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The effect of Nintendo Wii on physical fitness of adolescents and young adults with mild and moderate intellectual disability

Techlikidou, E.[1*], Michalopoulou, M.[1], Kourtessis, T.[1], Skordilis, E.[2]

[1]Department of Physical Education and Sport Science, Democritus University of Thrace, University Campus, 69100 Komotini, Greece
[2]School of Physical Education and Sport Science, National & Kapodistrian University of Athens, 41, Ethnikis Antistasis, Avenue Dafni, 17237, Greece

Abstract

The purpose of the current study was to examine the effect of a Wii program (Active, Fit Plus, Sports), in young adults and adolescents with mild/moderate intellectual disability. The eight-week program (3 sessions/week, 30 minutes each) was implemented during the adapted physical education classes of two special education schools. The sample consisted of seventeen young adults and adolescents with intellectual disability who were assigned into two groups, an experimental (EG, n=9) and a control one (CG, n=8). Physical fitness assessment included a) six minutes walking for cardiorespiratory endurance, b) standing broad jump for lower body strength and c) sit and reach test for flexibility. The independent variables were experimental condition (EG & CG) and time of measurement (pre, post & retention). The analyses revealed a significant interaction effect with respect to the 6-min walking. The result is promising and discussed in accordance to the self-efficacy theory employed.

Keywords: Adapted Physical Education; Intervention Program; Physical Interactive Games.

1 Introduction

Individuals with intellectual disability (ID) often exhibit low physical fitness (Pitetti & Tan, 1990) because of a passive life style, increased body weight (Howie, Barnes, Mc Dermott, Mann, Clarkson, & Meriwether, 2012), low motivation to exercise (Lotan, Yalon-Chamovitz & Weiss, 2010), delayed attainment of motor milestones, and decreased motor proficiency (Wuang, Chiang, Su & Wang, 2011). Therefore, it seems essential for individuals with ID to get involved in regular physical activity in order to reach and maintain a minimum fitness level (Miyachi, Yamamoto, Ohkawara, & Tanaka, 2009). According to the American College of Sports Medicine guidelines that means at least 30 minutes of moderate intensity exercise on daily basis (Franklin, Whaley, Howley, Balady & American College of Sports Medicine, 2000; Carmeli, Zinger-Vaknin, Morad & Merrick. 2005). Regular physical activity will improve their cardiorespiratory and muscular endurance (Pitetti, Beets & Combs, 2009), body weight control (Bryl, Matuszak & Hoffmann, 2013) and eventually, decrease several risk factors such as coronary artery disease, diabetes, obesity, and depression (Lotan et al., 2010).

Recently, researchers have introduced Physical Interactive Games (PIG) to enhance physical fitness and motor abilities of individuals with and without disabilities (Deutsch, Borbely, Filler, Huhn & Guarrera-Bowlby, 2012; Levac et al., 2010; Pompeu et al., 2012; Wuang, Chiang, Su & Wang, 2011; Lotan et al., 2010; Lotan et al., 2009; Karal, Kokoc &

**Corresponding author: e-mail:* texlikidoueleni@yahoo.gr

Ayy1d1z, 2010; White, Kilding & Schofield, 2009; Yalon-Chamovitz & Weiss, 2008). The effects of PIG have been investigated in people with ID (Yalon-Chamovitz & Weiss, 2008; Lotan et al., 2010; Wuang et al., 2011; Karal et al., 2010), multiple sclerosis (Plow & Finlayson, 2011), cerebral palsy (Deutch et al., 2008), obesity (Carrasco et al., 2013; Maddison et al., 2011), developmental coordination disorder (Mombarg, Jelsma & Hartman 2013; Hammond, Jones, Hill, Green & Male, 2014; Jelsma, Geuze, Mombarg & Smits-Engelsman, 2014) etc. In general, the results of the above efforts have been positive. However, they do not allow permanent conclusions to be drawn at this stage (Berg, Becker, Martian, Primrose & Wingen, 2012).

