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Original Article

Impact of a Novelty-based Intervention in Physical Education on Motivation and Physical Activity of Children with ADHD

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Abstract

Introduction: Little is known about amount of MVPA and influential factors during physical education lesson among students with ADHD.
Objectives: Current research aimed to examine impact of a novelty-based intervention in the physical education (PE) on motivation and objectively physical activity (PA) among children with ADHD during physical education lesson.
Methods: This study applied an experimental method. Participants included 53 students with ADHD (Mage: 10.82 years) who were randomly divided to intervention or control groups. The procedure consisted of the pretest, posttest, and follow-up. Moderate-to-vigorous PA (MVPA) was measured using accelerometer and standard questionnaires were used for measuring perceived novelty support, needs satisfaction, and motivation. Intervention program lasted for 16 weeks. Independent t test, ANOVA, and Pearson correlation test were used for data analysis.
Results: results showed that students in both groups (about 10% of the class time) did not meet the guidelines of 50% MVPA in PE class. It was found that novelty-based intervention enhanced significantly motivation from pretest to posttest and follow-up. Furthermore, MVPA was significantly increased from pretest (9.67%) to posttest (20.7%) and follow-up (23.14%) in the intervention group.
Conclusions: Supporting novelty may increase the motivation and PA among children with ADHD. To do that, it can be suggested that PE teachers in special schools should consider self-determined teaching styles in PE class.

Keywords: Exploratory Behavior, Exercise, Motivation, Instrumentation, ADHD

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1. Introduction

Physical activity (PA) has several benefits for physical and mental health including increasing physical fitness, controlling the weight, reducing the risk of death before puberty, reducing the risk of heart diseases or stroke, reducing the possibility of high blood pressure, having healthy bones, muscles and joints, etc. (1-8). Hence, to enjoy the health benefits of PA, world health organization (WHO) recommends 60 minutes of daily moderate to vigorous activity PA (MVPA) for all individuals, including children (4,6,9). Nevertheless, it was observed that children around the world do not participate in enough PA (10,11), which can create many risks for their current and future health.

In addition, it was found that children with attention-deficit/hyperactivity disorder (ADHD) engage in a lower level of PA than typically developing children and therefore enjoy less benefits of PA (12,13). Therefore, it seems necessary to consider interventions to increase PA in children with ADHD. The physical education (PE) is a suitable environment for interventions to improve PA in children (14). According to the guidelines, students for 50% of PE lesson time should participate in MVPA to obtain health benefits (15). In this regard, it found that students with disabilities spend only 17% of PE in MVPA (16). Also, it was found that students with mental retardation engaged in only 23% of PE in MVPA (17). However, a little is known about amount of MVPA during PE among students with ADHD.

A theory that has received a lot of attention in previous studies on increasing PA in children during PE is the self-determination theory (SDT). The main focus of SDT is on internal motivation. Accordingly, humans have three basic psychological needs: autonomy, competence, and relatedness (18-23). Concerning PA, it was found that satisfaction of these three needs would result in increasing autonomous motivation and real participation of children in PA (24,34).

In recent years, it has been proposed the need for novelty as an additional basic need alongside the needs proposed in self-determination theory (35). The need for novelty refers to experiencing things that have not been experienced before such as new person, smell, environment, or activity (35). It was found that supporting the need for novelty is associated with satisfaction of basic psychological needs and intrinsic motivation (36-42). In addition, in PE, it was found that novelty satisfaction is associated with higher autonomous motivation, enjoyment and vitality in PA (39).

However, the effects of supportive the need for novelty has received less attention in special groups such as children with ADHD. Due to the importance of

participating in regular PA for children with ADHD, it is necessary to examine impact of novelty support in PE on motivation and PA among children with ADHD. Therefore, the purpose of current research was to examine impact of an intervention in PE based on supporting the need for novelty on motivation and PA among children with ADHD. It was hypothesized that strategies used in PE for supporting the need for novelty would lead to increasing the motivation and PA of children with ADHD.

