

The Role of Physical Education on Motivation, Engagement, Sport Satisfaction, and Health-Related Fitness of High-School Students

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Abstract

Background: Students' participation in sports activities in the course of physical education is essential for their health and may be influenced by the teacher's instructing strategies. The present research aimed to examine the effect of a self-determined intervention in physical education class on motivation, engagement, sport satisfaction, and health-related physical fitness of adolescent students.

Methods: The present study employed a causal-comparative approach and was conducted on 80 high-school girls (mean age of 16.63 years) of Tehran, Iran, 2019, who were randomly allocated into two intervention and control groups. The students in the intervention group were exposed to a three-month self-determined-based intervention within the physical education class adopted by the teacher. On the other hand, those in the control group attended their regular physical education class. A standard questionnaire assessed the motivation, engagement, and sport satisfaction. Field tests evaluated physical fitness, comprising agility and cardiorespiratory fitness. Independent t-test and ANCOVA were employed for data analysis.

Results: The findings demonstrated that compared to traditional teaching, self-determined intervention contributed to a significantly higher level of motivation (3.58 ± 0.66 , $P < 0.001$), engagement (3.14 ± 0.49 , $P < 0.001$), and sport satisfaction (2.71 ± 0.20 , $P < 0.001$) in the post-test. Our results also revealed that exposure to a self-determined intervention did not significantly improve health-related physical fitness components, including agility ($P = 0.489$) and cardiovascular fitness, ($P = 0.561$) compared to non-autonomous training.

Conclusion: These findings may indicate that the feeling of autonomy, competence, and relatedness within physical education class encompasses greater effects on psychological factors (motivation, intention to engagement, and satisfaction) than physical factors (physical fitness).

Keywords: Self-determination, Motivation, Engagement, Fitness, Adolescents

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1. Introduction

Physical activity refers to body displacements along with energy consumption, which could have various forms, such as group or individual sports activities, active transportation, and household activities (1). It has been shown that participating in a physical activity is of numerous benefits for the psychophysiological health of children and adolescents, including improved cardiovascular-muscular function, physical fitness, cognitive and mental functions, and reducing depression, anxiety, and obesity (2-4). Longitudinal research showed that physical activity in childhood could continue into adulthood as a habit (5-7). However, according to previous research, the majority of children and adolescents do not participate in any regular physical activities and do not follow the WHO guidelines for 60 minutes of the moderate-to-vigorous intensity of physical activity per day (8, 9). Therefore, children and adolescents' participation in a regular

physical activity has become one of the important research challenges and a huge concern for parents and physical education teachers.

School, particularly physical education (PE) classes at school, could be considered as a potential environment for increasing students' motivation and participation in physical activity inside and outside school, resulting in various health benefits (10, 11). A critical factor in PE classes is the appropriate motivating environment that the PE teachers create for students in order to meet their psychological needs and increase their motivation to participate in class activities (12). Hence, PE teachers' strategies are of great importance for motivating students to engage in in-class activities and perform physical activity outside of school.

Within PE, Self-Determination Theory (SDT) is a well-known theory that has received empirical support and has been the theoretical basis of several

studies on increasing the motivation of individuals to participate in physical activity and sports (13-19). SDT concentrates on various kinds of motivation, including autonomous and controlled motivation (17, 18). It has been shown that autonomously motivated people are possibly more effective in performing the behaviors. In contrast, externally motivated people may persist with the behavior if the extrinsic bonus is available (17, 18). SDT also comprises the basic psychological needs of autonomy, competence, and relatedness (19). Based on SDT, when the psychological needs are accommodated, people can begin and persist in a broad spectrum of actions (19). Furthermore, fulfilling basic psychological needs enhances autonomous motivation in a wide range of behaviors (19).

Previous research has demonstrated that autonomy support was directly related to increased autonomous motivation and participation of children and adolescents in leisure-time physical activities (10, 20-23). In addition, intervention studies have shown that exercise intervention based on autonomy support increased motivation and physical activity in young individuals (24-26). However, there is scarce information about the effects of self-determined interventions within PE class on motivational and health-related components. PE class is compulsory for all students while recreational sports, such as school sports or clubs, take place outside of school. Thus, PE class could be considered as a unique environment and nature for children and adolescents. Given this fact, it is likely that the motivational components describing the participation of students in PE class are unique. It is therefore essential to identify teacher-based interventions that affect students' participation in sports activities within PE class. Accordingly, the objective of the present research was to investigate the effects of a self-determined intervention within PE class on motivation, engagement, sport satisfaction, and health-related fitness of high-school students. This study hypothesized that a self-determined intervention within PE class could significantly increase the motivation, engagement, sport satisfaction, and health-related physical fitness in high-school students.