Lotan and his colleagues (2009) applied the PIGT "PlayStation" (SONY), twice a week for 5-6 weeks, at the residential dormitory of a group of adults with ID. The researchers found a decrease in heart rate at rest and improvement of heart performance during exercise upon the modified 12min walk/run test. In a similar study, adults with ID participated in selected games (e.g soccer, birds and balls) of the "Gesture Xtreme GX" PIG (Gesture Tec), for a period of eight weeks and a frequency of 2-3 times per week (Lotan et al., 2010). Possible outcomes of the program show a decrease in heart rate at rest (RHR), significant for the intellectual disabled that are at high risk for cardiovascular diseases (Oppewal, Hilgenkamp & van Wijck, 2013), upon which the effects can also protect blood vessels according to the British Regional Heart Study, mentioned by Kastanias and Tokmakidis (2010). Also, the researchers claimed that PIG intervention had also improved their motivation and encouragement to participate throughout the study (Lotan et al., 2010). However, they indicated that the effect sizes were rather small to claim that the program improved overall the individuals' physical fitness.

Similar positive results were found in a pilot survey of four overweight students aged 7-10 years, Carrasco and his colleagues (2013). In particular, they implemented a program of aerobic activities (running, boxing and karate), which had a frequency of 3 times a week, duration of 60 minutes each session, and in total held 16 meetings to examine the effects of the PIG on functional ability and in body composition. In this program, which increased the intensity level each week, participants were evaluated with the 6-minute walk test for their functional ability. The results showed that the distance covered significantly increased, which from 532.5 meters to the initial measurement, reached 667.5 meters after the end of the intervention. As the researchers said, the mobilization of large muscle masses in the body led to increased energy demands, which led to cardiopulmonary adjustments, increasing maximum oxygen uptake (VO2max). However, the researchers point to the need to carry out further studies with a larger sample of the population, to examine the frequency, duration of the programs and also the exercise book in order to confirm the true effects of PIG on the physiological characteristics (Carrasco, Kerppers, Teixeira & Pires, 2013).

According to Lieberman and colleagues (2011), self-efficacy is a key mediating factor known to improve healthy behaviors, participation and adherence to physical activity for individuals exposed to PIGT. Self-efficacy is the confidence an individual possesses in order to meet the demands of a certain activity. According to Bandura (1997), self-efficacy is enhanced when the realistic demands of the activity are met. In this case, ongoing participation is fostering further interest and provides mastery experiences, greater interest and enjoyment in the activity across time (Bandura, 1997). In the case of active participation in a PIGT program, individuals are repeatedly exposed to virtual stimulation through observation. The compelling training environment can create and elevate the incentive for participation, therefore it can also provide a choice for activities in their spare time, which can be played alone, with friends or their family at home or at school. The ability to run several iterations, combined with visual, auditory and tactile feedback contributes to their learning and ability to perform with little or no supervision. Accessibility, the levels of difficulty in the exercises depending on the capabilities of each participant can amplify lack of failure and contributes to enhance their self-confidence. Additionally, the element of failure is absent, encouragement and verbal reinforcement is common, and individuals realize what they need to do to be more effective and eventually become more self-efficacious. The gains in self-efficacy may simply “rise after playing a vigorous game several times a week for several weeks” (Lieberman et al., 2011, p. 2510).

The aforementioned literature is encouraging with respect to the physical fitness of those involved. However, the effect of PIG implementation in a special education school environment as a course in Physical Education taught to students with intellectual disabilities for promoting health has not been confirmed yet. Furthermore, the physical fitness elements have been so far assessed separately and not in parallel. The present study therefore was designed to investigate the effect of an in-school PIG training program on selected elements on the physical fitness of adolescents and young adults with mild/moderate ID as a lesson in Physical Education within their special education school environment. The PIG “Wii” from the Nintendo Company was selected for the purposes of this study. This study is one of the few to include Wii in a Physical Education lesson program for students with intellectual disabilities. Based on previous research findings, it was anticipated that intervention would have a positive effect upon on physical fitness of the individuals involved.

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2 Method

2.1 Participants

Participants in the current study were 17 students (8 boys and 9 girls) with mild/ moderate intellectual disabilities, from two special education schools in Northern Greece. The sampling procedure was purposive (Wuang, et al., 2011) since the participants constituted a homogeneous group of interests which enabled, through the experimental procedure, to answer the research questions (Crossman, 2017). The participants’ ages ranged from 14 to 24 years, with no comorbidities or syndromes (such as Down, Williams, or genetic syndromes) reported in their school files, able to follow simple instructions throughout the study (Hammond et al., 2014; Lotan et al., 2010; Wuang, et al., 2011). Average age for the whole sample was 17.18 (±3.26) years, while body mass index (BMI) was 25.36 (+ 4.80). Nine students from the one school served as the experimental group (EG, 4 boys and 5 girls, mean age 17.33+3.32, mean BMI 26.07 + 5.07) while eight students from the second school comprised the control group (CG, 4 boys and 4 girls, mean age 17.00+3.42, mean BMI 24.58 + 4.69). All participants, from experimental and control groups have been diagnosed with mild/ moderate intellectual disabilities.

