Journal of Education and Learning; Vol. 12, No. 5; 2023
ISSN 1927-5250 E-ISSN 1927-5269
Published by Canadian Center of Science and Education

A Pedagogical Strategy Applied in Physical Education to Encourage Sustainable Physical Activity

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Received: April 30, 2023 Accepted: June 13, 2023 Online Published: June 29, 2023

doi:10.5539/jel.v12n5p13 URL: https://doi.org/10.5539/jel.v12n5p13

Abstract

It is known that the practice of physical activity (PA) drops off drastically in late adolescence, during the transition to adulthood, leading to a deterioration in physical fitness among post-secondary students. Given the importance of the consequences of physical inactivity, interventions aimed at the sustained adoption of sufficient PA practice must be developed. The objective of this study is to evaluate the impact of a pedagogical strategy based on the question-behavior effect (QBE) implemented in the final post-secondary physical education and health (PEH) course and that capitalizes on the benefits derived from PA. An iterative, self-reflective exercise involving the personal benefits derived from PA practiced in PEH class was tested among 496 students (mean age: 19.10 [SD: 2.42]) from 15 post-secondary institutions and divided into three groups: self-reflection on benefits and on PA practiced (Group A; n = 152), self-reflection on PA practiced (Group B; n = 142), no self-reflection (Group C; n = 210). Two measurements of weekly PA practiced outside the school setting were taken: one week before the start of the final semester of PEH, and then six months after the end of that semester. In particular, the results indicate that PA practice outside of school increased among participants in Group A and that the proportion of students who were inactive at Time 1 who became active at Time 2 was higher in Group A. Thus, it appears that repeated awareness of the personal benefits of practicing PA in PEH class promotes engagement in PA done outside of class.

Keywords: benefits of physical activity, pedagogical strategy, physical education and health, question-behavior effect, longitudinal study

1. Introduction

In Quebec, post-secondary education refers to the college level (first level) and the university level (second level). Colleges, called CEGEPs in the public sector, offer technical programs leading to the labor market, as well as pre-university programs (Ministère de l'Éducation et de l'Enseignement supérieur [MEES]), 2021]. Nearly half of the Quebec population aged 25 to 64 has a Diploma of College Studies (Institut de la statistique du Québec, 2020). In addition, all students enrolled in a college program are required to take and pass three physical education and health (PEH) courses in order to graduate from college. These courses are part of the general education that aims to foster socially responsible citizens, ones that have a healthy and active lifestyle (MEES, 2016). Specifically, the last of these three courses is designed to have the students demonstrate the ability to manage their PA practice with health in mind (MEES, 2016, p. 30). This last compulsory PEH course in the Quebec school system is thus the last opportunity for any pedagogical influence on young adults' autonomy in adopting a healthy PA practice.

Furthermore, the success rate for this last PEH course is 95% (Ministère de l'Éducation du Québec, 2020), indicating that students have demonstrated their ability to manage their PA practice. Paradoxically, this is not what is observed outside the school context, despite the 13 years of compulsory PEH courses completed before this final college course. For example, Leriche and Walczak (2014) observed that 37.2% of their sample of 1886 college students spent less than 10 minutes of PA per week outside of class. Similarly, several authors report a drastic decrease in PA practice at the end of adolescence, during the transition to adulthood (Ahmad et al., 2021; Castro et al., 2020; Poriau & Delens, 2017; Statistics Canada, 2021a; Wilson et al., 2021) as well as a deterioration of physical fitness among students (Chiasson, 2004; Lemoyne & Girard, 2018; Leone et al., 2023). Although students who take a PEH class do more PA than those who do not (Lemoyne, 2012), once all required

PEH courses are completed, there is a significant decrease in PA practice (Poriau & Delens, 2017).

For adults aged 18 to 64 years, the World Health Organization (WHO, 2021) recommends a minimum of 150 minutes of moderate-intensity endurance activity, or a minimum of 75 minutes of high-intensity endurance activity per week for health benefits. However, it is clear that a significant portion of the world's adult and adolescent population is not following PA recommendations: 27% of adults and 80% of adolescents are not active enough to reap said health benefits (WHO, 2019). In Canada, 50.8% of adults and 70% of adolescents aged 12 to 17 years do not follow the recommendations for PA practice (ParticipACTION, 2020; Statistics Canada, 2021b).

Too little PA practice can have serious repercussions. In fact, sedentary behavior (sitting) is considered one of the leading causes of death worldwide, making it a global scourge (WHO, 2018, 2020) and, therefore, a public health issue. Among Canadians aged 18 to 79, an average of 10 hours per day, outside of sleep, is spent in sedentary behaviors (Statistics Canada, 2015), and this number may have increased since the COVID-19 pandemic (Cheval et al., 2020; Hall et al., 2021; Institut national de la santé publique du Québec [INSPQ], 2020), resulting in numerous physical and mental health risks (Karakose, Yirci, & Papadakis, 2021). For example, with regard to physical health, physical inactivity leads to overweight and obesity rates that are expected to reach between 21% and 26% in Quebec by 2030 (Lo et al., 2014), leading in turn to other health problems. Sedentary behavior is also linked, among other things, to cardiovascular disease (Hall et al., 2021; Pandey et al., 2016), to type 2 diabetes (Biswas et al., 2015), and to certain types of cancer (Biller et al., 2021; Schmid & Leitzmann, 2014). With regard to mental health, sedentary behavior is associated with a higher risk of depression (Zhou et al., 2023), anxiety (Allen et al., 2019) and indicators of psychological distress such as low self-esteem, feelings of loneliness, and high levels of stress, among others (Hoare et al., 2016).