2. Methods

2.1. Participants

This study applied an experimental method. A total of 53 children with ADHD including 28 boys and 25 girls diagnosed with ADHD from special schools in Gorgan, Iran, voluntarily participated in this study. Based on G*Power with α=0.05, β=0.05, and r=0.20, the sample size should be 51 individuals. In the present study a sample of 53 children with ADHD were used. The participants aged 9 to 12 years (Mage: 10.82±0.76 years). This category of age was selected because we focused mainly on primary school students. The children were randomly divided to the intervention (n=27) and control (n=26) groups. Inclusion criteria was a diagnosis of ADHD. Exclusion criteria was suffering from other comorbid psychiatric or neurological disorders. The University Ethics Committee approved the research protocol. Participants and their parents gave written informed consent.

2.2. Intervention with PE Teachers

Before starting the intervention, PE teachers of the intervention group were explained the purpose of the study. Then, they attended in a training course based theoretically on SDT, which was held under the supervision of an academic professor specializing in PE in special schools. This training course was held for five days and three hours a day. The training course was carried out in a classroom at the university with full visual and video facilities and the ability to play a role. Moreover, during the training course, PE teachers were free to interact and ask any questions. In first day, an expert explained the theoretical background of SDT by emphasizing on different types of motivation regulation, the importance of supporting and satisfying basic psychological needs to promote autonomous motivation, the role of PE teacher' instructional style (supportive vs. controlling style) on basic psychological needs satisfaction and promoting autonomous motivation, and the impact of creating autonomous motivation on several outcomes on PE context (e.g., enjoyment, engagement in PE activities, and intention to do more MVPA). In the next days (second to fifth days), PE teachers were provided with several strategies focused on novel materials, environment or activities to support need for novelty in students, mostly based on the propositions of previous studies (36-42).

2.3. Procedure

First, demographic information (e.g., age, parental financial status, and parental educational status) was collected from parents and school officials. In addition, as a demographic variable, students' height and weight were measured using standard instruments. Based on some previous studies (37-39), the experimental procedure consisted of the pretest, intervention, posttest, and follow-up stages. In the pretest (i.e., week before the intervention), participants were asked to install an accelerometer on their right hip during PE lessons (two 60-minute lessons a week). Participants completed research questionnaires, too. The questionnaires took approximately 30-45 minutes to complete. Then, the participants of the intervention group attended in the intervention program for a 16-week period. During the intervention, the teachers of the intervention group were asked to implement the instructions and strategies in PE lessons that were taught in the training course. During the class, the teacher was asked to only focus on strategies that were given. During the intervention, the teachers of the intervention group were free to receive the necessary guidance from the expert if needed. The week after the intervention, the participants completed the posttest, which was similar to the pretest. Finally, follow-up stage was carried out two months after the posttest, which was also similar to the pretest and posttest. It should be noted that, we measured MVPA during the intervention, too. To this end, MPVA was assessed in fourth, eighth, and twelfth weeks, too. The control group performed all the tests similarly to the intervention group, except that they attended in their regular PE lessons without any additional instructions for their PE teachers.

2.4. Measures

2.4.1. Basic Psychological Needs Satisfaction

Basic psychological needs satisfaction in PE lesson was measured using the Basic Psychological Needs in Exercise Scale (BPNES) (43) consisted of 12 questions divided into three categories including autonomy, competence, and relatedness. The six items from the Novelty Need Satisfaction Scale (35) based on 5-point Likert-type scales, ranging from 1 ('strongly disagree') to 5 ('strongly agree') were selected to measure novelty satisfaction. Each question was scored on a Likert scale from strongly disagree (1) to strongly agree (7). Reliability of this questionnaire was measured here and its Cronbach's alpha coefficient was 0.91.

2.4.2. Motivation in PE

The Revised Perceived Locus of Causality in Physical Education (PLOC-R) (44) was employed to measure the motivation regulation in PE. Following the stem "I take part in PE …", the students provided their answers on 20 items with a 7-point scale (1 = strongly disagree, and 7 = strongly agree). Each of the subscales consisted of four items for amotivation, external regulation, introjected regulation, identified regulation, and intrinsic motivation. We measured the reliability of this questionnaire with a Cronbach's alpha coefficient of 0.92.