Participants from both groups come from same school settings, learning environments and have identical lesson programs; therefore, there are no influences in results. Also, during the program, participants did not participate in any other organized athletic programs in or out of school environment.

Permission was granted by the Institute of Educational Policy of the Ministry of Education. In addition to that, the primary researcher informed the parents who gave permission and signed the informed consent. The informed consent incorporated all necessary information, including the fact that the study had institutional approval from a Research Ethical Committee of the Democritus University of Thrace.

2.2 Measures

According to Verret, Gardiner and Beliveau (2010), aerobic capacity, strength and flexibility are predominant variables for fitness testing in children. Physical fitness assessment battery included the a) six minutes walking for cardiorespiratory endurance (Elmahgoub et al., 2011), b) standing broad jump for lower body strength (Tsigilis, Douda & Tokmakidis, 2002) and c) sit and reach test for flexibility (Golubovic, Maksimovic, Golubovic & Glumbic, 2012).

Six minutes walking: The participants completed the 6-minute self-paced walking test, in a 30-m-long corridor, in the school's indoor gym. They were instructed to cover as much distance as they could, without running (Enright, 2003). They were allowed to stop, if they felt uncomfortable, but they were also encouraged to continue their effort as soon as possible. The distance they covered during the 6-minute period was estimated at the nearest meter. Verbal encouragement was provided throughout the assessment.

Strength: It was assessed using the explosive leg power test, according to the guidelines of the Eurofit Physical Fitness Test Battery. The students were asked to jump as far as possible and to land on both legs, without falling backwards. One familiarization and two consequent trials were held; the trials were measured in centimeters and the best effort was recorded (Eurofit, 1992).

Flexibility: the sit and reach was used to measure lower back and hamstring flexibility. The participants were instructed to reach as far as possible and reach the box, while sitting on the ground with their knees straight. After a brief warm up, the students performed twice and the best measure was recorded to the nearest centimeter (Tsigilis, et al., 2002).

Finally, the PIGT “Wii” from the Nintendo Company was selected for intervention. The Wii uses player movement to control game play (via an avatar called Mii-pronounced “me”), which is an icon or figure representing the player in the game. Movement is controlled by the Wii remote, nunchuk, or balance board (or in combination). The Wii remote (similar in size to a television remote control) uses a three-axis accelerometer to translate body movement into onscreen movement. Up to four controllers can be connected wirelessly to the console, allowing group play and social interaction. The Wii remote also provides basic audio and vibration feedback. An expansion device (Wii Motion Plus), which attaches to the Wii remote, allows for more accurate motion capture and complex game play. The Wii Motion Plus, does this with a single and dual axis gyroscope. A secondary controller, the nunchuk also incorporates motion-sensing technology and provides additional controls. The balance board incorporates pressure sensors to translate the movement of the player's center of pressure. The signal from the controllers are received by a sensor bar (Taylor, McCormick, Shawis, Impson & Griffin, 2011).

2.3 Procedure

Initially the primary researcher visited two schools and explained the purposes of the study to the principals, teachers, staff and students. The two schools were randomly assigned to the experimental conditions. Thus, the students in one of the schools served as the experimental group (EG), while the students in the other school served as the control group (CG).

In order to organize the experimental period and select the Wii Games that stimulated the participant's interest, a pilot study was conducted for two weeks and they took place two students with intellectual disabilities (Lotan, et al., 2010; Karal, et al., 2010). Planning and content of the program consists of selected sports/games from Wii Sports, Wii Active and Wii Fit, simple comprehension of game and motor skills to stimulate interest (Kokaridas, 2010; Lotan, et al., 2010).

