0.91$, $\omega=0.92$ and T2: $\alpha=0.92$, $\omega=0.92$; e.g., *I put effort in this PE lesson because this PE class is fun*).

2.2.1.5 Effort

To measure pupils' effort in PE, we used four items of the Intrinsic Motivation Inventory (McAuley et al., 1989), one of which was reversed (T1: $\alpha=0.83$, $\omega=0.83$ and T2: $\alpha=0.80$, $\omega=0.80$; e.g., *In my PE lessons, I try very hard*).

2.2.1.6 Intention to be physically active

To measure pupils' intention to be physically active outside PE, we used the scale validated by Dupont et al. (2009). Pupils were asked to indicate how closely the following five statements match their current reality (T1: $\alpha=0.93$, $\omega=0.93$ and T2: $\alpha=0.90$, $\omega=0.90$; e.g., *I often do sport in my free time*).

2.2.2 Observed measures

To proceed to the codification of observations, temporal boundaries were first identified according to the phases of the PE lesson: preparation phase (teacher welcomes pupils and provides instructions about tasks and learning), realization phase (pupils are engaged in learning activities and teacher supervises and provides feedback), integration phase (teacher concludes the tasks and discusses what was learned during the lesson) and gaps (transitions between the phases of the lesson: team creation, equipment management, team rotation). In other studies using similar grids, researchers used 10–15 min intervals to code the lesson (Haerens et al., 2013; Smith et al., 2015). In the present study, however, we used temporal boundaries in keeping with Girard et al. (2023a) because this allowed us to limit coding times in order to code based on expectations for each phase of the lesson.

2.2.2.1 Observed motivational climate

To observe the motivational climate implemented by participants, we employed the procedure and grid developed by Girard et al. (2023a), consisting of 33 empowering motivational strategies and 13 disempowering strategies. Among the 33 empowering motivational strategies, seven referred to autonomy support (e.g., *Teacher provides rationale for requests and constraints*), eight to competence support in terms of mastery (AGT; e.g., *Teacher emphasizes task-focused positive competence feedback*), eight to competence support in terms of structure (SDT; e.g., *Teacher gives an overview of content and structure of the lesson*) and 11 to relatedness support (e.g., *Teacher engages in noninstructional conversation with pupils*). Of the 13 disempowering motivational strategies, three referred to control (autonomy-frustration; e.g., *Teacher uses extrinsic rewards*), three to a performance climate (competence frustration in AGT; e.g., *Teacher encourages rivalry between pupils*), three to chaos (competence frustration in SDT; e.g., *Teacher gives few or no explanations or they are imprecise*) and four to relatedness frustration (e.g., *Teacher uses sarcasm*). Specifically, two observers coded all the lessons to ensure the fidelity of the observation scores. To proceed, coders ranked each dimension of the motivational climate for each phase of the lesson from 0 (*not at all*) to 7 (*very strong*). At the end of each observed lesson, observers assigned a score for each phase of the lesson for each dimension of an empowering and a disempowering motivational climate. The

median score was then calculated for each phase, and the median score of all median scores was calculated to provide an empowering score and a disempowering score for the entire lesson.

2.2.2.2 Observation of pupils' engagement

To observe pupils' engagement during pre-service PE teachers' internship, an observation grid was created consistent with those of Reeve et al. (2004) and Aelterman et al. (2012). Observers coded pupils' engagement using a bipolar scale from 1 (*indicators of disengagement*) to 7 (*indicators of engagement*) for 15 observable elements. More specifically, the preparation and integration phases consisted of four observable elements given that during these phases, pupils are usually listening, while their teacher is speaking (e.g., 1 = *Pupils do not ask questions*; 7 = *Pupils ask several questions*). The realization phase consisted of five observable elements (*Pupils put no effort into activities and exercises*; 7 = *Pupils put great effort into activities and exercises*). Finally, gaps consisted of two observable elements (e.g., 1 = *Pupils' behavior interferes with the lesson*; 7 = *Pupils' behavior does not interfere with the lesson*). To establish the observation scores, observers considered both the intensity of pupils' behaviors and the proportion of pupils performing these behaviors. In other words, a high score indicates that a majority of the observed pupils were doing the behavior at a high intensity. To ensure the fidelity and validity of codification, two observers coded all the lessons together.

