



Original Article

The Effect of Nonlinear and Linear Methods and Inclusive Education on Self-Esteem and Motor Proficiency of Ordinary and Overactive Children

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ARTICLE INFO

Article History:

Received: 15/11/2020

Revised: 13/04/2021

Accepted: 26/04/2021

Keywords:

Education

Teaching methods

Self-concept

Motor skills

Attention deficit hyperactivity disorder

Please cite this article as:

Mohammadi Orangi B, Yaali R, Ackah-Jnr FR, Bahram A, Ghadiri F. The Effect of Nonlinear and Linear Methods and Inclusive Education on Self-Esteem and Motor Proficiency of Ordinary and Overactive Children. JRSR. 2021;8(2):69-78.

ABSTRACT

Background: This study highlights the effect of nonlinear and linear teaching methods and inclusive education on the self-esteem and motor proficiency of ordinary and overactive children.

Methods: This quasi-experimental research involved two groups of girls who had a 9-week intervention. One group consisting of 14 ordinary children ($M_{age}=6.53$, $SD_{age}=0.49$) with one overactive and obese child (age=6 years, height=115 cm and weight=27 kg) were trained using nonlinear pedagogy. The other group comprising of 14 ordinary children ($M_{age}=6.58$, $SD_{age}=0.52$) and one overactive obese child (age=6 years, height=117 cm and weight=28 kg) were trained using a linear method. Quantitative and qualitative instruments were used to collect data.

Results: The qualitative results showed control of violence and pleasure of the game, as well as family, educational and social relationships, improved in the obese and overactive child who practiced with the nonlinear pedagogy. Quantitative results indicated that general, family, social and school self-esteem, and motor proficiency increased, but BMI decreased in both children with ADHD. The result of the ANCOVA test indicates that self-esteem ($P=0.000$, $F=27.88$) and motor proficiency ($P=0.001$, $F=15.7$) improved in the nonlinear pedagogy compared to the linear method.

Conclusion: Results emphasized the importance of applying nonlinear pedagogy for motor skills development and in inclusive education to enhance physical activity participation for children with Attention deficit hyperactivity disorder (ADHD). Findings make a strong case for manipulating tasks and eliminating environmental constraints in inclusive settings to develop motor skills of all children.

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Introduction

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental disorder where individuals exhibit inappropriate developmental levels of inattention, over activity, distraction, and impulsivity, which occurs in childhood years [1]. In recent times, ADHD has been

found to be a common disorder among school children. The Centers for Disease Control and Prevention estimated the number of children with ADHD to be about 6.8% of the world's population [2]. One Iranian research reveals that the number of primary school-aged children with ADHD is rising and that about 9.7% of children in one city of Iran have ADHD, and this requires special attention [3].

Obesity refers to the abnormal development of specialized connective tissue, also called adipose tissue in the body that presents a risk to health [4, 5].

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The World Health Organization (WHO), estimates that 18% of children were obese [1]. People who are obese have multiple metabolic disorders, and many studies have reported that obesity is correlated with high rates prognosis of several immune-mediated conditions as well as negative effects including mobility and self-esteem problems [4].

Previous studies have shown mounting evidence of a relationship between ADHD and obesity in children or adults [6, 7]. "Due to mobility problems, inattention and lack of concentration, children with ADHD have negative self-concepts leading to low levels of self-esteem. Children with obesity suffer from low self-esteem, while children with ADHD are prone to obesity; hence, the problem of low self-esteem is more severe in obese children with ADHD" [8]. For Rodrigues, Stodden, and Lopes, low motor proficiency reduces children's self-esteem and self-confidence, which makes them feel alone, isolated and inactive [9]. The factors underlying the links between ADHD and obesity include decreased physical activity, so children with ADHD are also at risk for the future development of obesity [7], and their problems of self-esteem and motor proficiency are more prominent [10, 11]. Although overactive children have much energy for activity, they become angry soon and have difficulty controlling violence, which makes them unable to enjoy enough physical activity [1]. Therefore, it is important to improve self-esteem and motor proficiency in these children. Motor proficiency defined as the optimal level of fundamental movement skill is a prerequisite for professional sport and has a positive correlation with participation in physical activity [12]. Despite having various definitions [13, 14], it generally refers to one's feelings towards the self, which acts as a protective factor that may guard an individual against negative events. It affects motivation, functional behavior and life satisfaction, and is significantly related to well-being [13].