2.4.3. Physical Activity

We utilized modern accelerometers (ActiGraph wGT3X-BT, ActiGraph LLC, Pensacola, FL, USA) to measure MVPA in PE class, which has good validity (45,46). The device was initialized at a 30 Hz frequency. The students were instructed to wear it on the right hip during PE class. During PE class, two experimenters continuously monitored the location of the

accelerometer on the participants' hip. After the class, the accelerometers were collected and the data was downloaded, processed, and analyzed using the ActiLife v6.13.4 software (Actigraph Inc, USA).

2.5. Data Analysis

SPSS Statistics 26 was applied for data analysis. Means and SD were calculated to describe the data. Independent t-test was used to compare groups in the pretest, posttest, and follow-up test. In addition, a 2 (GROUP: intervention vs. control) × 3 (TIME: pretest, posttest, follow-up) mixed factorial analysis of variance (ANOVA) was used to examine any changes in the research variables during the study. Finally, we utilized Pearson correlation tests to determine whether novelty support is associated with basic needs satisfaction, motivation, and MVPA in PE lesson. Level of significance was set at $P < .05$.

3. Results

3.1. Demographic Data

Table 1 shows the demographic characteristics of the study sample. Means of age, height, weight, and BMI of the participants. BMI of both groups was at a good level. Moreover, most of parents were at medium level of financial status (about 70%), and had a college education (about 60%).

Table 1. Demographic Characteristics of Study Sample.

Variables	Intervention		Control	
	Mean ± SD		Mean ± SD	
Age (year)	10.82 ± 1.05		10.98 ± 0.86	
Height (cm)	150.48 ± 5.89		149.46 ± 5.25	
Weight (kg)	47.26 ± 4.83		46.22 ± 3.56	
BMI (kg/m^2)	18.02 ± 1.25		18.22 ± 0.79	
BMI (kg/m^2)	**N**	**Percent**	**N**	**Percent**
Parental Financial Status				
Low	6	22%	7	27%
Medium	19	71%	17	65%
High	2	7%	2	8%
Parental Education				
High-School and Less	10	37%	12	46%
College	17	63%	14	54%

3.2. Basic Psychological Needs Satisfaction

Table 2 shows mean and SD of basic needs satisfaction (e.g., autonomy, competence, relatedness, and novelty) in the pretest, posttest, and follow-up.

Table 2. Mean and SD of Research Variables Across Pretest, Posttest, and Follow-Up.

Variables		Groups	Pre-test	Post-test	Follow-up
Perceived Novelty Support		Intervention	1.32±0.92	2.83±1.49	2.64±1.27
		Control	1.28±0.84	1.37±1.04	1.20±0.59
Basic Needs Satisfaction	Autonomy	Intervention	1.19±1.55	3.08±1.51	2.83±1.45
		Control	1.30±0.97	1.49±1.10	1.19±0.76
	Competence	Intervention	1.45±1.63	2.80±1.56	3.10±1.42
		Control	1.36±1.41	1.27±1.21	1.40±0.83
	Relatedness	Intervention	0.84±0.53	2.11±1.37	2.64±1.27
		Control	0.79±0.68	0.76±0.58	0.81±0.70
	Novelty	Intervention	0.65±0.41	2.68±1.21	2.50±1.10
		Control	0.68±0.49	0.71±0.43	0.65±0.51
Motivation	Intrinsic Motivation	Intervention	1.02±0.74	2.25±1.29	2.42±1.63
		Control	1.06±0.67	0.95±0.58	1.04±0.91
	Identified Regulation	Intervention	0.85±0.70	1.82±1.21	1.77±1.69
		Control	0.79±0.80	0.68±0.71	0.59±0.66
	Introjected Regulation	Intervention	2.45±1.38	1.14±0.87	1.03±1.21
		Control	2.29±1.46	2.37±1.61	2.19±1.09
	External Regulation	Intervention	2.86±1.71	1.73±1.29	1.58±1.79
		Control	2.70±1.54	2.61±1.28	2.75±1.65
	Amotivation	Intervention	3.61±1.75	2.21±1.53	2.51±1.48
		Control	3.54±1.82	3.40±1.48	3.61±2.03