The program was applied with a three times frequency a week and each intervention lasted 30 minutes. Participants had executed the program in order to determine the suitability and the comprehension level of the selected exercises. Additionally, the duration of each exercise/activity, the total time of each program and the suitability of the game console was examined. After complement the pilot study, were selected the final exercises / activities, the execution order and the total exercise time which are described on Table 1. Consultation with the students, parents and teachers led to the decision to use the “Wii active, fit+ and sports” video games. These games incorporate activities for promoting physical fitness and motor skills (e.g. running, boxing, jumping, striking a tossed ball, catching, throwing, basketball shooting, bowling, balance activities, yoga exercises, e.t.c). Before pre-testing, all participants in the EG were exposed in a familiarization period, in three separate individual sessions (Wondrusch & Schuster-Amft, 2013). Exercises / activities were selected according to the physical education curriculum for students with special needs. Participants exercise individually in special designed area in school gymnasium.

During each session, the participant played individually (Berg, Becker, Martian, Primrose & Wingen, 2012), approximately for 30 minutes. As a warm up session, each participant spent the first 5-10 minutes either playing bowling, running slow, or walking. Accordingly, the participants continued with yoga exercises for strength training and then shifted to more intense activities, such as running faster, playing tennis, boxing, etc. The intense activities lasted approximately 15-20 minutes. Finally, five minutes at the end served as cool down session, with lower intensity activities such as stretching and walking in a slow pace.

Table 1. Content of the intervention program for the experimental group

Monday		**Wednesday**		**Friday**	
Duration / repeat		**Duration / repeat**		**Duration / repeat**	
Walk & Run Medium	1.32’ / 1	Rowing Squat	2’ / 1	Bowling	10’ / 1
Run, Knees & Kick Ups 2	3.40’ / 1	Sideways Leg Lift	1.30’ / 1	Tennis	10’ / 1
Heavy Bag (Box)	1.16’ / 1	Soccer Heading	2’ / 1	Box	10’ / 1
Track Random (Medium)	1.35’ / 1	Ski Jump	1’ / 2		
Jump Squats	48’’ / 1	Penguin Slide	1’ / 1		
Side to Side Jump s	40’’ / 1	Tight Rope	2’ / 2		
Passing1 (Basket)	1.15’ / 1	Obstacle Course	2’		
Shooting (Basket)	1.54’ / 1	Bird’s Eye	2-4’ / 1 ή 2		
Inline Skating	1.03’ / 2	Basic Run	4’ / 1		
Batting (Baseball)	1.20’ / 1				
Catching (Baseball)	1.18’ / 1				
Back Court (Tennis)	40’’ / 1				
Front Court (Tennis)	38’’ / 1				
Back, Front & Mid Court	57’’ / 1				
Bump, Set & Block (Volley)	1.45’ / 1				
Random medium (Volley)	1.28’’ / 1				

The Wii activities followed the basic principle of the known to the unknown, from easy to difficult, from concrete to abstract. According to Kokaridas (2011) and Kousoureta

(2014), feedback from the educator and the game may be necessary in order for the student to understand the game or activity. The participants were provided with visual and brief verbal feedback, while the encouragement provided was gradually reduced until eliminated.

Pre-testing was held few days before initiation of the intervention. Each person was assessed individually, by two experienced educators in the school's indoor gym, between 10 a.m. and 2 p.m. Both evaluators, blind to the purposes of the study, were considered experienced and specialists in the field of adapted physical activity and had received previous training regarding the assessment of physical fitness (e.g. Eurofit) in individuals with intellectual disabilities. The two evaluators scored the participants separately and compared their findings using Intraclass Correlation Coefficient (ICC). No disagreement was recorded during the pre, post and retention assessments (Table 2).

Table 2. Intraclass Correlation Coefficients (ICC) for Physical Measurements

Physical Fitness	ICC
Lower Body Strength	.837
Flexibility	.393
Balance	.319
Sit & Reach	.985
6 min Walk	.854

The intervention program was consistent throughout the study and lasted eight weeks, with a frequency of three sessions per week (e.g. Monday - Wii Active, Wednesday - Wii Fit and Friday – Wii Sports). The intervention sessions were taking place during the adapted physical education classes. On Mondays, the participants worked with activities from the "Wii active". On Wednesdays, they were exposed to "Wii fit+" and on Fridays to "Wii sports". Throughout the program, verbal encouragement was provided by the primary researcher as well as by the Wii programs themselves (i.e. tokens, medals awarded). The encouragement was deemed necessary to sustain their interest and motivate them to keep up with the demands of the activity. A detailed diary with the activities exposed, the attrition rate and absenteeism was kept. All students in the experimental group participated actively throughout the experimental period, and no absences were recorded (100% attrition rate). When the program ended, the students were re-evaluated by the same assessors, at similar conditions to those held at pre-test. Finally, one month after post testing, the participants were reevaluated to assess retention. During the 8-week program and during the month until the retention test session, the parents and students were instructed not to participate in any organized physical activity either at school or at their free time (e.g. Special Olympics).