Intervention practices for children with disabilities, especially those with ADHD, have been performed through various approaches. Exercise, a form of motor intervention, is found to be an effective approach, and recently such movement interventions have been used to improve the problems of overactive children or ADHD. Motor interventions include regular motor activities that aim to reduce motor and cognitive problems and to enhance physical and cognitive skills [15]. In acknowledging the positive impact of motor interventions on the problems of overactive children, Lee et al, examined the impact of horseback riding on motor proficiency, anxiety, and depression in overactive children and reported positive results [16]. Lee et al, showed that play activities are useful for children with ADHD [17]. Therefore, effective exercise and motor functioning can foster the involvement and participation of children with ADHD or obesity in schools and physical activities [17]. However, there are two issues in this regard. Firstly, past research has examined the impact of motor training on a group of overactive children. However, there were one or two overactive children in each class, so it is both costly and difficult to separate them from ordinary children. It seems

that the teaching of overactive children along with ordinary children is better in inclusive education, an approach where all students, including those with intellectual and motor disorders, or ADHD, study at the nearest school and alongside their peers (students) without disabilities [18]. It aims "to privilege all children with better opportunities to enhance their overall growth, development, and functioning in schools and society" [19].

The second issue concerns the method of teaching. While in inclusive education some teachers directly support children with disabilities [20], studies have shown that direct support is an ineffective approach to teaching all children [18, 21]. Recent studies utilizing ecological dynamics have reported that when the education and training of children is accompanied by the manipulation of environmental and task constraints, inclusive education becomes effective, encouraging all children to perform actions, which strengthens their independence without the need for direct support and protection of teachers [22]. According to Brodzeller et al, manipulating the inclusive environment helps greatly to improve the behavior of children with disabilities [23]. Other studies on motor activities [24] for children with disabilities neither used the inclusive education nor learning approach for children with ADHD.

The nonlinear pedagogy seems to be useful for enhancing inclusive education because it provides multifaceted motivated educational experiences for all students that enable participation in tasks and routines in inclusive schools. According to ecological dynamics, nonlinear pedagogy provides a design of a learning environment that increases learners' motivation and is effective in improving self-esteem [25]. The nonlinear pedagogy seems appropriate for enhancing physical education and activity participation of all children, including those with ADHD, and is potentially effective in helping all children to acquire relevant twenty-first-century competencies, such as developing self-esteem, self-awareness, and critical and inventive thinking [26]. According to Moy et al, unlike traditional linear pedagogies, which adopt a teacher-center approach, the nonlinear pedagogy is a well-grounded theoretical framework of the learning process, which informs the design and delivery of learning in physical education [27]. It is a more student-centered approach and has the potential to foster student learning of motor skills. In the nonlinear pedagogy, an instructor manipulates the environment and task, which helps learners to learn skills based on their specific physical characteristics [25], but in the linear method, the trainer uses verbal instructions and feedback, and encourages children to achieve an optimal pattern [28]. Experimental studies in people without disorders have shown that the nonlinear method in different cognitive and physical dimensions is better than the linear method [29-31]. Therefore, it is assumed that the nonlinear pedagogy, coupled with tasks and environmental constraints' manipulation, can be an effective way to improve motor proficiency, and self-esteem in an inclusive environment for children with ADHD. Based on the authors' knowledge, no research was found that addressed the above issues, so this study

highlights the effect of nonlinear and linear teaching methods and inclusive education on self-esteem and motor proficiency of ordinary and overactive children.

Methods

This study is quasi-experimental (quantitative and qualitative). The strategy used for this research is a qualitative case study in the first part and, quasi-experimental research with the control group in the second part. The key participants, including two children with ADHD (girls), their mothers, physical education teachers and 28 other children without ADHD (girls), were selected purposefully from four schools of one city in the same region with similar socioeconomic status. The criteria for selecting the children with ADHD were the following: 1) physical and mental health based on the school health case; 2) having ADHD based on the Dupaul questionnaire; 3) parental consent; and 4) parent and teacher's cooperation. The same criteria, except the ADHD questionnaire, were utilized in selecting the children without ADHD. One child each with ADHD in Neyayesh Pre and Elementary school (pseudonym) was selected, followed by 14 other children without disabilities selected from Musa Pre and Elementary School (pseudonym). The other child with ADHD was selected from Narges Pre and Elementary school (pseudonym), followed by 14 other children without disabilities selected from Payam Pre and Elementary School (pseudonym), all in District 16 of Tehran City. Randomly, the selected ADHD child from Neyayesh school practiced along with children from Musa School (group 1), and the other child with ADHD practiced with children from Payam school (group 2). The two children were suspected to have ADHD and they confirmed the diagnosis via the questionnaire and information and conversations with their parents. To select ADHD children in the first stage, children suspected of ADHD were selected through the child's health record at school and then their disorder was confirmed using Dupaul questionnaire.