3.2.1. Need for autonomy

There was no significant difference between group in the pretest ($t_{1,52}$=-1.37, p=0.41). Nonetheless, in the posttest and follow-up test, intervention group perceived higher autonomy need satisfaction compared with the control group ($t_{1,52}$=7.61, p=0.000, and $t_{1,52}$=-5.28, p=0.000, respectively). Moreover, main effects of GROUP ($F_{1,52}$=15.55, p=0.000, η^2=0.76), TIME ($F_{1,52}$=7.75, p=0.000, η^2=0.41) and interaction between GROUP×TIME ($F_{1,52}$=11.44, p=0.000, η^2=0.45) were significant.

3.2.2. Need for competence

We found no significant difference between groups in the pretest (t=0.68, p=0.82). However, in the posttest and follow-up test, intervention group perceived higher competence need satisfaction compared with the control group ($t_{1,52}$=8.55, p=0.000, and $t_{1,52}$=-5.61, p=0.000, respectively). In addition, main effects of GROUP ($F_{1,52}$=44.11, p=0.000, η^2=0.23), TIME ($F_{1,52}$=61.55, p=0.000, η^2=0.51), and interaction between GROUP×TIME ($F_{1,52}$=48.97, p=0.000, η^2=0.39) were significant.

3.2.3. Need for relatedness

We found no significant difference between groups in the pretest ($t_{1,52}$=0.81, p=0.79). However, in the posttest and follow-up test, intervention group perceived higher relatedness need satisfaction compared with the control group ($t_{1,52}$=6.71, p=0.000, and $t_{1,52}$=-7.79, p=0.000, respectively). In addition, main effects of GROUP ($F_{1,52}$=61.41, p=0.000, η^2=0.61), TIME

($F_{1,52}$=71.55, p=0.000, η^2=0.55), and interaction between GROUP×TIME ($F_{1,52}$=55.55, p=0.000, η^2=0.48) were significant.

3.2.4. Need for novelty

There was no significant difference between group in the pretest ($t_{1,52}$=-0.69, p=0.82). Nonetheless, in the posttest and follow-up test, intervention group perceived higher novelty need satisfaction compared with the control group ($t_{1,52}$=8.26, p=0.000, and $t_{1,52}$=6.81, p=0.000, respectively). Moreover, main effects of GROUP ($F_{1,52}$=25.17, p=0.000, η^2=0.81), TIME ($F_{1,52}$=11.65, p=0.000, η^2=0.62) and interaction between GROUP×TIME ($F_{1,52}$=15.26, p=0.000, η^2=0.51) were significant.

3.3. Motivation in PE

Table 2 shows mean and SD of motivation in PE (e.g., intrinsic motivation, identified regulation, introjected regulation, external regulation, and amotivation) in the pretest, posttest, and follow-up.

3.3.1. Intrinsic motivation

Both groups had similar levels of intrinsic motivation at baseline ($t_{1,52}$=0.55, p=0.92). However, in the posttest and follow-up test, intervention group reported significantly higher intrinsic motivation compared with the control group ($t_{1,52}$=6.61, p=0.000, and $t_{1,52}$=-8.15, p=0.000, respectively). Moreover, main effects of GROUP ($F_{1,52}$=65.55, p=0.000, η^2=0.31), TIME ($F_{1,52}$=61.55, p=0.000, η^2=0.51) and interaction between GROUP×TIME ($F_{1,52}$=82.22, p=0.000, η^2=0.72) were significant.

3.3.2. Identified regulation

Both groups had similar levels of identified regulation at baseline ($t_{1,52}$=0.67, p=0.61). However, the intervention group reported significantly higher identified regulation compared with the control group in the posttest and follow-up test, ($t_{1,52}$=7.61, p=0.000, and $t_{1,52}$=-9.22, p=0.000, respectively). Moreover, main effects of GROUP ($F_{1,52}$=63.55, p=0.000, η^2=0.53), TIME ($F_{1,52}$=82.55, p=0.000, η^2=0.67) and interaction between GROUP×TIME ($F_{1,52}$=44.55, p=0.000, η^2=0.51) were significant.