2.3 Analysis

After verifying the scales' internal consistency, we calculated composite scores for each variable. Descriptive statistics were then calculated at both measurement times, and data were screened for non-normality. Because some variables displayed non-normal distributions and the number of pre-service PE teachers was small, non-parametric tests were used (Cleophas and Zwinderman, 2016). The Mann–Whitney test for independent samples was employed to verify if the scores between the EG and CG were statistically different at each measurement time (objectives 1 and 3). The Wilcoxon signed rank test for related samples was used to verify changes between the start and end of the internship for each group (EG and CG; objective 2). As regards observation scores, because the sample consisted of only four pre-service PE teachers, trends up to 0.15 were also interpreted to avoid type 2 errors (i.e., concluding that scores are not significantly different when in fact they are), as was done by other researchers (Smith et al., 2016; Smith et al., 2017; Wahl-Alexander et al., 2017; Girard et al., 2023a).

3 Results

At Time 1, there were no significant differences between the EG and CG, indicating that both groups were equivalent at the start of the study. At Time 2, there were four significant differences between groups: the perception of a mastery climate ($p=0.012$), of autonomy support ($p=0.01$) and of relatedness support ($p=0.001$) was higher in the experimental group, while pupils' autonomy need satisfaction was higher in the control group ($p=0.009$). Table 3 displays means and standard deviations for the total sample for each measurement time and each group.

TABLE 3 Mean, standard deviation, and significant differences between the two measurement times for each group.

	Total sample	EG	CG
	M (SD)	M (SD)	M (SD)
Autonomy support T1	5.51 (1.10)	5.40 (1.22)	5.59 (1.00)
Autonomy support T2	5.13 (1.21)	5.56 (0.87)	4.81 (1.33)***
Mastery climate T1	5.77 (0.98)	5.68 (1.04)	5.84 (0.92)
Mastery climate T2	5.27 (1.14)	5.66 (0.87)	4.98 (1.24)***
Relatedness support T1	5.75 (1.05)	5.74 (1.24)	5.77 (0.89)
Relatedness support T2	5.05 (1.44)	5.69 (0.85)	4.55 (1.62)***
Autonomy T1	4.55 (1.27)	4.14 (1.27)	4.87 (1.19)
Autonomy T2	4.38 (1.23)	4.06 (1.18)	4.64 (1.22)
Competence T1	5.33 (1.27)	5.10 (1.49)	5.52 (1.06)
Competence T2	5.12 (1.36)	5.08 (1.53)	5.15 (1.22)*
Social relatedness T1	4.94 (1.62)	4.88 (1.84)	4.99 (1.44)
Social relatedness T2	4.85 (1.51)	4.78 (1.69)	4.89 (1.37)
Mastery goals T1	5.93 (1.35)	5.97 (1.40)	5.90 (1.32)
Mastery goals T2	5.78 (1.32)	5.60 (1.48)	5.92 (1.18)
Performance-approach goals T1	4.14 (2.03)	3.79 (1.98)	4.42 (2.04)
Performance-approach goals T2	3.65 (2.11)	3.26 (1.84)*	3.95 (2.27)*
Performance-avoidance T1	4.72 (1.71)	4.29 (1.84)	5.05 (1.53)
Performance-avoidance T2	4.65 (1.78)	4.50 (1.78)	4.77 (1.79)
Intrinsic motivation T1	5.71 (1.57)	5.55 (1.65)	5.67 (1.53)
Intrinsic motivation T2	5.59 (1.42)	5.50 (1.48)	5.65 (1.39)
Identified regulation T1	5.26 (1.67)	5.23 (1.74)	5.29 (1.64)
Identified regulation T2	5.37 (1.47)	5.37 (1.58)	5.37 (1.39)
Integrated regulation T1	4.90 (1.85)	4.57 (1.89)	4.97 (1.56)
Integrated regulation T2	4.85 (1.68)	4.70 (1.83)	4.53 (1.60)
Introjected regulation T1	4.29 (1.61)	4.00 (1.59)	4.28 (1.42)
Introjected regulation T2	4.31 (1.48)	4.34 (1.56)	2.79 (1.69)
External regulation T1	2.54 (1.57)	2.22 (1.35)	2.79 (1.69)
External regulation T2	2.90 (1.71)	2.89 (1.75)**	2.91 (1.70)
Amotivation T1	2.72 (1.89)	2.34 (1.68)	3.02 (2.00)
Amotivation T2	2.76 (1.71)	2.66 (1.92)	2.83 (1.54)
Effort T1	5.61 (1.31)	5.73 (1.27)	5.51 (1.35)
Effort T2	5.55 (1.24)	5.55 (1.26)	5.54 (1.24)
Intention to be physically active T1	5.34 (1.74)	5.04 (1.90)	5.59 (1.59)
Intention to be physically active T2	5.43 (1.54)	5.24 (1.75)	5.58 (1.35)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; EG, experimental group; CG, control group.