In the physical education classes, all the children engaged in similar training programs, and none of them attended extracurricular sports classes. Study group 1 practiced with the nonlinear pedagogy, while group 2 practiced with the linear method. The physical education teachers in both groups had master's degree in Motor Learning with specialization in nonlinear pedagogy and linear method. They had over 10 years of teaching experience and have been in charge of physical education activities for many schools in the city. Both mothers of the children with ADHD held bachelor degrees. The mothers and PE teachers were chosen through a purposive sampling approach because they can enhance our understanding of the research questions. After acquiring permission from the head teachers of the four schools, the researchers contacted the parents of the children and explained the study's purpose, as well as the class teachers, particularly the PE teachers. The parents and PE teacher signed written consent information forms before the commencement of the intervention and other

research activities. Further permission was sought to determine the children's obesity level using digital scales to measure their weight and height.

In group 1, the overactive child's height and weight were 115 cm and 27 kg respectively (age: 6 years and 10 months), and her body mass index was calculated as 20.41. In group 2, the overactive child's height and weight were 117 cm and 28 kg respectively (age: 6 years and 12 months), and her body mass index was found at 20.45. Based on the WHO Z-score chart (World Health Organization, 2016) [32], these scores for the two children with ADHD were above the 97th percentile, so they were considered obese. Ethical approval (IR.UT.PSYEDU.REC.1398. 026.) was obtained by the local university ethics committee prior to the commencement of the intervention process.

Measures

Semi-structured interviews: They were used to collect information from the mothers of the children with ADHD and PE teachers.

Dupaul questionnaire: This ADHD rating scale, developed by Dupaul et al, is used to diagnose ADHD and assess the effectiveness of treatment since the scale is based on sex and age, and it is observed and written by parents and teachers. The Dupaul ADHD Rating Scale-4 comprised 18 questions divided into inquiries about the signs of attention deficit disorder, hyperactivity, and impulsivity. Each question is scored from 0 to 3, and a child is identified to have ADHD when the parents obtain a score of 19 points, while teachers obtain 17 points. The Dupaul questionnaire e has high validity and reliability and has been used in recent studies to identify overactive children [16, 33].

Cooper Smith Self-esteem Questionnaire: This questionnaire was prepared and elaborated by Smith it measures four subsets of self-esteem: public, family, social and school. The author reported that the test-retest coefficient was 0.88 after 35 days and 0.70 after three years. In one study, the coefficient validity of this test through correlating its scores with the final grade years of subjects was calculated and the coefficients obtained were 0.69 and 0.71 for boys and girls respectively. The reliability of this questionnaire using the Cronbach's alpha method was 0.90 and the impromptu method was 0.88 [34].

Bruininks-Oseretsky Test of Motor Proficiency Second Edition (BOT-2): The test of motor proficiency [35] is a standardized instrument that is individually administered to youths between the ages of 4 and 21 years. The test assesses psychomotor development, comprising eight subtests, each measuring a motor function. The BOT-2 is scored as a single motor-area composite and has related subtests): (a) fine manual control, e.g., fine motor precision and fine motor integration, (b) manual coordination, e.g., manual dexterity and upper-limb coordination, (c) body coordination, e.g., bilateral coordination and balance, and (d) strength and agility, e.g., running speed, agility and strength. The four motor-area composite scores are combined as a total motor score, which represents the total motor proficiency. While the validity coefficient

of the test of motor proficiency was 90%, the retest reliability coefficients of the long and short forms were respectively 0.78 and 0.86.

Intervention: The two children with obesity and ADHD in both groups participated in the motor proficiency intervention for nine consecutive weeks. They had the intervention twice a week along with the other 28 students without ADHD and each session lasted for not less than 90 minutes. There were 14 students in group 1 ($M_{age}=6.53$, $SD_{age}=0.49$) and 14 students in group 2 ($M_{age}=6.58$, $SD_{age}=0.52$). The children with obesity and ADHD were introduced as friends to the group of children. Before the intervention, the research objectives and three sessions covering the scope of intervention activities were discussed with the physical education teachers as well as the need to manipulate environmental and task constraints.

In this study, the motor intervention skills included hopping and galloping, jumping, jumping with the ball, striking, kicking, and throwing [36, 37]. They were practiced by children with ADHD practiced with those without disabilities when they arrived each week for training. They practiced hooping and galloping and jumping with the ball for the first intervention and the remaining skills were practiced on the next training time. Some were repeated to ensure mastery. In terms of the nonlinear pedagogy, the learning design and provision

of instruction and feedback were based on the principles of representativeness, information-movement pairings, constraint manipulation, exploratory learning, and reduction of conscious movement control [38]. Table 1 presents the skills for intervention, how to manipulate the environment and tasks, and procedures for promoting motor functioning. It also shows the planned activities that children both with and without ADHD participated in. The intervention plan is based on the nonlinear pedagogy framework that “focuses on the learner and includes providing less prescriptive instructions and guided discovery which serves to develop greater autonomy, competence, and relatedness in the learning process” [39].

