

# Effects of Teacher's Teaching Style in Physical Education on Moderate-to-Vigorous Physical Activity of High-School Students: an Accelerometer-based Study

Zahra Chaharbaghi<sup>1\*</sup>, PhD;  Tayebeh Baniasadi<sup>2</sup>, PhD; Saeed Ghorbani<sup>1</sup>, PhD

<sup>1</sup>Department of Physical Education, Islamshahr Branch, Islamic Azad University, Islamshahr, Iran

<sup>2</sup>Visiting Scholar, Indiana University, School of Public Health, Department of Kinesiology, USA

\*Corresponding author: Zahra Chaharbaghi, PhD; Department of Physical Education, Islamshahr Branch, Islamic Azad University, Islamshahr, Iran. Tel: +98 9151000469; Email: z.chaharbaghi@gmail.com

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## Abstract

**Background:** Doing physical activity (PA) regularly is connected with better physically and psychologically state among adolescents. The objective of this survey was to enquire the effects of teaching style in physical education (PE) in schools on motivation and objective PA of adolescent-students.

**Methods:** This survey employed a cross-sectionally descriptive-correlational manner and was done in Tehran, Iran in 2020. 384 adolescent boys and girls (mean age of 15.76 years-old) participated in the study. Modern accelerometers (ActiGraph GT3X-BT) were used to objectively assess PA, and conventional questionnaires were used to evaluate other factors (autonomy support, needs fulfillment, and intrinsic motivation). We used the Pearson correlation test and structural equation modeling to evaluate the data.

**Results:** Boys (39.68 minutes per day) had significantly higher amount of moderate-to-vigorous physical activity (MVPA) than girls (31.73 minutes per day). Autonomy support was significantly correlated with needs satisfaction ( $r=0.483$ ,  $P<0.001$ ) and motivation ( $r=0.583$ ,  $P<0.001$ ). Motivation was also significantly associated with PA. Moreover, autonomy support significantly influenced needs satisfaction ( $T=6.394$ ) and intrinsic motivation ( $T=5.749$ ) in PE class and subsequently the intrinsic motivation created in PE was significantly conveyed to the intrinsic motivation to PA in leisure time ( $T=5.209$ ). Finally, intrinsic motivation in leisure-time has significantly influenced MVPA ( $T=9.587$ ).

**Conclusions:** These findings demonstrate importance of teaching style in physical education class to motivate students for engaging in physical activity in leisure time. These outcomes are very crucial for physical educators.

**Keywords:** Autonomy, Motivation, Physical education, Physical activity, School

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## 1. Introduction

Regular physical activity (PA) is associated with positive consequences including better physical competency and strength, better self-confidence, lower risk of cardiovascular disease, diabetes, cancer, osteoporosis, as well as lower risk of obesity and related illnesses (1-6). Nevertheless, research showed that modern lifestyle has led to a tendency for people to lead a sedentary life, and this trend is also evident in children and adolescents (7-12). In this regard, studies indicated that a small percentage of boys and girls worldwide currently meet the World Health Organization (WHO) recommendations of doing at minimum 60 minutes of moderate-to-intense PA (MVPA) per day (10-15). Some research showed that Iranian boys and girls do not meet international guidelines on daily PA (16-20). It should be noted that in these studies, PA was assessed subjectively using

a questionnaire. However, due to the fact that there is a large difference in the time recorded for moderate-to-vigorous physical activity (MVPA) between the questionnaire and accelerometer tools in children (21), the accuracy of the questionnaire data to assess PA of children is questionable, and therefore, the use of accelerometers to assess PA behavior of children is essential.

School and especially sports and physical education (PE) in schools are also considered as a very important environment, because initially sports and PE in school has a very important role in the PA of youth, and secondly that one of the important goals of sports and PE in schools is to motivate youth to engage in PA outside of school. For many youths, the sports and PE in schools is a great opportunity for PA. However, a review of 44 studies showed that children in elementary schools, regardless of age or gender, spent only one-third

of their time on MVPA (22). These results were also confirmed for children in Switzerland (23). However, PA in schools accounted for only 17% of the total PA of children (24). These findings indicate the important contribution of PE in schools to the total PA of youth. Thus, it seems important to investigate the factors within PE lesson which can affect engagement of children in sport and PA.