2. Methods

2.1 Participants

The present causal-comparative (pre-test and post-test) field study was conducted on high-school female students of Tehran, Iran, in 2019. To determine the final sample, we used the convenience sampling method and

selected 80 female students aged 16 to 18 years (mean age of 16.63 years) from four different schools as the study sample. In the present study, the inclusion criteria were being a student in high school, healthy without any physical or mental disorders, and providing written informed consents. The exclusion criteria included not completing the questionnaire or physical fitness items. We selected one class from each school and the students of the class were randomly assigned into either intervention or control groups by flipping a coin. Two classes consisted of 40 female students and were assigned to the intervention group and two classes were allocated to the control group. The specified sample size of 80 students was chosen according to G*Power statistical software with an effect size of 80%, a test power of 0.8, and a significant level of 0.05 (27).

2.2 Measures

The present study's dependent variables were intrinsic motivation to perform physical activity, engagement in PE activities, sport satisfaction in PE, and health-related physical fitness.

2.2.1 Motivation: The Sports Motivation Scale Questionnaire-2 (28) was utilized to measure the intrinsic motivation for performing physical activity in PE. This questionnaire consists of four questions based on a Likert scale from completely disagree (1) to completely agree (7). In this study, nine experts corroborated the Persian version of this questionnaire (CVI=1.00, CVR=0.90). The reliability of this questionnaire was also assessed and its Cronbach's alpha coefficient was 0.86.

2.2.2 Engagement: Engagement in PE Questionnaire (29) was employed to assess students' engagement in PE activities. This questionnaire comprises three questions using a Likert scale from never (1) to always (5). Herein, nine experts confirmed the Persian version of this questionnaire's validity (CVI=0.88, CVR=0.88). Cronbach's alpha coefficient of this questionnaire was 0.90.

2.2.3 Sport Satisfaction: Sport Satisfaction Instrument (30) was used to evaluate the students' satisfaction to perform physical activities within PE. This questionnaire involves eight items based on a Likert scale from strongly disagree (1) to strongly agree (5). In this research, nine experts were asked to assess the validity of the Persian version of this questionnaire (CVI=0.88, CVR=0.78). We measured the reliability of this questionnaire with a Cronbach's

alpha coefficient of 0.84.

2.2.4 Health-Related Physical Fitness: Two health-related physical fitness factors, namely agility (4×9-m shuttle run test) and cardiorespiratory fitness (20-m shuttle run test), were measured to assess the students' physical fitness. These tests were selected since they are field-based and compatible with the conditions of the present study.

4×9-m shuttle run test was employed for measuring the agility of the students. In this test, two parallel lines are drawn on the ground at a distance of 9 m. At the beginning of the test, the student should stand behind the starting line and then with the experiment's sound saying "start," she will run as fast as possible toward the other line. Afterwards, she comes back to the start point, crossing each line with both feet each time. In this work, this process was performed twice, covering a distance of 36 m (4×9 m). A piece of wood was placed at the end of each line, which the student had to pick up or exchange each time she crossed the line. We used a stopwatch to measure the student's performance time.

A 20-m shuttle run test was used to assess cardiorespiratory fitness. In this test, the student was asked to repeatedly run a 20-m distance at enhancing speeds until they could no longer keep pace. Primarily, the student runs the 20-m distance, beginning with an audible beep with the initial speed of 8.5 km/h, incrementally enhanced by 0.5 km/h every 1 minute. The test goes on until failure or fatigue happens on two consecutive runs. The student's score is calculated based on the number of shuttles (20-m) reached before they could not keep up with the recording.

2.3 Procedure

Before starting the protocol, all the students performed the pre-test in which they completed questionnaires and physical fitness tests at school and under the guidance of the experimenter and teachers. Subsequently, the intervention group was exposed to a three-month protocol whereas the control group was exposed to their regular PE activities. Following the intervention, the students in both groups performed the post-test and completed questionnaires and physical fitness tests.