In group 1, the physical education instructor did not provide supplementary verbal instructions or feedback on performance regarding the internal body movements of an ‘ideal’ technical hurdling action (the ‘how to do it’); rather she gave ‘broad performance outcome-oriented statements’ which served as constraints to the selected activities for learners. The PE teacher did not consider specific movements regarding how participants coordinate limb segments and joints in attaining the task goals but made participants, including the child with ADHD, time to automatically explore the practice environment and to maximize functional movement through self-generated feedback. After the participants

Table 1: Scope and Process of Intervention

Skills Intervention	Intervention environment design	Manipulation of environment constraints	Manipulation of tasks constraints	Procedure
Hopping and Galloping	Design a specific station for hopping and galloping	Determine the hopping and galloping skill Station with its related photograph, line-up between stations for walking and running (yellow line of between the stations was for running and the blue line was for walking)	Practiced by two classmates help	Hopping and galloping with a grope and with friends help, determine proper foot movement direction with related symptoms, limiting or giving more freedom for child’s move with color lines
Jumping	Design a specific station for jumping	Determine the jumping skill Station with its related photograph, Line-up between stations for walking and running (yellow line of between the stations was for running and the blue line was for walking)	Use of elastic shoe or mattress	Use of elastic shoe or mattress, giving more freedom in the early stages, defining a specific range for jumping in the later stages with color lines to jump successfully
Jumping with ball	Design a specific station for jumping with a ball	Determine the jumping with ball skill Station with its related photograph, Line-up between stations for walking and running (yellow line of between the stations was for running and the blue line was for walking)	Use of elastic shoe or mattress and lighter and more colored balls	Use of elastic shoe or mattress and lighter and more colored balls, giving more freedom in the early stages, defining a specific range for jumping in the later stages with color lines to jump successfully, use of trampoline
Striking	Design a specific station for striking	Determine the striking with ball skill Station with its related photograph, Line-up between stations for walking and running (yellow line of between the stations was for running and the blue line was for walking)	Use of colored arrows	Specifying the range for Strike, giving more freedom or limiting the individual to reach to the goal
Throwing	Design a specific station for throwing	Determine the throwing skill Station with its related photograph, Line-up between stations for walking and running (yellow line of between the stations was for running and the blue line was for walking)	Use of lighter and larger balls	Use of lighter and larger balls, specify the target to throw that, use of limitation such as setting the barrier to reach the specified throw, setting the range for hand movement
Kicking	Design a specific station for kicking	Determine the kicking skill Station with its related photograph, Line-up between stations for walking and running (yellow line of between the stations was for running and the blue line was for walking)	Use of small balls	Use of small balls, specify the target to kicking that, use of limitation such as setting the barrier to reach the specified kicking, setting the range for foot movement

achieved these outcomes, they were motivated to advance to the lanes of increasing difficulty [25]. The teaching method in group 2 was based on the principles of linear education, which does not manipulate tasks and constraints. In contrast to the nonlinear approach, the instructor helped the participant learn the skill with the template and the feedback. In this method, the design of the practice was changed by considering the total mean of the participants, not based on the growth characteristic of each individual. Generally, in the linear method, the trainer would first explain the skill, then practice the skill himself or show a film to the children, and then ask the children to incorporate what they saw. By providing feedback, the teacher tried to help the children learn [28].

Due to the nature of the nonlinear method, one skill cannot be taught in each session. Therefore, in all 18 sessions, the instructor placed the child in a designed environment to practice the skills of his choice. In this method, the role of the coach was only to manipulate the constraints based on the pervasive physical characteristics. However, the instructor tried to get the child to use all the stations, and if only certain stations were used, they would be blocked by the instructor. In this way, the child used all the stations. But in the linear method, the instructor divided the training sessions into three parts: 1-6, 7-12 and 13-18, and in each of these sections, the existing skills were practiced. In the first session, hopping and galloping, the second session, jumping, the third session, jumping with ball, in the fourth session, striking, in the fifth session, throwing, and in the sixth session, kicking were practiced. This procedure was repeated from session 7 to 12 and from session 13 to 18.

To assess the children's self-esteem after the nine weeks of intervention, their mothers were given one month to report on the self-esteem changes based on semi-structured interviews. The interviews involved three sessions, each was one-on-one and face-to-face, lasting for a half hour. The PE teachers were also asked educational questions after the intervention. Before the post-intervention interviews, the children's mothers and PE teachers were asked to answer questions to compare the children's behavior before and after the intervention program. The interviews with the children's mother and teacher were conducted within a friendly environment. This part of the work was for overactive children only. In the quantitative part, due to the young age of the children, they answered the questionnaire verbally.