The participants of the CG followed the regular weekly adapted physical education program (every Monday, Wednesday and Friday), according to the guidelines provided from the Greek Ministry of Education (APS, EEEEK, 2004). Group games, track and field events and balance and strength games, which were in line with the potential of school students, comprised every class. The students of the CG and their parents were instructed not to participate in any organized physical activity throughout the study period.

2.4 Data analysis

Separate t-tests examined the baseline differences between the EG and CG in mental age, chronological age and BMI. A 2 X 3 MANOVA examined the interaction effect between condition (experimental group-EG vs control group-CG) and time (pre-test, post-test, retention), with respect to the physical fitness of adolescents and young adults with intellectual disability. Univariate analyses and t-parameter estimates were used as post hoc comparisons. The η^2 was used as an estimation of effect size, with values of .02 to .05 being small, .05 to .08 being moderate, and above .08 being large (Cohen, 1977).

Estimation of sample size was based in the study of Wuang, Chiang, Su and Wang (2011). Specifically, with an effect size of 1.10, alpha level of .05, and power of .80, a total of 8 participants would be sufficient to detect significant differences (4 participants per group) (Grimm, 2003)

3 Results

The descriptive statistics for the Physical Fitness and BOTMP assessments, for the EG and the CG during pre, post and retention, may be found in Table 3.

Table 3. Pre, post and retention measures for the Experimental and Control Group

Physical Fitness Elements		Pre Test	Post Test	Retention
Lower Body Strenth (cm)	EG	98.78±30.24	103.22±21.60	114.00±26.14
	GG	102.75±27.35	108.88±27.21	104.88±29.26
Flexibility (cm)	EG	19.11±11.89	20.33±11.95	21.00±10.70
	GG	27.25±6.20	28.00±7.48	28.50±9.12
6 min Walk (m)	EG	569.31±59.31	652.64±65.48	636.33±31.64
	GG	519.13±36.24	526.75±36.62	502.88±42.75

Separate independent sample t-tests examined the baseline differences between EG and CG, with respect to chronological age, mental age and BMI. The results were not significant for the above comparisons (chronological age: t = .204, p = .841; mental age: t = 1.116, p = .282; BMI: t = .626, p = .541).

The 2X3 MANOVA for the three physical fitness measures (6 min walk, sit and reach, lower body strength) did not reveal a significant interaction (F=2.398, p=.106, η^2=.590) and time (F=2.377, p=.108, η^2=.588) main effect. The results were significant for the condition (F=18.006, p<.001, η^2=.806) main effect. The univariate post hoc analyses revealed a significant interaction (F=6.816, p<.01, η^2=.312), time (F=6.678, p=.01, η^2=.308) and condition (F=32.570, p<.001, η^2=.685) effects for the six minutes walking test. Examination of the t parameter estimates revealed significant differences between the two groups in the six minutes walking test during the second - post (t=4.800, p<.001, η^2=.606) and third - retention (t=7.375, p<.001, η^2=.784) comparisons. Specifically, the EG scored significantly higher compared to the CG in the six minutes walking test during the post and retention assessments. No significant differences were evident in the first assessment (t=2.070, p=.056, η^2=.222). These findings are presented in Figure 1. The univariate analyses for the sit and reach did not reveal a significant interaction (F=.090, p=.898, η^2=.006) and no significant time (F=2.070, p=.149, η^2=.121) and condition (F=2.689, p=.122, η^2=.152) main effects. Finally, the univariate analyses for lower body strength did not reveal a significant interaction (F=1.081, p=.330, η^2=.067), and main effects for time (F=1.263, p=.288, η^2=.078) and condition (F=.000, p=.989, η^2=.001) respectively.