To implement the self-determined strategies with PE, we asked two female PE teachers (aged 40 to 49 years old) to join this project. Each teacher had a class with 20 students and thus, a total of 40 students

attended the intervention group. On the other hand, we asked two other PE teachers to act as teachers of the control group. Similarly, each teacher had a class with 20 students and 40 students were categorized in the control group.

During the intervention, the students in the intervention group were trained by their teacher for 12 weeks and one session per week (within PE class). Prior to the experiment, the teachers of the intervention group attended a workshop under the supervision of a university professor. These teachers have been explained the strategies according to which they should teach in PE classes. The strategies within PE class were based on SDT to promote students' autonomous motivation to perform PE activities. A variety of activities were designed based on SDT and the intervention group teachers were asked to run these activities in PE classes. The activities were adapted from the previous studies (20-26). They focused on a set of strategies and techniques that support autonomy (use of informational language, providing a rationale for exercising, providing a variety of sports activities, and giving students freedom in decision-making; they also focused on strengthening students' autonomous motivation, showing patience and understand students' negative emotions in PE class), competence (making the content of the class achievable for students, balancing students' skills with the difficulty of sports tasks, allowing all the students to achieve the goals and successfully perform the tasks), and relatedness (being close and intimate and helping the students). The students in the control group performed their regular activities during the PE classes.

2.4 Data Analysis

This research applied descriptive statistics, including means and standard deviations, for describing the research variables. Kolmogorov-Smirnov test was employed in order to assess the normality of data. Independent t-test and ANCOVA were utilized for comparing the means of the groups in the pre-test and the post-test, respectively. The significance level was set at $P < 0.05$.

3. Results

A total of 80 adolescent students (40 students in the intervention group and 40 in the control group) participated in this study. The mean age of the participants of intervention and control groups were 16.96 ± 0.75 and 16.38 ± 0.51 years, respectively.

Regarding the normality of the data, Kolmogorov-Smirnov tests revealed that our data were normally distributed ($P>0.05$). The results showed no significant differences between the groups concerning the pre-test in all the research variables (Table 1). Therefore, both groups had similar conditions before training.

Comparison of the Pre-test and Post-test

Motivation

ANCOVA revealed significant differences between the intervention and control groups ($F=67.30$, $P<0.001$). The means of the pre-test and post-test of both groups are presented in Table 2. As shown, a self-determined intervention in PE class significantly increased the level of motivation to perform physical activity in PE class (2.37 ± 0.77 vs. 3.58 ± 0.66 ; $t=-6.923$, $P<0.001$); meanwhile, no improvement was observed in the control group (2.51 ± 0.77 vs. 2.54 ± 0.55 ; $t=-0.443$, $P=0.660$).

Engagement in PE Activities

Results of ANCOVA demonstrated significant

differences between the intervention and control groups ($F=77.25$, $P<0.001$). Table 2 represents the means of the pre-test and post-test of both groups. As could be observed, implementation of a self-determined intervention in PE class significantly enhanced engagement of the students in PE activities (2.56 ± 0.51 vs. 3.14 ± 0.49 ; $t=-7.525$, $P<0.001$) while no improvement was observed comparing the pre-test to post-test in the control group (2.51 ± 0.49 vs. 2.39 ± 0.45 ; $t=1.423$, $P=0.090$).

Sport Satisfaction

ANCOVA results demonstrated significant differences between the intervention and control groups ($F=40.58$, $P<0.001$). The means of the pre-test and post-test of both groups are shown in Table 2. According to the means of the groups, it could be stated that the students in the intervention group were significantly satisfied with PE sports activities following being exposed to a self-determined intervention (2.46 ± 0.25 vs. 2.71 ± 0.20 ; $t=-10.989$, $P<0.001$) whereas no increments were observed regarding sport satisfaction comparing the pre-test to post-test in the control group (2.40 ± 0.32

Table 1: Comparison of the mean scores of the groups in the pretest

Variables	Intervention Group (n=40) M±SD	Control Group (n=40) M±SD	Statistics
Age	16.96±0.75	16.38±0.51	t=0.791 P=0.385
BMI (kg/m ²)	22.59±2.50	22.72±2.12	t=-0.523 P=0.470
Motivation	2.37±0.77	2.51±0.77	t=-0.829 P=0.410
Engagement	2.56±0.51	2.51±0.49	t=0.444 P=0.658
Sport Satisfaction	2.46±0.25	2.40±0.32	t=0.960 P=0.340
4×9 m shuttle run	12.80±1.47	12.93±1.79	t=-0.360 P=0.719
20-m shuttle run	5.02±1.47	5.07±1.50	t=-0.150 P=0.881