The Wilcoxon signed rank test scores revealed two significant differences for the experimental group: pupils' adoption of performance-approach goals decreased at Time 2 ($p = 0.045$), while their external regulation was higher at Time 2 ($p = 0.007$). As for the pupils in the control group, five significant differences were observed: pupils' perception of a mastery climate ($p = 0.000$), autonomy support ($p = 0.000$) and relatedness support ($p = 0.000$) decreased along with their competence need satisfaction ($p = 0.027$) and their adoption of performance-approach goals ($p = 0.047$).

Table 4 displays observation scores for empowering and disempowering motivational climates for each phase of the lesson and for the total lesson for both groups. There were no significant differences between groups. However, there was a positive trend ($p \leq 0.15$) for the observed empowering motivational climate during the preparation ($p = 0.102$) and realization ($p = 0.121$) phases of the lesson: scores tended to be higher in the EG.

Table 5 displays observation scores for pupils' engagement for each phase of the lesson and for the total lesson for both groups. There were no significant differences between groups. However, there was a positive trend ($p \leq 0.15$) for observed engagement during the integration phase ($p = 0.121$) as well as for the total lesson ($p = 0.121$): pupils' engagement tends to be higher in the CG.

4 Discussion

Students' engagement in PE is declining once they begin high school (Noetel et al., 2023), and this issue is anticipated by pre-service PE teachers (de Guise et al., 2024). To help them create an empowering motivational climate, the *Learning how to motivate* training was designed to complement teachers' initial training (de Guise and Girard, 2023). The present study aimed to evaluate its effects on pupils' perceived motivational climate, basic psychological needs, motivation, achievement goals, effort and intention to be physically active during pre-service PE teachers' final high school internship as well as its effects on observed motivational climate and pupils' engagement.

4.1 Main findings and implications for practice

To begin, results show that before the start of the internship, pupils from both groups displayed high levels (> 5.00) of a perceived mastery motivational climate, autonomy and relatedness support, competence need satisfaction, mastery goals, intrinsic motivation, identified regulation, effort and intention to be physically active. These scores suggest that pupils were already fairly motivated and engaged in their PE courses before pre-service PE teachers arrived in their gymnasium. The scores for observed engagement were also quite high in both groups, which aligns with these results. These findings are encouraging insofar as high school pupils are generally considered to be little engaged in PE (Noetel et al., 2023) and less engaged in physical activity outside school than younger pupils (ParticipACTION, 2020; ParticipACTION, 2022).