A previous study examined a conceptual model in which, supporting the sense of autonomy in PE class has positive effects on intrinsic motivation in PE class; it consequently has positive effects on intrinsic motivation and engagement in PA in leisure time (25). Thus, PE teachers who support students' autonomy are more likely to increase intrinsic motivation and persistence in PA out of school. The structures of this conceptual model are mostly adapted from the theory of self-determination (26-28). According to this theory, behavior can be caused by four types of motivation that are in a continuum from completely internal motivation to completely external motivation. This continuum is referred to as the "source of perceived causality" and is a reflection of the relative degrees of autonomy perceived by the individual. Previous studies showed that supporting autonomy support in PE class can increase satisfaction of the basic psychological needs and motivation in the class (16-18, 20, 22-23). However, role of teaching style (e.g., based on autonomy support) in motivating school-students for engaging in objectively-measured PA has been rarely investigated. Therefore, present study was designed to: 1) measure PA pattern of high-school students with considering gender differences, and 2) examine the effects of teaching style (e.g., based on autonomy support) in PE on motivation and PA behavior of high-school students.

## 2. Methods

This survey employed a cross-sectionally descriptive-correlational manner and was done in Tehran, Iran in 2020. The protocol of this survey was reviewed and confirmed by institutional ethics committee with the code of IR.IAU.AK.REC.1398.001. The participants voluntarily attended in this survey and subscribed written notified consent.

The statistical sample of this study consisted of 384 high-school students (mean age of 15.76 years

old), including 192 male and 192 female students which were selected by using convenience sampling method. Inclusion criteria was being students in regular high-school without any physical or mental disabilities. Any students with any injuries or disabilities were excluded from the study. PA was measured objectively by the accelerometers ActiGraph wGT3X-BT. Accelerometers are small, non-encroaching, and easily-carried devices that measure the density, magnitude, and length of PA. ActiGraph accelerometers have high validity and reliability (29). Using this device, information about individuals' daily PA can be obtained. This device was installed on the right hip for seven days (i.e., one week). The data obtained from this device is analyzed by the relevant software. Perceived autonomy support in PE class was assessed through a 5-question scale (25), scoring on a Likert scale from completely disagree (1) to completely agree (7). In this survey, Cronbach's alpha coefficient for this scale was 0.84. Moreover, eight experts affirmed its validity (CVR=1.00, CVI=0.90). Basic psychological needs satisfaction in PE class was evaluated using the Basic Psychological Needs in Exercise Scale (BPNES) (30) consisted of 11 questions divided into three categories including autonomy, competence, and relatedness. Every item was evaluated based on a Likert scale from strongly disagree (1) to strongly agree (7). In this survey, Cronbach's alpha coefficient of the scale was 0.86. In addition, eight experts affirmed its validity (CVR=0.88, CVI=0.88). Intrinsic motivation in PE class and leisure-time were measured by using Intrinsic Motivation Scale (31) with eight questions, scoring on a Likert scale from completely disagree (1) to completely agree (7). In this survey, Cronbach's alpha coefficient of this scale was 0.91. Furthermore, eight experts affirmed its validity (CVR=1.00, CVI=1.00). For data analysis, we used mean and standard deviation as well as correlation test and structural equation method (by Lisrel software). Independent t-test was used to compare gender differences. The Kolmogorov-Smirnov test was used to check the normality of data. Significance level was considered at the level of 0.05.

## 3. Results

Demographic data including age, height, weight, and BMI of both genders are given in Table 1. As it can be observed, boys and girls are relatively similar in age and body mass index; however, boys were taller and heavier than girls.

**Table 1:** Demographic data of the participants

Variable	Boys	Girls	Comparison
Age (years)	15.17±1.97	15.74±1.28	t=0.967 P=0.210
Height (m)	1.58±0.12	1.49±0.09	t=1.013 P=0.096
Weight (kg)	56.54±9.08	50.47±7.23	t=2.761 P=0.001
BMI	18.67±1.69	18.43±1.51	t=0.857 P=0.134

**Table 2:** Mean and Standard Deviation of research variables as well as gender differences

Variables	Boys (n=192)		Girls (n=192)		Comparison
	Mean	SD	Mean	SD	
<b>Physical Activity Pattern</b>					
% Sedentary Behavior	65.07	2.39	69.93	2.51	t=2.117 P=0.023*
% Light PA	25.67	1.56	24.30	2.89	t=-0.681 P=0.293
% MVPA	9.26	0.98	5.77	1.12	t=2.937** P=0.008
Daily MVPA (minutes)	39.68	10.18	31.73	8.82	t=-3.547*** P<0.001
Perceived Autonomy Support	4.97	1.04	4.03	0.83	t=-2.138* P=0.018
<b>Need Satisfaction</b>					
Autonomy	4.55	0.95	3.94	0.94	t=-3.937*** P<0.001
Competence	4.28	1.06	3.67	1.04	t=-2.680** P=0.007
Relatedness	4.49	1.24	3.59	0.55	t=-4.558*** P<0.001
Intrinsic Motivation in PE	4.72	1.22	3.79	1.24	t=-6.551*** P<0.001
Intrinsic Motivation in LT	4.65	1.02	3.71	1.52	t=-5.937*** P<0.001