Faced with this problem of physical inactivity (insufficient PA practice to derive health benefits), it is essential to intervene with young adults to get them to concretely take charge of their health, because acquiring healthy lifestyle habits between the ages of 15 and 29 can influence lifestyle and health throughout adulthood (Gouvernement du Québec, 2015; WHO, 2012). In this way, PEH classes appear to be an appropriate place to intervene because in addition to being compulsory, they make it possible to reach young people from various social backgrounds by offering opportunities to practice PA in physical places that are conducive to it, including access to human and material resources (Trost & Loprinzi, 2008; van Sluijs et al., 2021). Consequently, this study aims to develop and evaluate a possible pedagogical solution to the problem of physical inactivity observed among college students. It is also hoped that this possible solution will have a positive influence on the independent practice of PA, i.e., even after the end of the PEH academic path. This study is unique in that its application and its longitudinal design can be incorporated into postsecondary PEH courses.

2. Theoretical Framework

2.1 Determinants of Physical Activity

Determinants of PA refer to factors that influence PA practice. Facilitators of PA practice include motivation, enjoyment, perceived competence in PA practice, benefits derived from PA practice, and a positive attitude toward PA (Cabot & Surprenant, 2022; Chen & Wang, 2017; Couture-Wilhelmy et al., 2021; Nahas et al., 2003). Conversely, barriers to PA practice may include perceived lack of time, lack of motivation, cost related to sports infrastructure, or social influences (Cabot & Surprenant, 2022; Hilger-Kolb et al., 2020; Leriche & Walczak, 2014; Martins et al., 2021; Wilson et al., 2021). Furthermore, some authors make a distinction between determinants that are internal and external to the individual (Rosselli et al., 2020; Zelenović et al., 2021).

Among the determinants of independent PA practice, enjoyment—the main component of situational interest—should be the focus of educational interventions encouraging the adoption of regular PA practice (Caplette-Charette et al., 2023; Chen & Wang, 2017; Grenier, 2006; Lemoyne, 2012; Leriche & Walczak, 2016; Lewis et al., 2016; Martins et al., 2015; Roure & Pasco, 2017, 2018). Moreover, in a sample of low-activity adults (n = 448), Lewis and collaborators (2016) measured which of two important predictors, perceived enjoyment, or self-efficacy, influenced PA behavior more. Their results show that enjoyment is a stronger and more direct predictor of PA than self-efficacy. Furthermore, these authors recommend developing interventions that focus on the enjoyment of movement to engage individuals in PA practice. For their part, Roure and collaborators (Dieu & Roure, 2022; Roure & Pasco, 2018, 2022) focus on the enjoyment experienced during PA in a PEH context to stimulate student engagement in PEH and in PA practice. The researchers underline the importance of considering the personal characteristics and interests of students when organizing pedagogical situations, to lead to student engagement. With this in mind, Bradette and Cabot (2022) organized evaluation situations for college students in PEH by allowing them to choose the PA on which they would be evaluated,

based on their personal PA preferences. This strategy led to greater engagement in PA practice even outside the school setting. Lemoyne (2012), at the end of his study in post-secondary PEH, also recommends developing pedagogical interventions that emphasize affective dimensions, including enjoyment.

With a view to helping solve the problem of physical inactivity, an international team (van Sluijs et al., 2021) thoroughly reviewed the literature on intervention strategies related to the social environment, urban utilitarian environments, and the school context. As the social environment of adolescents becomes increasingly digital, its positive influence on PA is being questioned, especially as there is a lack of information on the types of social support relevant to young adults. However, urban environments organized to facilitate play and walking, as well as means deployed to encourage active transportation, are solutions identified as having interesting potential for increasing PA among young adults. Finally, the authors point out that the difficulties of implementing the interventions attempted in the school context are a major obstacle to their success. However, in-class interventions have a better effect than out-of-class ones. For example, outdoor PE classes that foster a motivational climate focused on learning rather than competition seem to be a good idea.

2.2 The Benefits of Physical Activity

It is well recognized that regular PA practice provides many long-term and overall health benefits (INSPQ, 2015; Liao et al., 2014; Public Health Agency of Canada [PHAC], 2023; WHO, 2018), that include, among other things, a decrease in the risk of developing cardiovascular disease, type 2 diabetes, osteoporosis, obesity, and certain cancers (Benedetti et al., 2018; Canadian Society for Exercise Physiology, 2020; Ozemek et al., 2018; Sun et al., 2014; Tomkinson et al., 2017; WHO, 2019). In terms of mental health, PA can prevent and treat depressive and anxiety disorders (Dimeo et al., 2001; Dunn et al., 2001; Wolf et al., 2021), foster social integration (Armstrong and Oomen-Early, 2009; Valois et al., 2004), decrease psychological distress (Hoare et al., 2016), and be associated with positive self-esteem (Gilani & Dashipour, 2017; Schmalz et al., 2007).

In a more perceptible way in the short term, the practice of PA promotes a sense of well-being (INSPQ, 2015), allows in particular for a better management and reduction of stress (Biddle & Asare, 2011; De Nys et al., 2022; Marconcin et al., 2022), improves concentration, sleep, body image (Levy & Ebbeck, 2005; PHAC, 2018), feelings of self-efficacy and competence (Levy & Ebbeck, 2005; Strauss et al., 2001), and improves mood (Chan et al., 2019; Hogan et al., 2013; Kino-Québec, 2000; Kritz-Silverstein et al., 2001; Peluso & Andrade, 2005). A recent study indicates that the personally perceived and attributed benefits of PA are the primary reason for PA practice cited by active students (Cabot & Surprenant, 2022). Thus, benefits are also major determinants of PA. An intervention aimed at integrating PA into lifestyle could therefore build on these. In fact, more than 15 years ago, Grenier (2006) suggested that ways be found to make students aware of the benefits of regular PA practice.