At the end of the internship, however, some differences between groups emerged regarding perception of the dimensions of an empowering motivational climate (mastery, autonomy and relatedness support), which were higher in the EG. These differences can be explained by the decline of these three variables for CG pupils. The dimensions of the motivational climate were perceived as less empowering by CG students at the end of the internship, which was not the case for the EG group; this suggests that the training enabled pre-service PE teachers to maintain an empowering motivational climate that pupils perceived as such. These results align with those of previous studies focused for the most part on autonomy support (Cheon et al., 2012; Cheon and Reeve, 2013; Aelterman et al., 2014) and are quite promising in terms of the relevance of *Learning how to*

TABLE 4 Observed scores for motivational climate.

	P		R		I		G		Total	
	M	Mdn	M	Mdn	M	Mdn	M	Mdn	M	Mdn
Empowering motivational climate										
EG	3.69	4.00	4.79	5.50	0.88	0.50	1.67	1.00	2.76	2.50
CG	2.50	2.00	3.38	3.00	1.25	1.25	1.38	1.50	2.12	1.75
Disempowering motivational climate										
EG	0.38	0.25	1.50	0.75	0.33	0.00	0.85	0.00	0.77	0.13
CG	1.50	1.25	1.13	0.75	0.50	0.25	0.75	0.25	0.97	0.50

M, mean; Mdn, median; EG, experimental group; CG: control group; P, preparation; R, realization; I, integration; G, gaps; Total, total lesson; minimum, 0; maximum, 7.

TABLE 5 Observed scores for pupils' engagement.

	P		R		I		G		Total	
	M	Mdn	M	Mdn	M	Mdn	M	Mdn	M	Mdn
EG	3.58	4.00	4.55	4.50	2.50	3.00	5.38	5.75	4.00	4.25
CG	4.57	5.00	3.95	4.00	4.75	6.25	5.89	6.25	4.79	5.63

M, mean; Mdn, median; EG, experimental group; CG: control group; P, preparation; R, realization; I, integration; G, gaps; Total, total lesson; minimum, 1; maximum, 7.

motivate for improving pre-service PE teachers' ability to implement an empowering climate. Even more so, considering the findings of [Honrubia Montesinos et al. \(2023\)](#) stating that professional development is linked to pupils' motor skill development in PE.

Furthermore, the fact these significant results did not emerge from observations, contrary to those of previous studies ([Cheon et al., 2012](#); [Cheon and Reeve, 2013](#); [Aelterman et al., 2014](#); [Girard et al., 2023a](#)) could be explained by the small study sample. With a larger sample, these results might have reached statistical significance, as suggested by the positive trends ($p \leq 0.15$) observed for the preparation and realization phases of the lesson. In addition, coding observations relative to each phase revealed that pre-service PE teachers in the EG were more empowering during these phases than those in the CG. During the integration and gap phases of the lesson, however, participants were less empowering, which affected the score for the entire lesson. The fact pre-service PE teachers were not yet teaching "experts" could explain why they had more difficulty being empowering during transitions between activities: it is possible the teachers were more preoccupied with classroom management and organizational activities (moving material, installing equipment, etc.) than with supporting pupils' motivation. Indeed, to avoid the appearance of disturbing behaviors, these gaps should be kept as short as possible ([Girard et al., 2023a](#)). As for the integration phase (which occurs mainly at the end of the lesson), it is recognized as an ambiguous phase often overlooked by in-service PE teachers, and this despite its importance in the learning process ([Girard et al., 2023a](#)). Thus, it is hardly surprising that pre-service PE teachers had difficulties being empowering during this phase of the lesson. This is especially reflected in the low observed score for EG pupils' engagement during the integration phase, which tended to be lower than for the CG. Accordingly, some improvements are needed to specifically address ways to implement empowering motivational strategies during gaps and integration phases. Focusing on specific parts of the lesson was in fact recommended in a previous study (preparation phase; [Van den Bergh et al., 2016](#)). To this end, the content of *Learning how to motivate* could be reinvested in courses