PA: Physical Activity; PE: Physical Education; LT: Leisure-time, MVPA: Moderate-to-vigorous physical activity

Moreover, the descriptive results of the research variables are given in Table 2. Initially, the results of normality test demonstrated that our data was normally distributed (all  $P > 0.05$ ). Regarding the students' PA pattern, it should be noted that both boys and girls had lower MVPA than recommended by the WHO (39.68 vs. 31.73 minutes per day for boys and girls, respectively). Here, boys had significantly higher amount of MVPA than girls ( $P < 0.001$ ). In light PA, we found no significant differences between boys and girls ( $P = 0.293$ ); however, girls were significantly more sedentary than boys ( $P = 0.023$ ). Regarding the perceived autonomy support, both boys and girls had above-average perception of autonomy support provided by their PE teacher. However, boys had significantly higher level of perception of autonomy

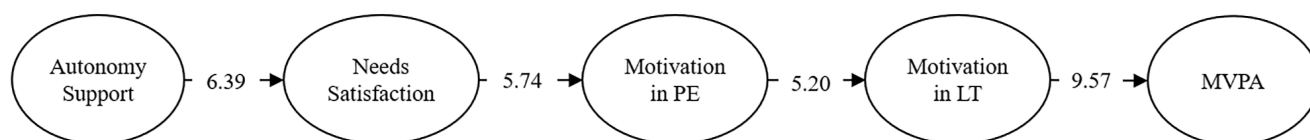
support than girls ( $P = 0.018$ ). In addition, scores for needs satisfaction were also above average, where boys had higher amount of satisfaction than girls (all  $P < 0.05$ ). Intrinsic motivation in PE and leisure-time were above average, too, for both boys and girls, and here, again boys were significantly more motivated than girls (both  $P < 0.001$ ).

To investigate the two-way correlations between the research variables, Pearson correlation coefficient was used, the results of which are as follows: 1) There was a significant association between perceived autonomy support and needs satisfaction ( $r = 0.483$ ,  $P < 0.001$ ), 2) There was a significant correlation between perceived autonomy support and intrinsic motivation in PE ( $r = 0.583$ ,  $P < 0.001$ ), 3) There was a significant

**Table 3:** Results of structural equation modelling

Path	$\beta$	T-value
1 Autonomy support => Needs satisfaction	0.539	6.394
2 Needs satisfaction => Intrinsic motivation in PE	0.497	5.749
3 Intrinsic motivation in PE => Intrinsic motivation in LT	0.461	5.209
4 Intrinsic motivation in LT => MVPA	0.760	9.578
	Z	P value
5 Autonomy support => Needs satisfaction => Intrinsic motivation in PE	5.596	P<0.001
6 Intrinsic motivation in PE => Intrinsic motivation in LT => MVPA	5.930	P<0.001

PE: Physical education; LT: Leisure-time; MVPA: Moderate-to-vigorous physical activity



**Figure 1:** The figure shows the structural equation modelling. PE: Physical education; LT: Leisure-time; MVPA: Moderate-to-vigorous physical activity

correlation between needs satisfaction and intrinsic motivation in PE ( $r=0.609$ ,  $P<0.001$ ), 4) There was a significant correlation between intrinsic motivation in PE and leisure-time ( $r=0.490$ ,  $P<0.001$ ), 5) There was a significant association between intrinsic motivation in leisure-time and MVPA ( $r=0.517$ ,  $P<0.001$ ).

The results of the structural equation modeling are given in Table 3 and Figure 1. The results showed that: 1) perceived autonomy support has a significant effect on needs satisfaction ( $T=6.394$ ), 2) Needs satisfaction has a significant effect on intrinsic motivation in PE ( $T=5.749$ ), 3) intrinsic motivation in PE has a significant effect on intrinsic motivation in leisure-time ( $T=5.209$ ), 4) intrinsic motivation in leisure-time has a significant effect on participation in MVPA ( $T=9.587$ ), 5) perceived autonomy support has a significant effect on intrinsic motivation in PE through needs satisfaction ( $P<0.001$ ), and 6) intrinsic motivation in PE has a significant effect on MVPA through intrinsic motivation in leisure-time ( $P<0.001$ ). Finally, our results revealed that the conceptual model has good fit ( $RMSEA=0.07$ ;  $X^2/df=2.84$ ;  $RMR=0.05$ ;  $NFI=0.96$ ;  $CFI=0.94$ ).

#### 4. Discussion

Previous research showed that teaching style in PE class has a positive effect on students' participation in PA (25). However, physical activity was measured using self-report questionnaires, the validity of which is questionable (21). Therefore, present study was designed to: 1) measure PA pattern of high-school students with considering

gender differences, and 2) examine the effects of teaching style (e.g., based on autonomy support) in PE on motivation and PA behavior of high-school students.