Grenier (2006) published the results of a study conducted with 1047 college students to learn about their past experiences with the benefits of PA. Among these, the enjoyment felt during the activity, the reduction of stress, and the fact of feeling proud to be active are among the benefits most reported by the participants in the study (Grenier, 2006). As part of this same study, she interviewed 17 college students who had become active. The contents of the interviews indicate that, from the students' point of view, for PA practice to become a habit, emotional conditions such as motivation and enjoyment felt during PA are involved. The development of a pedagogical intervention could therefore aim to act on these elements: enjoyment, stress, and pride.

In addition, Doré and colleagues (2016) conducted a study exploring the links between PA and mental health in young adults with a sample of 1527 college students in Quebec. The authors note that youth in transition to adulthood have poorer mental health, including more anxiety and depressive symptoms, than their elders. In fact, a study of 12 208 college students revealed that 17.4% of them feel *a great deal of* or *enormous* distress and 35.1% experience anxiety *often* or *all the time* (Gosselin & Ducharme, 2017). Moreover, these difficulties may have been exacerbated by COVID-19 (Karakose, Yirci, & Papadakis, 2021). Also, 65.4% of the college students surveyed (n = 11 894) by the Fédération des cégeps (Gaudreault et al., 2018) reported needing help controlling their stress. Among the results of Doré's (2016) study, a negative association between PA and these symptoms was reported. Considering the beneficial effects of PA on mood (Hogan et al., 2013) and on stress management (Nguyen-Michel et al., 2006), these two could also be targeted in the development of a strategy that builds on the benefits of PA.

2.3 The Question-Behavior Effect on Physical Activity Practice

Some researchers have relied on the principle of the question-behavior effect (QBE) to change or bring about a certain behavior (Dholakia, 2010; Godin, 2011, 2012; Wilding et al., 2019). Ennis (2017) states that interventions that seek to engage the student through awareness transform the passive student into an active one, both cognitively and physically. Indeed, answering questions about one's own behavior can lead to the adoption

of that behavior (Miles et al., 2020; Spangenberg et al., 2016). In addition, the application of the QBE as an intervention is simple, quick, and inexpensive (Wilding et al., 2019). This method, which first appeared more than 30 years ago in the field of social psychology, has become widespread, particularly in health psychology (Kwasnicka et al., 2017; Rodrigues et al., 2015; Wilding et al., 2019). The QBE on health-related behaviors, appears to be quite real (Cohen's $d = 0.20$) and robust under different methodological conditions (Rodrigues et al., 2015). Some even consider it a potential bias, in the experimental evaluation of interventions not based on the QBE, if the target behavior is increased by questioning participants in addition to the intervention itself (McCambridge, 2015; Miles et al., 2020). In work specifically on physical inactivity, researchers have used the QBE technique to intervene and have shown that by answering personal questions related to a desired behavioral change, the likelihood of adopting that change is increased (Amireault, 2013; Chandon et al., 2011; Conner et al., 2010; Godin, 2012; Sandberg & Conner 2011). Godin (2012) recommends that this be done by having individuals comment on their personal behavior rather than on general, impersonal behavior (p. 20).

Reviews of the literature (Spangenberg et al., 2016; Wilding et al., 2016) reveal different theoretical rationales that could explain QBE. One explanation is based on the concept of attitude. The characteristics associated with an object by the individual form a positive or negative representation of the object (e.g., PA) resulting in a favorable or an unfavorable attitude toward that object. This attitude influences behavior. Being questioned about a behavior would activate the individual's attitude about that behavior, which would then influence the performance of the questioned behavior. A second explanation concerns the cognitive dissonance that the respondent would try to avoid by adjusting their behavior to coincide with their answers to questions about it. Another explanation is based on a motivational rationale. Being asked about a behavior would activate an intention that would motivate the person to engage in that behavior. The findings of the meta-analysis by Spangenberg et al. (2016) provided predictive weight to each of these theoretical rationales by investigating their respective effects on different moderating variables involving questioning characteristics (e.g., answering methods such as by computer versus pencil and paper, or question type such as prediction versus intention questions) and behavioral characteristics (e.g., respondent's personal well-being behavior versus other types of behavior, or self-reported versus observed behaviors). The results did not rule out any of these explanations, all of which potentially contribute to explaining the QBE.

Studies on behavioral prediction routinely ask participants about their cognitions related to the behavior (e.g., intention, self-evaluation, attitude, beliefs) to then measure their ownership of said behavior (Vézina-Im, 2016). Moreover, in QBE, questioning the cognition related to the behavior appears to be more effective than questioning the behavior itself (Wilding et al., 2016). In this sense, questioning the utility attributed to the behavior could be wise. Utility represents a cognitive assessment of the compatibility between a task and the person's intended goals (Bouffard et al., 2006). For a behavior to be considered useful, its contribution to the goal must be perceived by the individual (Jacobs & Eccles, 2000) and this connection must be personal (Hulleman & Harackiewicz, 2020). These authors explain that for a behavior to be motivating, students themselves must make the connection between the perceived benefits of that behavior and their personal needs, rather than being told or taught why they should value that behavior. This principle has been tested more than once by Hulleman's team (2010, 2017). Thus, by acting pedagogically in such a way that students perceived learning as useful to themselves, their performance in relation to that learning was superior to that of a control group. This principle is transferable to the case of the present study. By focusing students' cognitive attention on personally derived benefits of PA, their PA practice could be positively influenced. The present research team found no literature aimed at stimulating PA practice that focused on the QBE through questioning to reflect on the personal benefits of PA practice.