Table 2: Comparison of the pre- and post-intervention mean scores of the groups

		Motivation	Engagement	Sport Satisfaction	4×9 m shuttle run	20-m shuttle run
Intervention Group	Before	2.37±0.77	2.56±0.51	2.46±0.25	12.80±1.47	5.02±1.47
	After	3.58±0.66	3.14±0.49	2.71±0.20	12.64±1.09	5.35±0.89
	Comparison	t=-6.923 P<0.001*	t=-7.525 P<0.001*	t=-10.989 P<0.001*	t=1.029 P=0.310	t=-1.767 P=0.085
Control Group	Before	2.51±0.77	2.51±0.49	2.40±0.32	12.93±1.79	5.07±1.50
	After	2.54±0.55	2.39±0.45	2.36±0.35	12.83±1.34	5.27±1.44
	Comparison	t=-0.443 P=0.660	t=1.423 P=0.090	t=0.774 P=0.444	t=0.599 P=0.553	t=-1.599 P=0.118

*Significant at $P<0.001$

vs. 2.36 ± 0.35 ; $t=0.774$, $P=0.444$).

4×9-m Shuttle Run Test

No significant differences were found between the intervention and control groups according to ANCOVA ($F=0.483$, $P=0.489$). Table 2 depicts the means of the pre-test and post-test of both groups. It revealed no improvement in the performance of the intervention group in the 4×9 shuttle run test in the post-test, indicating that a self-determined intervention did not significantly improve their physical fitness (12.80 ± 1.47 vs. 12.64 ± 1.09 ; $t=1.029$, $P=0.310$). Similar results were observed in the control group (12.93 ± 1.79 vs. 12.83 ± 1.34 ; $t=0.599$, $P=0.553$).

20-m Shuttle Run Test

The results implied no significant differences between the two groups ($F = 0.342$, $P = 0.561$). As shown in Table 2, performances were not significantly enhanced in the intervention group in the 20-m shuttle run test in the post-test (5.02 ± 1.47 vs. 5.35 ± 0.89 ; $t=-1.767$, $P=0.085$). There were no improvements in 20-m shuttle run performances in the post-test in the control group (5.07 ± 1.50 vs. 5.27 ± 1.44 ; $t=-1.599$, $P=0.118$).

4. Discussion

School, specifically physical education (PE) classes at school, can be regarded as a potential environment for increasing students' motivation and participation in physical activity inside and outside school, which could subsequently contribute to various health benefits. Hence, the teaching strategies of PE teachers are of particular importance for motivating students to engage in in-class activities and perform physical activity outside of school. Accordingly, the current research was conducted to investigate the impact of a self-determined intervention within PE class on motivation, engagement, sport satisfaction, and health-related fitness of high-school students. We assumed that self-determined intervention within PE class significantly enhances the motivation, engagement, sport satisfaction, and health-related physical fitness in high-school students.

Concerning the motivation to perform physical activities in PE class, the results demonstrated no significant differences between the intervention and control groups in the pre-test (2.37 vs. 2.51), indicating the same pre-intervention conditions for all the students. However, the comparison of pre-test to post-

test revealed that the students in the intervention group had a significantly higher level of motivation to perform physical activities in PE class compared to the control group (3.58 vs. 2.54). These findings indicated that exposure to a self-determined intervention in PE class significantly increased the motivation to perform physical activity in PE class in the adolescent students. Meanwhile, no improvements were observed in the control group, which is consistent with the assumptions of SDT (13-19). These findings are by the findings of previous studies (24-26) and confirm the first part of our hypothesis. Our results revealed that the sense of autonomy, competence, and relatedness in adolescent students within PE class may enhance their motivation to perform physical activities in PE class. In other words, adopting strategies by PE teachers, such as providing a variety of sports activities and giving students the freedom to choose, understanding students' negative emotions, balancing students' skills with the difficulty of sports tasks, and being friendly with the students in PE class, induced greater motivation in adolescent students to perform physical activities in PE class. These findings could also be considered very important for PE teachers as they could use these strategies within PE class to increase students' motivation to perform further physical activities in PE class.