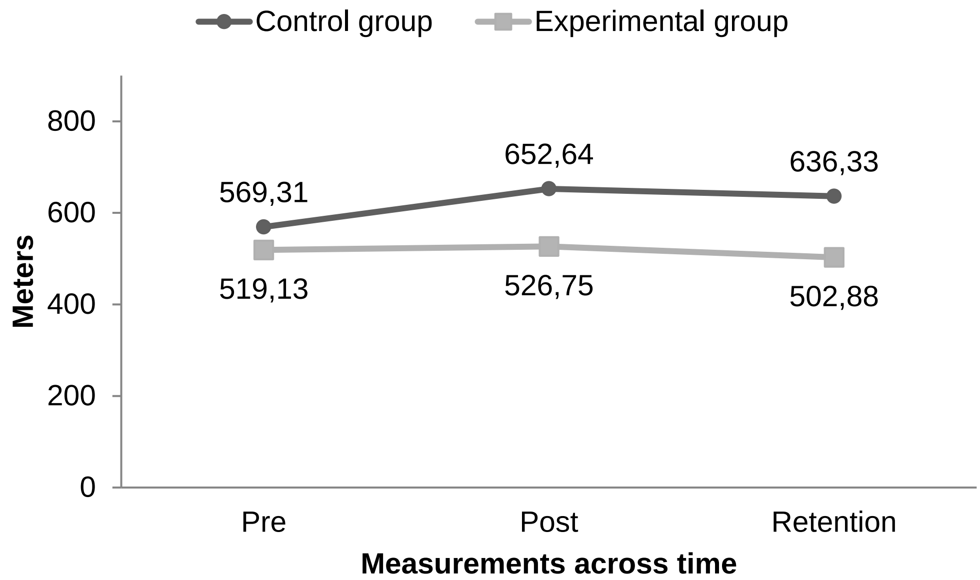

Figure 1. Group means for both groups during the three test sessions in six-minute walking test (in meters).

4 Discussion

The present study was designed to investigate the effect of an in-school Physical-Interactive-Games-Training program (PIGT) on selected physical fitness elements of adolescents and young adults with mild/moderate Intellectual Disability (ID). The PIGT "Wii" from the Nintendo Company was selected for the purposes of this study. Based on previous research findings, it was anticipated that intervention would have a positive effect on physical fitness of the individuals involved. According to the findings, intervention seemed to influence significantly the participants' cardiorespiratory endurance (6 minutes-walks by covering more distance with the experimental group). This finding is similar to the findings of relative studies, confirming the positive effects of PIGT intervention on cardiorespiratory endurance (Deutch, Borbely, Filler, Hunn & Guarrera-Bowlby, 2008; Lotan, Yalon-Chamovitz & Weiss, 2010; Mejia-Downs, et al., 2011; Owens, et al., 2011; Carrasco et al., 2013).

Explaining the similarity to the present ones' results, Carrasco and colleagues (2013), claimed that the fact that these types of activities demand the engagement of large muscle groups of both hands and legs, thus resulting to higher energy expenditure. As a result, the adaptations caused at the muscle system and cardiorespiratory capacity, lead to improvement of the endurance (Carrasco et al., 2013). Similar adjustments, following PIGT programs, have been shown for people with severe motor disability (Deutch et al., 2008) and for people with moderate to severe mental retardation (Lotan et al., 2009; 2010). Furthermore, similar improvements also found among non-disabled young college students (Mejia-Downs et. al., 2011; Warburton et al., 2007). According to the researchers, all the changes were the result of the engagement of large muscle groups leading to the increase of energy expenditure and heart rate. According to Biddis and Irwin (2010), energy expenditure appears to elevate up to 222% above the tranquility levels, while heart rate increases up to 64% during interactive games (Graf, Pratt, Hester & Short, 2009; Hurkmans et al., 2010). The increase of energy expenditure caused by the large number of PIGT tasks, classifies this kind of activity as “medium intense”, thus explaining the adjustments caused on endurance (Miyachi, Yamamoto, Ohkawara & Tanaka, 2010).