2.4 Objective of This Study

A review of the literature on QBE-based intervention strategies to increase PA practice was conducted. The research team found no specific research findings that specifically involved a post-secondary PEH pedagogical strategy that focused on increasing awareness of the benefits of PA to increase out-of-school practice. This absence contributes to the pertinence of this study. The objective of this study was to evaluate the impact of a PEH pedagogical strategy based on an iterative, self-reflective exercise involving the personal benefits of PA practice on college students' management of their PA practice outside of class. The iterative, self-reflective exercise represents the pedagogical application of the QBE to be tested. PA behaviors and cognitions (self-evaluation of personally experienced benefits) will be questioned through this pedagogical exercise.

3. Method

3.1 Pedagogical Devices Implemented

Three pedagogical devices were implemented in the final college PEH course so that their effectiveness on the dependent variable, out-of-class PA practice, could be compared.

Device A consisted of filling out a table (see Figure 1) at each PEH class, the right-hand side of which reported the number of minutes of PA for the week, the nature of these PAs and their intensity, while distinguishing between those done in the course and those done outside the course. On the left side of the table, students in this group (Group A) were asked to complete two Likert-type items prior to the start of the PEH class, aimed at self-assessing their stress level and mood in the present moment. Then, at the end of the same PEH class, these students were asked to respond again to the same two items on stress and mood felt in the present moment, in addition to two other items: one aimed at self-assessing the enjoyment they had felt during the PA session, the other targeting the pride of having moved. At the end of the semester, in the last class, Group A students were asked to make a general observation: they were instructed to look at what they had circled in the weekly charts for the semester and formulate a reflection based on that. To be included in the sample, participants had to have completed at least 6 of the 11 tables in order to account for some student or teacher absences from PEH classes.

Circle your level of stress, mood, enjoyment, pride
AT THE BEGINNING OF THE CLASS **STRESS:** Not at all = 0, A lot = 10 **0 1 2 3 4 5 6 7 8 9 10** **MOOD:** Very bad mood = 0, Very good mood = 10 **0 1 2 3 4 5 6 7 8 9 10**
AT THE END OF THE CLASS **STRESS:** Not at all = 0, A lot = 10 **0 1 2 3 4 5 6 7 8 9 10** **MOOD:** Very bad mood = 0, Very good mood = 10 **0 1 2 3 4 5 6 7 8 9 10** Did you **ENJOY** moving? Not at all = 0, A lot = 10 **0 1 2 3 4 5 6 7 8 9 10** Are you **PROUD** of yourself for moving? Not at all = 0, Very proud of myself = 10 **0 1 2 3 4 5 6 7 8 9 10**

AT THE BEGINNING OF THE CLASS		
Physical activities from last week until today	***Duration (min.)***	***Intensity (to be circled)***
Outside of class (just for me).		
-	Min.	low/moderate/high/very high
-	Min.	low/moderate/high/very high
-	Min.	low/moderate/high/very high
As homework for class:		
-	Min.	low/moderate/high/very high
-	Min.	low/moderate/high/very high
-	Min.	low/moderate/high/very high
AT THE END OF THE CLASS		
During today's class:		
-	Min.	low/moderate/high/very high
-	Min.	low/moderate/high/very high
-	Min.	low/moderate/high/very high

Figure 1. Iterative, self-reflective exercise involving benefits and physical activity practiced during the week

Device B consisted of filling out a table on only the PA practiced during the week. Therefore, the answer sheet received by these students contained only the right side of Table 1, which was centered on the sheet so that these students would not have the self-reflection exercise targeting the benefits. At the end of the semester, in the final class, Group B students were also asked to make a general observation based on what they had circled in the weekly tables over the course of the semester. Like Group A, Group B participants were required to have completed at least 6 of the 11 tables for the semester.

Device C consisted of participating in the PEH course normally, without exposure to either of the two methods testing for the QBE.

3.2 Participants and Procedures

Since a follow-up six months after the end of the last PEH course was planned, it was expected that there would be some difficulty in reaching participants, many of whom would likely have graduated by then. For this reason, no recruitment limit was set at baseline. In April 2021, a description of the project was distributed to PEH teachers in all Quebec colleges. As a result, 35 teachers of the last PEH course expressed interest in collaborating in the study, giving the research team access to their class groups for recruitment of student participants during the 2021–2022 school year. Students in the Fall 2021 semester cohort and the Winter 2022 semester cohort were approached to participate during their first class of the PEH course. In all, 1697 students signed the consent form and completed the General Information Questionnaire (GIQ) for this study.

Next, these students were exposed to one of the three pedagogical scenarios described in the previous section for 11 weeks of class. Of the 35 teachers, 11 had class groups assigned to Group C. Of the other 24 teachers, the documents for devices A and B were randomly distributed among the students at the first meeting of the semester. Each student identified their document with a pseudonym to ensure confidentiality, as teachers were responsible for storing the envelope of documents for each class group between weekly PEH classes. Each student retrieved their document at the beginning of each class to provide pre- and post-class data until the end of the semester.