Regarding the second variable of this study (engagement in PE activities), the results demonstrated no significant differences between the intervention and control groups in the pre-test (2.56 vs. 2.51), indicating similar pre-intervention conditions for all the students. Nevertheless, the comparison of the pre-test and post-test results showed that the participants in the intervention group engaged significantly more than those in the control group in PE activities (3.14 vs. 2.39). These results indicated that administering a self-determined intervention in PE class significantly increased engagement of adolescent students in PE activities, which confirmed the second part of the research hypothesis and is consistent with the assumptions of SDT (13-19), as well as the results of previous studies (24-26). Herein, we further indicated that adopting teaching strategies based on the support for autonomy, competence, and relatedness in PE class could significantly increase their engagement in PE activities compared to traditional teaching methods. Therefore, PE teachers could apply these strategies within PE class to enhance their students' engagement in PE activities.

Concerning sport satisfaction, this study's results demonstrated no significant differences between the

intervention and control groups in the pre-test (2.46 vs. 2.40), which is indicative of the equal pre-intervention conditions for all the students. Nonetheless, comparison of the pre-test to the post-test revealed that the intervention group were significantly satisfied with PE activities more than the control group (2.71 vs. 2.36). These results implied that applying a self-determined intervention in PE class significantly increased the satisfaction of adolescent students with PE activities. These findings confirmed the third part of the research hypothesis and are in line with the propositions of SDT (13-19) and the findings of previous studies (24-26). Adopting teaching strategies based on the support for autonomy, competence, and relatedness in PE class was also shown to significantly satisfy the students with performing PE activities more than traditional teaching methods. Thus, it could be suggested that PE teachers employ these teaching strategies within PE class to boost students' sense of satisfaction while performing PE activities.

Regarding health-related physical fitness, the results showed no significant differences between the intervention and control groups concerning the pre-test (12.80 vs. 12.93 for 4×9-m Shuttle Run Test and 5.02 vs. 5.07 for 20-m Shuttle Run Test), suggesting that all the students had similar pre-intervention conditions. Furthermore, there were no significant differences between the intervention and control groups in the post-test (12.64 vs. 12.83 for 4×9-m Shuttle Run Test and 5.35 vs. 5.27 for 20-m Shuttle Run Test). These findings revealed that exposure to a self-determined intervention compared to traditional teaching strategies in PE class did not enhance health-related physical fitness in adolescent students. These results do not corroborate the fourth part of the research hypothesis and are not in accordance with previous studies in which physical activity improved health-related physical fitness components (31-33). This contradiction may be because students were exposed to intervention for three months and one session per week; this period may have been shortened to improve their fitness. On the other hand, it could be mentioned that the interventional training in the present study was mainly based on psychological changes in students whereas the changes in physical fitness require interventions focusing on physical exercises.

Application of a comprehensive approach in order to manipulate needs-support in PE class could be regarded as the strength of the current work. This approach manipulated all needs-support within SDT, including autonomy, competence, and relatedness, while previous research mostly relied on autonomy-

supportive interventions (24-26). However, there were certain limitations to this study. Initially, we did not assess social-economic variables. Thus, further research emphasizing socio-economic variables is needed to present a better perspective of the effects of needs-supportive interventions on psychological and physical components in adolescent students. Moreover, validity methods were not performed for assessing the validity of questionnaires applied in this research. Hence, we could propose that future studies run validity methods for assessing the validity of scales.

5. Conclusion

The present research aimed to investigate the effect of a self-determination-based intervention in PE class on motivation, engagement, sport satisfaction, and health-related physical fitness among adolescent students. In sum, the results revealed that compared with traditional teaching methods in PE class, the self-determined-based teaching strategies adopted by PE teachers increase motivation, engagement, and sport satisfaction in PE class. Meanwhile, no significant improvement was observed in health-related physical fitness components. These findings may indicate that the feeling of autonomy, competence, and relatedness within PE class encompasses greater effects on psychological components (motivation, intention to engagement, and satisfaction) compared with physical components (physical fitness). Our findings also have certain practical implications for PE teachers. According to the results, it could be recommended that PE teachers adopt needs-supportive-strategies in PE classes, such as providing a variety of various sports activities, allowing students to choose sports activities, understanding students' stress, balancing students' abilities with the difficulty of sports skills, and making a close and friendly relationship with the students.

Ethical Approval

This research was approved by the University Ethics Committee (IR.IAU.AK.REC.1398.001). All the students willingly attended this research and written informed consent was obtained from the teachers, students, and their parents.

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Conflicts of interest: None declared.

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