Data Analysis

All the interviews with the children's mother and PE teachers were recorded electronically and transcribed, which was followed by initial analytic memos of key aspects of the data [40, 41]. From the unstructured data that emerged from the interviews, the first author initially undertook open coding to identify emergent themes from the interview extracts of the children's mothers and PE instructors to form the units of data analysis [41]. Units of meaning formed were placed in temporary groups and categories, but these evolved, were merged or changed as the analysis progressed [41]. To enhance the

trustworthiness of the results, the initial themes were re-read, checked, or verified. A triangulation consensus was reached among the authors. All the researchers reviewed the themes, and some transcribed data were sent to participants to resolve misunderstanding or to member check for accuracy [40, 41].

Pre- and post-test results of the Cooper Smith Self-esteem questionnaire were computed to evaluate children's self-esteem quantitatively. Changes in motor proficiency were ascertained with the Bruininks-Oseretsky-2 test (The short form), where changes of each movement from the pre- to post-test were graded and total scores recorded. Scores were recorded for each subset of motor proficiency. Changes in motor proficiency and self-esteem were derived with the formula ($\text{percentage of changes} = \frac{\text{post test} - \text{pre test}}{\text{pre test}} \times 100$). Finally, body mass index (BMI) was measured with the formula BMI ($\text{BMI} = \frac{\text{Weight}}{\text{Height}^2}$).

Statistical analysis was computed by the second researcher. At first, information and research data were analyzed using descriptive statistics methods. We also used the Shapiro-Wilk test to calculate the normality of the data, while we employed the independent t-test to examine anthropometric differences between groups in the pre-test and, dependent t-test was used to examine changes in variables. In each group, the ANCOVA test was used to investigate the effects of motor skill intervention on the dependent variable. The selected level to show the significant statistical difference was $P < 0.05$. Version 24 of SPSS software was used for calculations.

Results

Five themes were extracted from the interview transcripts of teachers and parents of children in the two training groups: control of violence, pleasure from the game, family relationships, educational relationships, and social relationships. Each theme is described and supported by selective quotations. The results focus on the experiences of the children with ADHD as provided by the mothers and PE teachers.

Control of violence: Control of violence refers to having friendly relationships with other children and enjoying class or school activity with friends without sadness and anger. Violence control enables a child to relate well with others in a group setting. The interview results revealed that inclusive education, training, and planned intervention designed in nonlinear pedagogy were effective in minimizing projections or acts of violence from the children with ADHD and among the other groups of children. Initially, it was identified that the girls projected violent behaviors that ranged from mild (e.g., anger and sadness), to extreme such as fighting and destructiveness. These destructive and disruptive behaviors later improved to more friendly ones such as being happy, playful and lessened complaints as seen in quotes. In the linear group, the problem of violence in the child with ADHD has not been resolved.

"Early in the intervention, she always fought with her friends. She usually spent most of her time expressing sorrow, sadness, or anger. But she was less angry at the

final sessions and she was happy to practice with her friends. She did not argue with any of the kids in the last two sessions and happily separated from the kids at the end of the exercise.” (PE Teacher, group 1). “The problem that I had and never solved during the interventions was that she would beat the kids, fight with them and take up a significant amount of training time. Her anger made other children unable to be close to her. I was talking to him, making him the leader of the group, but I still couldn’t get a good result” (PE Teacher, group 2).

“I used to argue with mothers of other children due to fights because my daughter was always arguing with their kids. She is now less annoyed and less distracting or breaking devices. She complains less about other children, or her friends and school” (Child’s Mother Group 1). “I’m always worried that she’ll fight with other children. Her teacher always talks to me and says she fights with other children in the class. It really worries me and it’s getting worse day by day” (Child’s Mother Group 2).

Pleasure from the game: Pleasure from the game means getting involved in the game happily no matter the passage of time and trying to be more present in the game. Opinions from both the teacher and the mother of the girl in the nonlinear pedagogy group indicated the child at the advanced stages of the intervention and afterward, enjoyed playing and participating in the physical activities. She was also happy and satisfied with the daily activities. She expressed improved pleasure, or happiness by her enthusiasm and preparedness to participate more in the physical education activity. She also developed a positive attitude and thus was willing and excited to speak freely about the physical activity she was practicing.

“She laughs more at the end of the intervention than the initial sessions. She usually asked what time the next session would be, and she was very eager for the next exercise and activities. I think the interventions made her happy or had a positive impact on her pleasure” (PE Teacher group 1).

“She had a positive attitude towards interventions in the final sessions and always described them to her friends and coach. She had a great desire to go to class and always asked how she was practicing. She really enjoyed the class” (Child’s Mother Group 1)

In group 2, the child did not experience changes relating to take pleasure from the physical activity participation. “Her activity was not happy. She seemed not satisfied with this class. She usually cried because of fights or looked for other things like playing with the phone” (PE Teacher group 2).

“She’s very active and has a lot of energy, but I don’t know why she doesn’t like it in the group. She always stops crying and upset and always complains about her friends. She was not satisfied with the sports class that she was in” (Child’s Mother group 2).