Six months after the end of each of the two semesters (i.e., June 2022 for the Fall 2021 cohort and December 2022 for the Winter 2022 cohort), a short post-course follow-up questionnaire was emailed or texted to participants. After three reminders (email, text, or phone call), 496 participants from 15 post-secondary institutions provided longitudinal follow-up data. Figure 2 shows the recruitment flow based on the three groups to be compared. The sample that participated in the two measurement periods is therefore composed of these 496 people (mean age: 19.10 [SD: 2.42]), consisting of 176 men and 318 women). Table 2 provides a general description of the participants based on their distribution in the three groups to be compared.

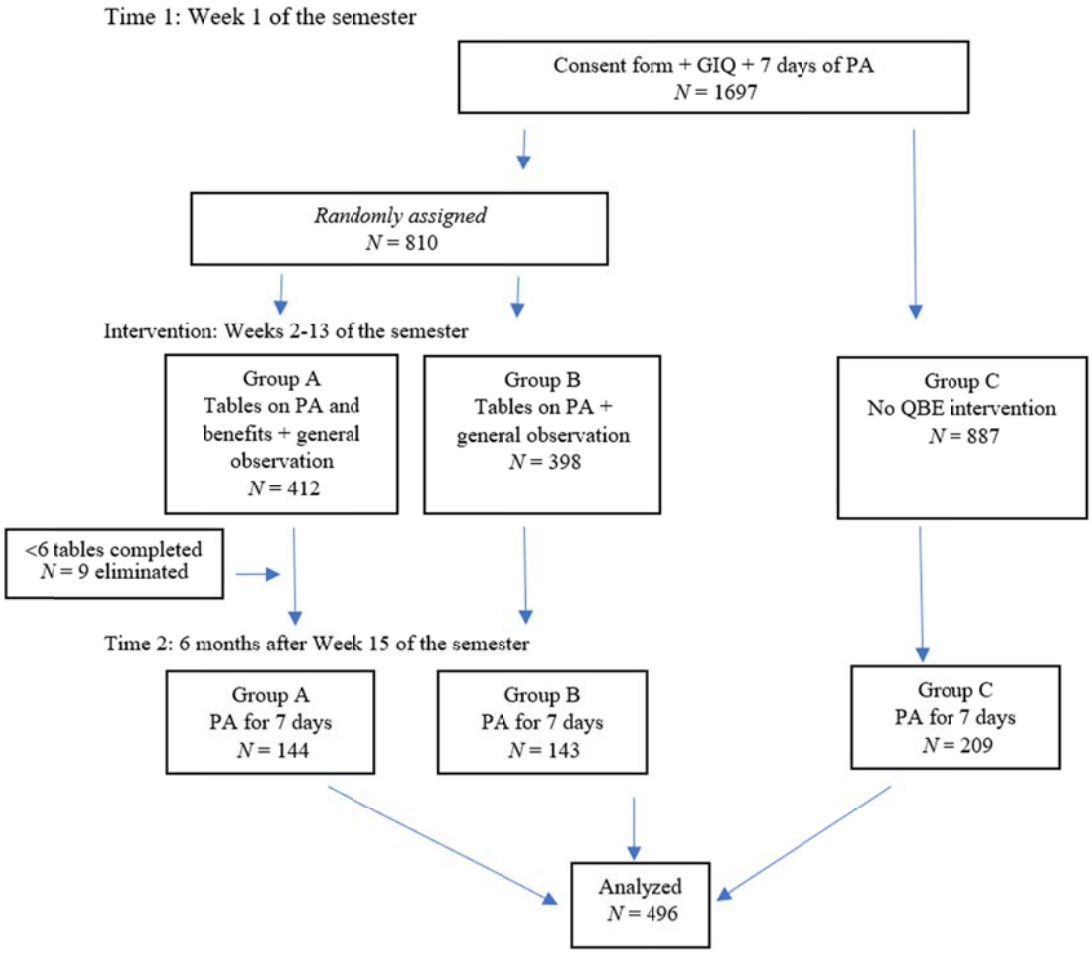

Figure 2. Participant recruitment flow diagram

Table 1. General description of the three subsamples to be compared

	Group A (*N* = 144)	**Group B** (*N* = 143)	**Group C** (*N* = 209)	**ANOVA (F)**
How many hours of class per week do you have on your schedule?	22.66 (6.76) *N* = 140	22.87 (7.38) *N* = 137	23.26 (8.05) *N* = 197	*F*(2471) = .29 *p* = .75
How many hours a week do you spend on your studies outside of class?	13.28 (8.93) *N* = 139	12.61 (7.70) *N* = 142	10.36 (7.03) *N* = 201	*F*(2479) = 6.66 *p* = .001
If paid employment, how many hours per week?	13.59 (5.68) *N* = 104	14.68 (5.62) *N* = 113	15.01 (5.91) *N* = 164	*F*(2378) = 2.00 *p* = .14
Currently, would you say you have an interest in physical activity in general? (4-point Likert scale)	2.01 (.83) *N* = 143	2.06 (.78) *N* = 141	1.98 (.76) *N* = 209	*F*(2490) = .45 *p* = .64
How many hours a day do you usually spend in front of a screen:				
A) For your school or professional obligations	3.78 (2.47*)* *N* = 142	3.88 (4.23) *N* = 141	3.60 (2.45) *N* = 206	*F*(2486) = .35 *p* = .70
B) In your spare time	3.88 (2.60) *N* = 143	3.80 (2.77) *N* = 141	4.04 (2.29) *N* = 206	*F*(2487) = .41 *p* = .66
Number of weekly minutes of PA practiced before the start of the semester	346.13 (420.23) *N* = 144	356.01 (479.15) *N* = 143	440.59 (726.90) *N* = 209	*F*(2493) = 1.44 *p* = .24
The World Health Organization recommends at least 150 minutes of moderate-intensity physical activity or at least 75 minutes of vigorous physical activity per week. Over the next three months, do you intend to follow these recommendations? (4-point Likert scale)	3.24 (.91) *N* = 144	3.36 (.71) *N* = 141	3.29 (.76) *N* = 209	*F*(2491) = .91 *p* = .40