on the planning of learning situations. For example, teacher trainers could explicitly state how content they have already discussed regarding planning for each phase of the lesson can also be used to help sustain pupils' motivation. Additionally, given that EG participants took the training almost a year before their internship without follow-up, reinvesting some of the training content in other theoretical and practical courses could certainly improve pre-service PE teachers' ability to create an empowering motivational climate. This is consistent with the findings of [de Guise et al. \(2024\)](#), which highlight pre-service teachers' needs for more coherence and continuity during their training and suggests that results may have been more conclusive if there had been follow-up to consolidate learning in other courses of the teacher program.

Finally, there may be different reasons for the decrease in the pursuit of performance-approach goals in both groups. According to AGT, pupils are inclined to adopt goals consistent with the perceived motivational climate ([Ames and Archer, 1988](#); [Blais et al., 2020](#)). The high perception of a mastery climate in the EG may thus explain why pupils were less inclined to pursue performance-approach goals. As for the CG pupils, the decrease in the pursuit of performance-approach goals adoption may be explained by a reduced competence need satisfaction, an important determinant of these types of goals. Indeed, according to AGT, pupils who feel they are less competent than their counterparts are more inclined to pursue performance-avoidance goals ([Lochbaum et al., 2020](#)). However, studies involving more pre-service PE teachers are needed to verify these hypotheses.

4.2 Limitations and future lines of research

A few limits need to be considered when interpreting results. First, this pilot study included a small number of pre-service PE teachers from the same university, which can be explained by the post-pandemic context. Moreover, students from high schools were selected according to the internship placement from the university.

This limit may therefore have introduced a selection bias. Additional studies involving a higher number of pre-service PE teachers from different universities are needed to verify if our results can be replicated. Moreover, the fact pupils were already quite motivated at the start of the study does not seem representative of high school pupils in PE (ParticipACTION, 2020; ParticipACTION, 2022). Again, a broader sample of pupils from multiple backgrounds would be necessary to generalize our results. Moreover, even though precautions were taken when giving instructions to students (e.g., answer according to your own opinion, there are no right or wrong answer) and setting the context for completing questionnaires (e.g., asking the pre-service PE teacher to be out of the gym during the completion, being available to respond to students' questions during completion), using self-reported questionnaires with students may introduced bias, such as social desirability. To help compensated this aspect, it is advisable to also collect observational data, which provide an objective point of view. Finally, we did not assess pupils' perception of the dimensions of the disempowering motivational climate. Given that observation scores for the dimensions of the disempowering motivational climate were quite low and those for an empowering climate were high, it is reasonable to believe pupils' perceptions would be consistent with these results. However, this choice was made because the questionnaire items currently available to measure these dimensions tend, in our view, to be confrontational (e.g., *My PE teacher yells at pupils for messing up; My PE teacher shouts at pupils in front of others to make them do certain things; Milton et al., 2018*), and there was a concern participants would withdraw if pupils were questioned using these items.

5 Conclusion

In conclusion, results are quite promising in terms of the effectiveness of the *Learning how to motivate* training for translating theory into practice. Results indeed suggest that pre-service PE teachers can be helped to create an empowering motivational climate, perceived as such by pupils, at the completion of their initial training through the teaching of explicit motivational strategies.

Data availability statement

The datasets presented in this article are not readily available because of ethical considerations. Requests to access the datasets should be directed to SG, stephanie.girard3@uqtr.ca.

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Ethics statement

The studies involving humans were approved by the Comité d'éthique de la recherche avec des êtres humains de l'Université du Québec à Trois-Rivières. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

Author contributions

SG: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. A-Ad: Formal analysis, Investigation, Methodology, Project administration, Supervision, Validation, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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