3.3.3. Introjected regulation

Both groups had similar levels of introjected regulation at baseline ($t_{1,52}$=0.82, p=0.81). However, in the posttest and follow-up test, intervention group reported significantly lower introjected regulation compared with the control group ($t_{1,52}$=4.61, p=0.000, and $t_{1,52}$=-2.28, p=0.000, respectively). Moreover, main effects of GROUP ($F_{1,52}$=66.55, p=0.000, η^2=0.58), TIME ($F_{1,52}$=83.55, p=0.000, η^2=0.62) and interaction between GROUP×TIME ($F_{1,52}$=83.77, p=0.000, η^2=0.53) were significant.

3.3.4. External regulation

Both groups had similar levels of external regulation at baseline ($t_{1,52}$=0.76, p=0.86). However, in the posttest and follow-up test, intervention group reported significantly lower external regulation compared with the control group ($t_{1,52}$=4.61, p=0.000, and $t_{1,52}$=-5.28, p=0.000, respectively). Moreover, main effects of GROUP ($F_{1,52}$=67.55, p=0.000, η^2=0.62), TIME ($F_{1,52}$=83.55, p=0.000, η^2=0.63) and interaction between GROUP×TIME ($F_{1,52}$=62.55, p=0.000, η^2=0.46) were significant.

3.3.5. Amotivation

Both groups had similar levels of amotivation at baseline (t=0.83, p=0.96). However, in the posttest and follow-up test, intervention group reported significantly lower amotivation compared with the control group ($t_{1,52}$=6.61, p=0.000, and $t_{1,52}$=-5.12, p=0.000, respectively). Moreover, main effects of GROUP ($F_{1,52}$=43.43, p=0.000, η^2=0.31), TIME ($F_{1,52}$=16.63, p=0.000, η^2=0.24) and interaction between GROUP×TIME ($F_{1,52}$=51.62, p=0.000, η^2=0.16) were significant.

3.4. Physical Activity

Figure 1 shows the mean and SD of MVPA during PE class. Overall, our results showed that students in both groups did not meet the guidelines of 50% MVPA in PE class. However, MVPA of students in the intervention group significantly increased from pretest (9.67%) to the posttest (20.7%) and follow-up (23.14%), while the students in the control group engaged in almost similar percent of MVPA in the all phases of the study (see Figure 1). Results of the pretest showed almost similar MVPA for both groups ($t_{1,52}$=0.76, p=0.27). However, in the posttest and follow-up, the intervention group engaged in significantly higher MVPA than the control group ($t_{1,52}$=8.11, p=0.000, and $t_{1,52}$=-4.51, p=0.000, respectively). ANOVA showed that the intervention group engaged significantly in more MVPA than the control group during the study ($F_{1,52}$=11.54, p=0.000, η^2=0.24). Moreover, main effects for TIME ($F_{1,52}$=55.33, p=0.000, η^2=0.16) and interaction of GROUP×TIME were significant ($F_{1,52}$=72.55, p=0.000, η^2=0.33), indicating that the amount of MVPA of the intervention group significantly increased from the pretest to posttest and follow-up, while that was almost similar for the control group.