It can be seen that the three groups are similar at the outset, except for the number of hours spent on studies outside of class. It should be noted that the last question presented in Table 1, on the intention to practice PA, including a reminder of the WHO recommendations (2021), was posed to all participants. This question could have a QBE, but because it was posed to all three groups, this potential bias (McCambridge, 2015) will not be considered in the assessment of the pedagogical intervention.

In addition, using variance analysis, participants were compared to non-participants at Time 2 in each of the three groups and on the basis of the variables contained in Table 2. No differences were found except for the number of minutes spent on studies outside of class for Group A, with non-participants spending 11 hours. The data for this variable was examined but no aberration was found. Furthermore, in each of the three groups, participants were similar to non-participants at baseline.

3.3 Data Collection Instruments

The GIQ, administered at the first PEH class immediately after the consent form was signed, collected information to describe the sample, as presented in Table 1. A table describing the PA practiced during a typical week was also appended to obtain data on the number of minutes, nature, and intensity of PA before the start of the PEH semester (Table 1 in Cabot & Surprenant, 2022). The follow-up questionnaire administered six months after the end of the semester contained the same weekly PA practice description table as the GIQ, as well as the same question about intention to practice PA (see Table 1), allowing for a comparison of these data outside of the PEH context.

3.4 Analysis

To attain the objective of this study, the main analysis provided for was the analysis of variance (ANOVA) using repeated measurements of the variable *Number of minutes of weekly PA*, describing a typical week before the start of the last PEH class, as well as six months after the end of that semester (both measurements not influenced by the context of a PEH class). However, the raw data were transformed prior to this analysis to incorporate moderate and high-intensity activities into a single variable. The number of minutes spent in high-intensity activity was multiplied by two and then added to the number of minutes spent in moderate-intensity activity. Thus, the variable *Number of minutes of weekly PA* includes moderate and high-intensity activities done outside of a semester of PEH classes. As a complement to the main analysis, chi-square was calculated on the intention to participate in PA at Time 2, based on the belonging group.

4. Results

The objective of this study was to evaluate the impact of a pedagogical strategy based on an iterative, self-reflective exercise involving the personal benefits of PA practice on college students' management of their PA practice outside of class. Three pedagogical devices were compared, as described in Section 3.1. The results of the repeated-measures ANOVA and chi-square tests conducted are presented in Table 2.

Table 2. Descriptive data from Time 2 by group and test results

Variable	Group A (N = 144)		Group B (N = 143)		Group C (N = 209)		Value of F *Effect size* (η^2_p)		
	Time 1	Time 2	Time 1	Time 2	Time 1	Time 2	Time	Group	Time X Group
Average number of minutes of PA practiced weekly	346.13 *(420.23)*	393.65 *(416.02)*	356.01 *(479.15)*	189.48 *(193.72)*	440.59 *(726.90)*	226.96 *(296.43)*	20.06*** *.04*	2.39 *.01*	10.48*** *.04*
Number of participants who increased their PA practice	92 (63.88%)		48 (33.57%)		68 (32.54%)		^{2}(4) = 42.20***		
Number of positive status changes (Time 1: inactive + Time 2: active)	30 (20.83%)		14 (9.79%)		19 (9.09%)		^{2}(4) = 27.35***		
…Over the next three months, do you intend to follow these recommendations?	No: 2 (1.39%) Probably not: 28 (19.44%) Yes, maybe: 36 (25%) Yes: 78 (54.17%)		No: 8 (5.63%) Probably not: 24 (16.90%) Yes, maybe: 63 (44.37%) Yes: 47 (33.10%)		No: 7 (3.38%) Probably not: 43 (20.77%) Yes, maybe: 63 (30.43%) Yes: 94 (45.41%)		^{2}(6) = 20.42**		

Note. **p < .01; ***p < .001.

There was a difference in the average number of minutes of PA between the two measurement times in the three groups. However, this difference was positive only for Group A. Overall, the effect of the belonging group on the difference in the number of minutes of PA practiced weekly outside of the school setting was highly significant (p < .001) although its effect size was modest (η^2_p = .04).

To fine-tune the interpretation of these results, and given the large standard deviations observed in the three groups, a more individualized descriptive analysis was conducted. Thus, the *Difference in minutes* variable was obtained with the subtraction: *Number of PA minutes Time2 - Number of PA minutes Time1*, and then recoded into the categorical variable *Increase in PA* or *Decrease in PA* or *No change in PA*, directly revealing individuals who increased or decreased their number of minutes of PA between the two measurement times (45 participants reported no change in the number of minutes of PA). A chi-square test was performed on this variable and on the belonging group variable. Table 2 shows these results.