Family relationships: Family relationships denote friendships between parents and children in which a child and parents understand and respect each other. The quotes following from the child’s mother interview show that the family’s relationship improved due to the inclusive

education and nonlinear pedagogical approach used for the child and a group of children. The interview extracts indicated there was improved communication, teamwork and friendliness between the child and the family. There was joint sharing of qualitative time, and the child felt more comfortable, was sympathetic, and had improved relationships with the family. These were behaviors not observed in a child practiced in the linear method group.

“She understood that she is important to us and we always attend to her. Now she has better relations with us, and we can make better communication together. She is now talking to us more and spends a lot of time with us. She is also kinder to us. She has a great desire to play with us, and go out with us. She now volunteers to do her work. She is listening more to us now and is not stubborn. She sympathizes and is comfortable with us” (Child’s Mother Group 1). “I haven’t had a good relationship with her before or now. I love her but she thinks her father and I don’t like her. She is usually stubborn and likes annoying us. She does what we don’t like” (Child’s Mother Group 2).

Educational relationships: Educational relationships indicate friendships between the child and other peers that he or she plays with and accept as friends. The findings show that the intervention exercises in nonlinear pedagogy created a better school environment that enabled the child to experience improved relationships and to form friends with other peers. Such improved educational relationships resulted in increased respect, happiness, and the willingness to volunteer to assist other children. But in the linear intervention group, educational relationship of the child with ADHD did not improve.

“Now she has a lot of friends at school and praises them more. She feels happy because she is at school and is among friends. She has improved her relationship with her teachers, and she respects them a lot” (Child’s Mother Group 1). “She fights with children in the intervention class and elsewhere. She can’t find a good friend for himself, gets mad early and fights with her friends” (Child’s Mother group 2).

“She is happy with her friends; she has a good relationship with us. She helps her friends, or volunteers to help them. She is now happy with the success of her friends” (PE Teacher group 1). “She was less seen as having a good relationship with others, fighting with others and not being a good friend to others” (PE Teacher group 2).

Social relationships: The child’s social relationships within the group and class that used the nonlinear pedagogy improved. The child exhibited better social relations evidenced by interacting, playing and communicating with other children without ADHD who participated in the physical activity designed for the group. The child has overcome her initial social struggles and now mixes well with other peers without ADHD. This is clear in these quotes and was not observed in the linear group.

“She is now friendly with the other children; she plays with them more and enjoys being on their side. Now she struggles less with her friends and communicates more with her classmates” (Child’s Mother Group 1). “Her

teachers at school, in the classroom, and all the children complain about her behavior. She’s a really good girl and she wants to be nice to others, but I don’t know why she can’t have a good relationship with others” (Child’s Mother group 2).

“Her relationship is much better with her friends in games at school and in class. She encourages her friends and commends them for their successes” (PE Teacher group 1). Her social relations are very low. She is angry and she cannot be close with others (PE Teacher group 2).

Table 2 presents the results of the Cooper Smith questionnaire, which shows that the general, family, social and educational self-esteem figures rose generally in the group that used the nonlinear pedagogy. In group 1, the post-intervention scores for general self-esteem and family self-esteem increased by 12 and 6 scores respectively. In total, there were a 142.1% (27 points) increment in self-esteem scores. While the total motor proficiency as determined by the Bruininks-Oseretsky-2 test increased by 23.3 % (12 points), the child’s body mass index decreased by 1.15 kg/cm. In group 2, self-esteem did not change, and motor proficiency and BMI improved less than group 1.

An independent sample t-test was run to compare age, height, weight and BMI in the two groups of children

without ADHD. As shown in Table 3, there was no significant difference between groups for age ($t_{(26)}=-0.22$, $P=0.79$), height ($t_{(26)}=-1.41$, $P=0.17$), weight ($t_{(26)}=-0.82$, $P=0.41$) and BMI ($t_{(26)}=-0.91$, $P=0.99$).

Table 4 presents the descriptive information and the rate of change of the variables’ scores in children without ADHD. Self-esteem scores increased 12.21 units in the nonlinear pedagogy group, and motor proficiency scores were enhanced 7.07 units in the nonlinear pedagogy group, which were much higher than those in the linear group.

One-way ANCOVA was performed to determine the statistical significance difference between the nonlinear and linear groups on self-esteem, and motor proficiency by controlling for pre-test after doing motor skill intervention (Table 5). There was a significant effect of training type on self-esteem ($F=27.885$, $P=0.000$, $\eta^2=0.527$), and motor proficiency ($F=15.701$, $P=0.001$, $\eta^2=0.386$) after controlling for pre-test.

Discussion

The study investigated the effect of two teaching methods and inclusive education on self-esteem and motor proficiency of ordinary and overactive children.