Another important element contributing to aforementioned adjustments, seems to be the increase of active participation in relation to an ordinary physical education class (Sandlund, McDonough & Häger-Ross, 2009). This seems to be mainly due to the fact that practice on the same activities leads to familiarization that reduces the time spent for explaining rules. In addition to that the fact that participation can be individual or coupled (parallel) increases the time for active involvement. As a result, the teachers are able to manage time more efficiently thus minimizing the time students remain inactive while waiting for their turn (Fogel et al., 2010; Sandlund et al., 2009). The importance of increasing the time of active participation has been stressed by Sit and colleagues (2007), who have shown that in special school units only 42% of the total of teaching time (i.e. 7.9 minutes) corresponds to medium intense level activity. Similar studies have been shown even lower percentages such as 22% to 23% of the total of teaching time (Faison-Hodge & Porretta, 2004; Lieberman et al., 2000). Having that in mind, it seems that increasing the interest of the students by creating an attractive class environment will definitely lead to increased active participation. Including PIGT programs within physical education class seems to increase physical activity 6-time more compared to a traditional teaching approach (Fogel, Miltenberger, Graves & Koehler, 2010). In many relevant studies, it is mentioned that the attractive exercise environment and the fun character of the activities of PIGT programs lead to high persistence and commitment for participation thus resulting in increased participation time and improvements in physical characteristics (Leiberman, Chamberlin, Medina, Frankiln, Sanner & Vafiadis, 2011; Warburton et al., 2007). The environment where activities take place as well as the activities per se are so riveting that the users are absorbed, forgetting any limitations they experience due to their disability and therefore focus exclusively on the game (Guixeres et al., 2013; Taylor, McCormick, Shawis, Impson & Griffin, 2011). The present study confirmed the strong persistence and commitment resulting from the universal participation of students that reached 100%. A characteristic element of their wish and the increased interest, was their constant demand to prolong the task, to increase frequency and to be able to exercise on many different activities.

As was mentioned in the introductory section of the current paper the present results can be supported by the theoretical approaches regarding self-efficacy. The attractive and fun exercise environment promotes the motive for participation, affecting and forming their behavior and the level of their efficiency (Theodorakis, Goudas & Papaioannou, 1998). It evokes the experience of positive sentiments and the reinforcement of the understanding of the efficacy level regarding capability when a game is successfully played, leading them that way to make a bigger effort and therefore improve their performance. The feeling of success is so powerful that develops the conviction that the students can do it, increasing worthiness, belief on their abilities and the improvement of self-respect (Ziori, 2011). This reassures the fact that the improvement coming from PIG training programs is a result of the increase of self-efficacy due to the acquisition of positive movement experiences, the feeling of happiness, model learning and improvement of their emotional state. These elements that are the base, according to the theory, for the improvement of self-efficacy and which explain effort and persistence, commitment, persistence in activities, increase of joy and existence of positive feelings as well as the increase of communication (Theodorakis et al., 1998), that are observed and recorded in all studies and support the improvement in performance. Similar positive outcomes have been observed in sentiments throughout interjections.

As any study involving individuals with mental disabilities, the present study face a number of limitations as a result of its experimental design. Short intervention time and low frequency, small sample size mainly from remote areas, do not allow the generalization of results. Finally, it should be taken under consideration that some of the positive changes may be due to Hawthorne effect, according to which some participants may try harder when they perform under the observation of outside evaluators. Similar future research should address these limitations. However, the positive results of the present study not only remain but move beyond physical state and cardiorespiratory endurance and motor adequacy. The increased endurance contributes to the improvement of operation, increase of autonomy and social integration, all necessary for the covering of everyday needs (Horvat et al., 2011; Vuijk, Hartman, Scherder&Visscher, 2010; Vuori, 2004; Watkinson et al., 2001). Furthermore, better motor performance is positively linked to increased participation at athletic activities, more physical activity and better health. At the same time, it leads to the increase of self-trust and self-efficacy (Wrotniak, Epstein, Dorn, Jones & Kondilis, 2012).

Conclusively, it seems that PIGT programs lead to strong motivation and to high commitment for participation (Gordon et al., 2012; Karal et al., 2010; Yalon-Chamovitz et al., 2008), due to the fun exercises, the attractive environment (Berg et al., 2012; Brumels, Blasius, Cortright, Oumedian & Solberg, 2008; Lin & Wuang, 2012) and the increase of focus and commitment (Arthur, Bennett, Edens & Bell, 2003; Guixeres et al., 2013; Rezaiyan et al., 2007). PIGT programs could be used within Adaptive Physical Education class as a tool for improving some aspects of physical fitness and increasing motivation to participate.

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