These results were then presented to PEH teachers who collaborated in the study. A skeptical reaction was noted and a question emerged from their reaction: What proportion of these participants showing an *Increase in PA* were inactive at the start of the semester and then became active after it ended? Since the ultimate objective of the study (and of the teachers) was to fight sedentary lifestyles and physical inactivity, the answer to this question appeared to be crucial. Consequently, a categorical (active/inactive) variable was created for both measurement times, based on the WHO recommendations and the average number of minutes of weekly PA reported by the participants: An "active" status represents 150 minutes or more of PA, and an "inactive" status represents less than 150 minutes. Next, changes in status were identified in three categories: *Positive change in status*, *Negative change in status*, or *No change in status* (342 [67.7%] participants had no change in status). A chi-square test was performed on this variable and the belonging group variable. The results are presented in Table 2.

Finally, the same intent question as the one contained in the GIQ was asked six months after the end of the intervention. The data presented in Table 2 indicate a greater intention of Group A to follow the WHO recommendations for PA practice.

5. Discussion

The objective of this study was to evaluate the effect of a pedagogical device based on an iterative, self-reflection exercise involving the personal benefits of PA practiced in a PEH class on college students' post-course management of their PA practice. Three pedagogical devices, implemented as part of the final course of the PEH pathway, were compared. One of them was composed of participants (Group C) taking their PEH class without any particular condition. This was the pedagogical device used as the basis for comparison. Another device consisted of participants (Group B) who recorded weekly PA. The purpose of the survey was to replicate the basic QBE, i.e., to question a behavior and observe possible changes in that behavior. The final device consisted of participants' (Group A's) weekly record of PA and an assessment of the effect of PA practiced in PEH on four benefits felt in the present moment: stress, mood, enjoyment, and pride in having moved. This group represented the *Increased* QBE. Post-course follow-up found a clear increase in independent PA practice, i.e., outside the context of PEH classes, among Group A participants only. These results suggest that an awareness of the personal benefits of PA practice promotes autonomous engagement in this behavior.

5.1 Consciously Attribute the Benefits Experienced to the PA Practiced

By the time they start their last college PEH course, all Quebec students have taken and passed 13 years of mandatory PEH courses during which they have studied the benefits of PA. Consequently, they know them. In fact, active students mainly explain their PA practice by the benefits they get from it (Cabot & Surprenant, 2022). However, the reverse is not seen among inactive students: they do not explain their physical inactivity by the uselessness or lack of benefits of PA. With this in mind, one could ask if they had ever experienced any benefits associated with PA. Studying benefits theoretically or experiencing them personally may have different consequences for behavioral engagement or for the ability to consciously explain that engagement or disengagement. Thus, building on the awareness of the personal benefits of PA practice appears to be a coherent and justified strategy to implement in order to integrate PA into the lifestyle of initially inactive students.

This rationale is consistent with Grenier's (2006) recommendation that steps be taken to make students aware of the benefits of regular PA practice. Specifically, to bring the benefits of PA to life for students, she suggested that an experiential approach [could] be offered by attempting to make the students aware of the benefits of regular physical activity (p. 60). In the study by Cabot and Surprenant (2022), the benefits reported by active students went beyond instant gratification. Consequently, the present study intended to focus the attention of Group A students on other possible benefits. These could therefore be emotional in nature for those who realized that they enjoyed moving. Others could be more cognitive in nature, such as realizing that their stress levels decreased following a PA session, or that their overall mood improved with PA practice. They also focused on their self-esteem by asking them to rate their level of personal pride in having moved. Thus, four benefits were used, allowing for awareness of instant enjoyment, as proposed by Roure's team (Roure & Pasco, 2017, 2018) or attributing utility to PA for benefits derived from it (stress, general mood, self-esteem), as inspired by the work of Hulleman's team (2010, 2017).

The results provide two main contributions to the literature in the fields of PEH and Health and to the literature on the QBE: (1) the relevance of looking beyond the behavior to be performed due to QBE, through an awareness of the benefits derived from that behavior; (2) the relevance of pairing benefits from the PEH context with those of the QBE.

5.2 Contribution of the Benefits of the Questioned Behavior to the Question-Behavior Effect

First, the results in Table 2 indicate at the outset that going beyond the behavior being questioned by having participants reflect on the benefits of that behavior is a sound strategy. Indeed, although the baseline QBE (Group B) led to a less drastic decrease in PA than the control group, Group A represents the only device that led to an increase in PA outside the school setting, as well as an increase in the intention to follow WHO recommendations for PA practice. These results are in line with those of Wilding et al. (2019), who compared the QBE to a "dissonance-enhanced QBE condition" by inducing a state of discomfort in participants with regard to their inactivity, by emphasizing the importance of being active to be healthy. There is a body of literature that would expect a decline in PA time as various social roles and responsibilities begin or expand in early adulthood (Hilger-Kolb et al., 2020; Richard, 2022; Wilson et al., 2021). In this context, the results of Group A show great potential. There are various ways to understand these results.

The literature on attitudes suggests that asking questions about the benefits of the targeted behavior can contribute to a positive representation of the behavior, leading to a favorable attitude toward it (Albarracin et al., 2005). These authors explain that the characteristics attributed to a behavior form this cognitive representation of the behavior leading to the attitude. In this study, this suggests that the four questions on benefits led the majority

of the sample to view benefits as positive characteristics of personally experienced PA, contributing to a positive representation of PA and possibly a favorable attitude toward the behavior. To explore this hypothesis, it would be instructive to analyze the content of respondents' overall reflections at the end of the intervention to see if they actually expressed recognizing the benefits of PA for themselves.