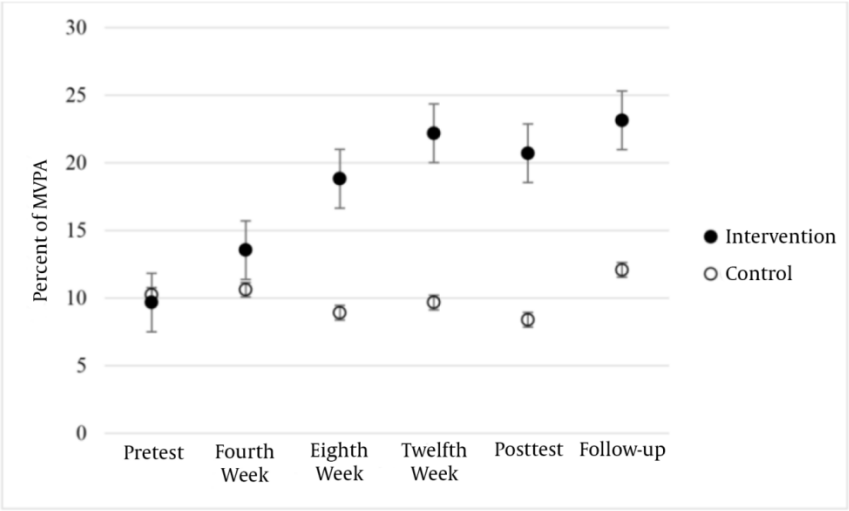

Figure 1. Mean and SD of MVPA% in PE Lesson Across the Study.

3.5. Bidirectional Correlations

Results of correlation tests are shown in Table 3. Most importantly, novelty support was directly and significantly associated with autonomous motivation and MVPA (both P<0.001). Moreover, autonomous motivation was directly and significantly associated with MVPA (P<0.001).

Table 3. Results of Correlations Between Variables in the Posttest.

Variable	1	2	3	4	5	6	7	8	9	10	11
1.Novelty Support	-										
2.Autonomy	r=0.64 P<0.001	-									
3.Competence	r=0.51 P<0.001	r=0.42 P<0.001	-								
4.Relatedness	r=0.43 P<0.001	r=0.34 P<0.001	r=0.55 P<0.001	-							
5. Novelty	r=0.43 P<0.001	r=0.34 P<0.001	r=0.55 P<0.001	r=0.58 P<0.001	-						
6.Intrinsic Motivation	r=0.53 P<0.001	r=0.68 P<0.001	r=0.39 P<0.001	r=0.52 P<0.001	r=0.48 P<0.001	-					
7.Identified Regulation	r=0.36 P<0.001	r=0.29 P<0.001	r=0.46 P<0.001	r=0.27 P<0.001	r=0.63 P<0.001	r=0.38 P<0.001	-				
8.Introjected Regulation	r=-0.16 P<0.05	r=-0.24 P<0.001	r=-0.15 P<0.05	r=-0.42 P<0.05	r=-0.58 P<0.001	r=-0.43 P<0.001	r=-0.68 P<0.001	-			
9.External Regulation	r=-0.25 P<0.01	r=-0.33 P<0.001	r=-0.28 P<0.001	r=-0.30 P<0.001	r=-0.71 P<0.001	r=-0.52 P<0.001	r=-0.48 P<0.001	r=0.47 P<0.001	-		
10.Amotivation	r=-0.39 P<0.001	r=-0.48 P<0.001	r=-0.40 P<0.001	r=-0.39 P<0.001	r=-0.68 P<0.001	r=-0.61 P<0.001	r=-0.73 P<0.001	r=0.49 P<0.001	r=0.50 P<0.001	-	
11.MVPA	r=0.58 P<0.001	r=0.61 P<0.001	r=0.54 P<0.001	r=0.61 P<0.001	r=0.62 P<0.001	r=0.54 P<0.001	r=0.58 P<0.001	r=-0.56 P<0.001	r=-0.62 P<0.001	r=-0.75 P<0.001	-

4. Discussion

This study is, to the best of our knowledge, first study that examined the effects of a novelty-supportive intervention in PE class on motivation and accelerometer-measured MVPA among children with ADHD. Our findings showed that manipulation of teaching strategies in PE was successful, as the intervention based on novelty-support fostered perception of novelty support from PE teacher, satisfaction of basic psychological needs, and autonomous motivation in PE class among children-students with ADHD. Moreover, controlled motivation and amotivation were significantly decreased in the intervention group from the pretest to posttest and follow-up. These findings indicate that tenets of novelty-support could be extended to students with ADHD. Supporting the need for novelty leads to meet the basic needs, which in turn increases the autonomous motivation through the process of internalization [i.e., behaviors that previously existed for reasons with an external source emerge from an internal causal source (i.e., intrinsic motivation)] (18,19,35).