Table 2: Changes in motor skill, self-esteem, and body mass index

Variable		Before intervention	After intervention	percentage of changes
General self-esteem	G1	12	24	↑%100
	G2	11	12	↑%9.06
Family self-esteem	G1	2	8	↑%300
	G2	2	2	0%
Social self-esteem	G1	1	7	↑%600
	G2	2	3	↑%50
School self-esteem	G1	4	7	↑%75
	G2	3	3	%0
Total self-esteem	G1	19	46	↑%142.11
	G2	18	20	↑%11.11
Motor proficiency	G1	52	64	↑%23.03
	G2	51	56	↑% 9.80
Body mass index	G1	20.41	19.26	↓% -5. 63
	G2	20.45	20.39	↓% -0.29

Table 3: Independent T-test comparison of anthropometric characteristics of subjects

	F	T	DF	Sig. (2-tailed)	Std. Error Difference
Age	0.547	-0.228	26	0.791	0.19162
Height	0.049	-1.410	26	0.170	0.65854
Weight	1.069	-0.829	26	0.415	0.43085
BMI	1.693	-0.910	26	0.993	0.38892

Table 4: Pre and post-test results of descriptive information on self-esteem and motor proficiency

Variable	Group	N	Pre-test	Post-test
Self-esteem	Nonlinear pedagogy	14	26.78±3.88	39.00±6.06
	Linear method	14	25.78±5.38	27.07±5.51
Motor proficiency	Nonlinear pedagogy	14	61.57±5.94	68.64±5.37
	Linear method	14	60.35±6.34	63.71±6.1

Table 5: ANCOVA results statistics

	Df	F	sig	η^2
Self esteem	1,25	27.885	0.000	0.527
Motor proficiency	1,25	15.701	0.001	0.386

The study consisted of two parts in which we reported changes in self-esteem and motor proficiency in overactive children. In the second part, we reported changes in self-esteem and motor skills in ordinary children. The overall study results showed that the combination of inclusive education with non-linear pedagogy is useful to improving the self-esteem and motor proficiency of overactive children. Results highlighted the effectiveness of nonlinear pedagogy compared to linear method, found for the first time in this study. Other studies have reported positive effect of inclusive education on a variety of factors. Chen et al, reported that an inclusive soccer program had positive impacts on the motor performance and sport skill development of both young adults with and without intellectual disabilities [42]. Brodzeller et al, in one case study showed that the needs and demands of autistic children are better met when inclusive education is associated with environmental manipulation [23]. Our results also confirm the prediction of the study of Engelbrecht and Savolainen on the effectiveness of inclusive education in combination with the nonlinear pedagogy [42]. Moy et al, showed that non-linear pedagogy had stronger effect on children's motivation than the linear method [29]. Our study supports the positive effect of nonlinear pedagogy compared to the linear method on other variables [30, 31], specifically on self-esteem and motor proficiency variables for both ordinary and inclusive children.

The qualitative results from the children's mother and the PE teachers showed positive effects of the intervention— improvement in control of violence, pleasure from the game, family relationships, educational relationships, and social relationships in the nonlinear pedagogy. Generally, we found that nonlinear pedagogy combined with inclusive education not only improves the subsets of self-esteem (family, social and school relationship) but is also effective in controlling violence and enhancing children's enjoyment of physical activity. The quantitative results from the Cooper Smith Questionnaire similarly showed that self-esteem (public, family, social and school) improved for the selected child in group 1 but this improvement was not remarkable in group 2. It is essential to develop self-esteem as positive self-esteem may help children with ADHD to cope with challenges of everyday life. Self-esteem development in children with ADHD enhances their performance and outcomes in physical activity participation and engagement in inclusive settings generally [14]. It is also crucial for healthy psychological development and is indeed essential to the acquisition of social skills that enable involvement and engagement in inclusive settings. Self-esteem also increases when one is alongside others; hence, this contributes to improving children's physical activity participation. Ensuring increased activity participation in inclusive education settings for all children, especially those with ADHD, would increase the likelihood of overcoming their struggles with social relations. This finding highlights the significance of planned physical activity and the helpfulness of a non-linear pedagogy [23].

Results further indicate that there was game enjoyment

for all the children. The child with ADHD in group 1 was especially happy and she enjoyed participating in all the activities from the planned practice and inclusive class. Enjoyment and satisfaction are important goals of physical activity participation, which can further enhance children's motivation for learning, and improve their self-esteem in inclusive schools [26]. For some children, the satisfaction and enjoyment they derive from physical activities stimulate their exploration and motor functioning [19]. The joy and happiness make children less likely to fight and argue with their friends. In fact, enjoying a good educational method makes children happy (whether with or without disorders) and this has a positive impact on social, educational and even family relationships.