Other literature attributes the QBE to avoidance of the cognitive dissonance that questioning could lead to (Spangenberg et al., 2016, Wilding et al., 2016). Could this phenomenon have occurred in participants who, week after week, saw benefits from PA? One could think that, under these circumstances, remaining inactive might elicit the discomfort of dissonance, leading the person to move, so as to restore personal consistency between the benefits attributed to PA and the PA behaviors. Cooper (2019) explains that the three important features of the concept of dissonance are "that (1) it is experienced as discomfort, (2) it propels people to take action and (3) people feel more comfortable after the action has been taken" (p. 3). Moreover, McGrath (2017) states that one dissonance reduction strategy is behavior change.

As for the motivation-based explanation of the QBE, it suggests that by asking students about the benefits they received from PA, an intention to do it was activated, with that intention leading to the behavior (Spangenberg et al. 2016). The findings of Study 4 by Van Kerckhove et al. (2012) indicate that when an intention develops, by keeping the intention active, such as by maintaining contact with information related to that intention, the intention persists, deepens, and resists behaviors that would be contradictory to it. In the case of this study, by repeating the questioning of PA and its benefits over several weeks, the effect on intention and behavior was able to crystallize and lead to the sustained practice of the behavior. Moreover, the increase in the intention expressed by the participants between the two measurement times points in this direction.

5.3 The Question-Behavior Effect in Physical Education and Health

Pairing the benefits of the QBE with those of the PEH context seems appropriate. Indeed, although the results of the present study indicate that the intervention had a modest effect size, the cost/benefit ratio of the intervention concerning public health could be significant (Wutzke et al., 2001). First, it is very inexpensive, requiring only one or two sheets of paper per student to print the 11 tables and space to formulate the general observation afterwards. Second, the *Increased* QBE intervention in this study requires less than two minutes of student time and is conducted during the PEH class, facilitating participation by more students than if it were scheduled outside the gym. With regard to teachers, the intervention requires minimal involvement on their part. This may counteract the implementation difficulties reported by van Sluijs et al. (2021). In this case, the sole responsibility of the teachers of Groups A and B was to collect the sheets containing the tables (see Section 3.1) in an envelope for each class group and bring this envelope to class weekly from Week 2 to Week 13 so that students could complete one table per week and then formulate an overall reflection at the end of the semester. Participating teachers appreciated the fact that their teaching habits were not changed by the intervention. It is indeed very difficult to bring about a change in practice in post-secondary education, where teachers have a great deal of professional autonomy (St-Germain & Labillois, 2016). Finally, because PEH classes are mandatory, all students are exposed to them regardless of socioeconomic status or interest in PA. In addition, the QBE is greater with students than with other sample types (Wilding et al., 2016). With approximately half of the adult population of Quebec holding a college degree (Institut de la statistique du Québec, 2020), this represents a significant pool of individuals who could be exposed to pedagogical intervention. Consequently, the effectiveness of an intervention in this context can be seen at the public health level.

5.4 The Question-Behavior Effect: Side Effects?

The objective of the present study was to increase "Do PA" behavior. However, it is questionable whether asking participants about more than just the targeted behavior, by also targeting benefits related to that behavior, may have had an effect beyond the targeted behavior alone. For example, it is known that the prevalence of symptoms related to depression and anxiety is very high among post-secondary students (Doré, 2016; Gaudreault et al., 2018; Gosselin & Ducharme, 2017). Because the positive influence of PA on mental health is well documented, one could already hypothesize that an intervention such as the one tested in the present study may have had an effect on mental health, through the increase in PA found. However, the literature on QBE clearly indicates a direct effect between questioning and the behavior questioned. Consequently, it would be interesting to explore the potential direct effect between questioning mood and stress and symptomatological indicators related to depression or anxiety. The QBE may be larger than the behavior being questioned when the questions indirectly address that behavior, such as, in the case of this study, the benefits derived from that behavior.

6. Conclusion

It is recognized that PA practice drops during the transition to adulthood, which can lead to impacts on overall

health. The findings of this study indicate that the pedagogical intervention tested is promising because it reversed the negative PA trend typically observed. In addition, a significant proportion of Group A participants who were considered inactive one week before the final semester of PEH became active six months after the end of that semester. Consequently, raising students' awareness of the benefits of their own PA practice (mood, stress, enjoyment, pride) to increase engagement in PA practice seems to meet the needs of these students.

While the findings of the present study help deepen knowledge of pedagogical strategies that promote engagement in independent PA practice, some limitations must be considered. First, one of these limitations concerns student self-reported PA practice. Although this PA data collection tool is easy to use, and was used in the same way in the three groups compared, it has some biases related to the accuracy of statements that may vary (Ekelund et al., 2011). In addition, respondents may be victims of social desirability and overestimate their PA practice. The use of accelerometers provides more reliable data on PA use, but it would have been expensive and difficult to implement this method of data collection in the context of this study.

Furthermore, the literature on the QBE indicates that the effect of this pedagogical intervention should be studied on the mental health of college students, since the questions asked dealt with mental health issues. In addition, this intervention could be tested in the context of high school PEH classes with adolescents for health prevention purposes. Moreover, since school attendance is compulsory until the age of 16, this pedagogical measure could have positive effects on the health of a significant proportion of the population.

Acknowledgements

This study was funded by the Ministère de l'Enseignement supérieur under the Programme d'aide à la recherche sur l'enseignement et l'apprentissage (PAREA). In addition, the preparation of this article benefited from a financial contribution from the Ministère de l'Enseignement supérieur under the Programme d'aide à la diffusion des résultats de recherche (PADRRC).

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