Concerning PA pattern, our findings revealed that, at baseline, students with ADHD engaged in very few percent of MVPA in PE class (i.e., 9.67% and 10.24% for the intervention and control groups, respectively). These findings are in line with previous studies (12), indicating that students with ADHD do not meet WHO guideline of engaging in 50% of PE class in MVPA. However, as expected, exposing to a novelty-supportive intervention resulted in significantly higher engagement in MVPA in PE class than traditional teaching styles (20.7% vs. 8.39% for the intervention and control groups in posttest, respectively). Interestingly, in the follow-up test, students of intervention groups engaged in significantly higher percent of MVPA in PE class than those in the control group (23.14% vs. 12.08%, respectively). However, despite the fact that the students in the intervention group were more physically active than those in the control group during PE class, they do not still meet the WHO guidelines of engaging in 50% of PE class time in MVPA.

As mentioned earlier, generally individuals with ADHD participant in fewer amount of PA compared with typically developing individuals, possibly due to their physiological, developmental, cognitive, and/or psychological impairments (47,48).

In addition, results of correlations between research variables revealed that perceived novelty support was directly associated with basic needs' satisfaction, autonomous motivation, and MVPA. These findings further confirm the tenets of SDT regarding positive influence of novelty support on engagement in a particular behavior (e.g., participation in PA) and are in accordance with the findings of previous studies on typically developing individuals (25-34). Interestingly, the students in the intervention group have shown higher amount of MVPA in the follow-up phase, indicating that internalization of the values of novelty-based intervention in PE lesson could last during the time. Based on these findings, it can be stated that despite the difficulties for planning curriculum-based activities within PE class in special schools, the application of interpersonal teaching styles based on basic psychological needs (at least the need for novelty) can have a meaningful impact on the participation of students with ADHD in PA, suggesting that PE teachers in special schools should consider self-determined teaching styles in PE class.

The strengths of our study are: firstly, we applied for the first time the need for novelty in a PE setting for students with ADHD. Second, we used the up-to-date accelerometers to determine objectively amount and levels of PA of students with ADHD, which prevent typical biases occurred in self-reporting methods. Secondly, we measured PA and other research longitudinally in an attempt to examine whether the positive effects of novelty support could last. Here, as our findings showed, the positive effects of novelty support intervention lasted at least for two months. Future studies should address this issue using more longitudinal design. However, our study is limited in the sense that our sample consisted of only children with ADHD, perhaps limiting the study's generalizability to children from other special groups. Moreover, the intervention utilized in this study was only based on novelty support. However, in the previous studies an intervention based on need for autonomy, competence, and relatedness was used to foster MVPA among school students. Future studies using an intervention based on all basic needs is required to address this issue comprehensively.

4.1. Conclusions

This study was one of the first to examined the effects of a novelty-supportive intervention in PE class on motivation and accelerometer-measured MVPA among children with ADHD. Our findings showed that manipulation of teaching strategies in PE was successful, as the intervention based on novelty-support fostered perception of novelty support from PE teacher, satisfaction of basic psychological needs, autonomous motivation, and MVPA in PE class among children-students with ADHD. Moreover, controlled motivation and amotivation were significantly decreased in the intervention group from the pretest to posttest and follow-up. These findings indicate that the tenets of novelty-support could be extended to students with ADHD. Moreover, students with ADHD did not meet WHO guideline of engaging in 50% of PE class in MVPA. However, exposing to a novelty-supportive intervention resulted in significantly higher engagement in MVPA in PE class than traditional teaching styles and this effect lasted until the follow-up test, suggesting that PE teachers in special schools should consider self-determined teaching styles in PE class.

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Footnotes

Authors' Contribution: This study was carried out solely by the corresponding author.

Conflict of Interests: The researcher confirms that there is no conflict of interests in this study with any participant.

Data Availability: The data that support the findings of this study are openly available upon request from the corresponding author.

Ethical Approval: Approval for this study was obtained from the university. The author confirms that all steps . The requirements of this study comply with ethical guidelines. Participants were informed about the characteristics of the study and gave written informed consent.

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Informed Consent: Informed written consent was obtained from all participants.

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