Findings indicate that the nonlinear pedagogy considers individual differences, e.g., learners' intrinsic dynamics, which can help teachers to design appropriate practice environments for all learners, including students with ADHD. Our findings show that the nonlinear pedagogy also fosters independence and increases the self-esteem of children with ADHD [26]. For Moy et al, nonlinear pedagogy can inform learning design and delivery in physical education, and it potentially enhances student learning of motor skills in physical education [27]. As noted in this study, the PE teacher provided some appropriate practice environment that stimulated all learners' exploratory behaviors, and this may have increased the (child's with ADHD) learner's autonomy and self-esteem [27]. The nonlinear pedagogy used in combination with inclusive education or learning approach for children with disabilities who are otherwise more dependent on exceptional help from teachers can thus foster the physical activity participation of all children. But the linear teaching method was not effective because it is designed based on the average progress of all children as it does not consider individual differences. Notably, failure to follow the pattern correctly discourages the child [31, 38]. In the nonlinear pedagogy, a person does not ask for direct help, but the practitioner manipulates tasks and environmental constraints to stimulate learners' exploratory behaviors [38] or limit disadvantages of a person with disorder, which prevents frustration, so the person continues to work more confidently [23, 25]. Hence, the use of inclusive education and nonlinear pedagogical approach contributed to making physical activities enjoyable and appealing to children with ADHD.

Our results confirm the positive effects of nonlinear pedagogy in limiting violence or complaints among children. For example, after the initial struggles with life in inclusive settings, the child with ADHD in group 1 did not complain to the PE teachers and friends at any stage of the intervention. She was able to manage her emotional outbursts and destructive behaviors, which could have resulted in fights and other violent or aggressive behaviors towards other peers. Also, she did not want to opt out of the intervention but rather volunteered to go to class always, although, before the intervention, she always gave an excuse in order to avoid going to school and did not want to participate in physical activities. As noted,

the child with obesity always had a story to describe her physical activity participation, spoke well about her friends, the game and exercise enjoyment, as opposed to clashes and detestations she encountered previously. The physical activity thus led to improved relationship, friendship formation, and increased enjoyment of exercising.

Interestingly, results show that the BMI of the child in group 1 decreased by 1.15 points, which indicates changes in her weight while that of the other child with ADHD did not witness much decrease. The change in the linear group was not significant, which further reveal that physical activity can play a helpful role in weight loss. Regular physical activity is a major strategy for weight loss as regular activity consumes energy. As the selected children practiced regularly for 9 weeks, the reduction or changes in their body mass index can be related to their participation in the physical education activity intervention. Due to improved self-esteem and weight loss, resulting from physical activity participation, our study suggests the inclusive learning approach should be enhanced in the Iranian education system and schools. To do this, Ackah-Jnr argues, schools need to be resourced adequately to develop and build the capacity of teachers to “smooth-drive” inclusive practice.

Study results indicate the intervention also improved the children’s motor proficiency and self-esteem in both groups with and without ADHD, but in nonlinear group this improvement was great. In discussing the effect of exercise and physical activity on the variables of this study, Robinson et al, indicate that motor competence is positively correlated with perceived competence and multiple health domains such as cardiorespiratory fitness, muscular strength and endurance and weight status [42, 19, 26]. Regular physical activity increases the motor competence of the individual. This competence improves one’s self-esteem to continue exercise, and eventually physical activity improves multiple health domains. This issue has been confirmed in the present study to improve motor proficiency, self-esteem in children, but more importantly as identified in this study is the type of teaching. The nonlinear pedagogy seems to work better than linear education because of its advantages.

Our research was conducted in a natural environment based on the composition of the diverse children in the classes. We also tried to combine the inclusive teaching method with the nonlinear pedagogy, which yielded some interesting results. The limitation of the present study is that we did not consider other disorders, so it is advisable to include other children with disabilities in future research. We suggest that future researchers focus on including children with autism or developmental coordination disorders in addition to overactive children at inclusive education.

Finally, findings show that educating children with disabilities in inclusive settings, accompanied by manipulating environmental and task constraints, can foster increased participation, engagement and performance. Inclusive education develops best practices, principles, and pedagogies that support sustainable programs for all children and conditions that create

equal and accessible educational opportunities. Effective inclusive education could limit psychological and physical problems children may suffer due to isolation from mainstream school settings.

Conclusion

Because of the difficulty, disadvantage or high cost associated with separating a few children with ADHD from group physical activity and inclusive settings, our findings suggest that it is better to manipulate the learning environment and tasks, and more importantly, overcome barriers to participation and engagement so that inclusive schools can be adapted to the learning conditions and practices intrinsic to the dynamics and needs of all learners and develop their motor skills. The nonlinear pedagogy and inclusive education learning approach have positive effects for children, so with effective training, coupled with eliminating environmental constraints, this can resolve problems of educating children with ADHD and obesity in inclusive settings.

Conflict of Interest: None declared.

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