In relation to the first goal presented in this study, the results showed that boys accounted for 65.07% of the total time to sedentary, 25.67% to light PA, and 9.26% to MVPA, while girls spent 69.93% of the total time in sedentary, 24.30% in light PA, and 5.77% in MVPA. In addition, on average, the daily time spent in MVPA was 39.68 minutes for boys and 31.73 minutes for girls. These results showed that the adolescent-students in this study did much less than the recommended levels by the WHO (i.e., 60 minutes of MVPA per day). These results confirmed the findings of past studies (7-12, 16-20) and indicated a low level of PA in our sample. Given the many benefits of regular PA, there is a need to explore strategies and to adopt appropriate intervention exercises to enhance engagement in PA and exercise among adolescent students. In the meantime, strategies to create and increase motivation in children to participate regularly in PA can be of particular importance (17, 19).

Regarding gender differences in participation in PA, the results of this survey showed that boys participate significantly more than girls in MVPA. These results confirmed the findings of past studies (32-35). These findings showed that findings strategies to enhance PA in adolescents should focus mainly on PA in girls. In this regard, some studies suggested that fewer opportunities for PA and exercise at school, parental support, less participation in organized sports, and gender-

specific socialization in terms of exercise may be cited as possible reasons (33, 35).

Regarding teaching style in PE, the results of this survey showed that the perceived autonomy support has a positive effect on needs satisfaction and intrinsic motivation in PE environment in school. In addition, the intrinsic motivation created in PE environment was transported to intrinsic motivation in leisure time. These results are consistent with the results of previous studies (25, 36-38). Intrinsic motivation is an important factor in the promotion of PA behavior, because it persists on the activity in the absence of any extrinsic motivation or coercion (37). For instance, teachers who increase students' intrinsic motivation in PE class can expect for better results in PE class and encourage students to perform more PA. This may be because supporting autonomy leads to students having a sense of control over their actions while performing activities in PE class, and this feeling leads to a sense of competence and satisfaction. In opposite, in the absence of intrinsic motivation, external motivating components are needed to engage in PA, and ultimately this cannot lead to positive emotions, a sense of competence and satisfaction in PE class. Therefore, creating intrinsic motivation in PE class is a basic matter that can be considered as a component of perceived autonomy support in PE class. In addition, transferring motivation from PE class to leisure time indicate that using autonomy-supportive teaching style in PE class can motivate students to do PA outside the school environment (i.e., leisure-time).

According to the theory of self-determination (26-28), the source of autonomy behaviors and the satisfaction of basic needs such as autonomy can promote behaviors via the procedure of internalization. Internalization is the procedure by which individuals create behaviors they have already experienced with external motivation into autonomous or self-motivating behaviors. Conversely, behaviors that formerly happened due to external resource are now generated by a source of internal causation (i.e., intrinsic motivation). Internalization demonstrates that behavioral contexts are not firm and intractable, but adjustable and variable, and can be moderated by protective components in a condition that has the inherent to protect autonomous behaviors (e.g., PE class environment at school). Research showed that PE teachers are able to develop high levels of (internal

autonomy motivation and powerful persistence on PA behavior by giving instructions that focus on autonomous learning. Additionally, they do so by delivering learners the right to select to exercise and control their PE (39). Research also showed that autonomy support from PE teachers can result in the transport of a source of motive from an exterior resource to an interior resource (40). These findings confirmed the results of past studies and show that the more PE teacher supports the students' autonomy in PE class, the more the intrinsic motivation to do PA. Motivation generated in PE environment at school can be transported to the environment outside the school (i.e., leisure-time).

#### 4.1. Limitation

As a strength of this survey, it can be stated that we used modern devices to measure PA, which consequently avoided bias in self-reported tools. As a limitation of this survey, we can mention that socioeconomic status was not measured; future studies can focus on the effects of teaching style in PE on PA with considering socioeconomic status of the students.

## 5. Conclusion

In summary, an important point in this survey was that the development of intrinsic motivation by supporting autonomy in adolescents in the school environment has been transferred to the motivation to perform PA in leisure time. This can be an important result and shows the importance of PE in the school. In addition, it can be concluded that the motivational components suggested in the theory of self-determination directly and positively affect PA behavior in adolescents. Based on the findings of this survey, it is suggested that PE teachers provide support for students' sense of autonomy through giving students more choices and opportunities to choose the type of exercise during PE class. Finally, given the fact that our sample has not met recommended amount of daily MVPA, there is a need to explore strategies and to adopt appropriate intervention exercises to enhance engagement in PA and exercise among adolescent students.

## Ethical Approval

The protocol of this survey was reviewed and confirmed by institutional ethics committee (IR.

IAU.AK.REC.1398.001). Also, written informed consent was obtained from the participants.

### Acknowledgement

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**Conflict of Interests:** None declared.

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