Sports & Exercise Research
Vol. 14, No. 3, 296-309 (September, 2012)
DOI:10.5297/ser.1403.003

Physical Activity in Adolescents with Autism Spectrum Disorders and Intellectual Disabilities during Inclusive Physical Education Lessons

Jin-Hsien Tsai, Chia-Hua Chu, Kai-Wen Hsieh, and Chien-Yu Pan
Department of Physical Education, National Kaohsiung Normal University, Kaohsiung 802, Taiwan

Corresponding Author: Chien-Yu Pan
Address: No.116, Heping 1st Rd., Lingya District, Kaohsiung City 802, Taiwan
Fax: (07)711-4633
E-mail: chpan@nknucc.nknu.edu.tw
Received: March, 2011
Accepted: May, 2012

Abstract

The purpose of this study was to examine the physical activity (PA) in adolescents with autism spectrum disorders (ASD) and intellectual disability (ID) during inclusive physical education (PE) lessons. Fifty-six adolescents with ASD (n = 26) and ID (n = 30) participated in this study. The System for Observing Fitness Instruction Time (SOFIT) was used to record the PA of participants, as well as lesson content and teacher behavior during one PE lesson. The main findings were as follows: 1. Adolescents with ASD and ID showed less moderate-to-vigorous PA (35.76% engagement time) when participating in school PE as compared to the U.S. recommendation of 50%. 2. Vigorous PA was significantly higher during outdoors lessons rather indoors. 3. Student PA, lesson content, and teacher behavior did not differ due to teacher specialty. Teachers' interest in promoting their students' PA during PE might take into consideration the location of classes (e.g., outdoors), how PE lesson was delivered (e.g., more time for students to spend in skill practice) and behavior of teachers (e.g., more time to demonstrate fitness). From this study, additional opportunities to increase the PA are recommended for this population.

Keywords: activity levels, pervasive developmental disorders, mental deficiency, adapted physical education

Introduction

Regular physical activity (PA) is crucial for improving and maintaining health and fitness (U.S. Department of Health and Human Services [USDHHS], 2000), and it is important for individuals to develop active lifestyle early in life because it leads to reduced sedentary-related diseases among people with and without disabilities (Rimmer & Braddock, 2002; Strong et al., 2005). Current PA guidelines as well as researchers recommend that youths with and without disabilities should participate in at least 60 minutes of moderate PA on most days of the week (Strong et al., 2005; U.S. Department of Health and Human Services and Department of Agriculture, 2005), and school physical education (PE) has been recognized as the most widely available resource for promoting PA among youths throughout the world (Ministry of Education, 2004; USDHHS, 2000; World Health Organization, 2004). National and international PA guidelines recommend that PE should be provided for all students and lessons should be designed so that students are physically active at least 50% of the time (Ministry of Education, 2004; USDHHS, 2000). Accruing PA during PE is critically important in Taiwan because the limited recreational market base and small sports industry provide limited opportunities for PA outside of school. Research indicates that the majority of students both with and without disabilities went directly home or private nursing/talent class in the community after school (Pan, 2008a). The reliance on sedentary activities rather than physical activities after school, unfortunately, was part of the daily routine for a majority of students in Taiwan. This also presents a serious concern especially for students with disabilities because prior research has indicated that individuals with disabilities have limited opportunities for active leisure time (Schleien, Germ, & McAvoy, 1996) and lack the skills to participate in after-school PA programs (Levinson & Reid, 1991). Because PE is highly structured and student's participation is required, it seems that school PE appears to be an important (and sometimes the main) place for the contribution to overall daily moderate PA in those students with and without disabilities.

A number of studies have assessed PA in students without disabilities during PE (Chow, McKenzie, & Louie, 2009; Gidlow, Cochrane, Davey, & Smith, 2008; McKenzie et al., 2006; McKenzie, Sallis, et al., 2004; Nader, Bradley, Houts, McRitchie, & O'Brien, 2008). It is a concern that students in these studies did not achieve 50% of PE class time in PA. There is relatively little information regarding PA for individuals with disabilities, and more is known about PA in the elementary than the secondary schools. In Taiwan, intellectual disability (ID) is the most common type among school-aged students with developmental disabilities, with autism spectrum disorder (ASD) being the second most common disorder and the prevalence rate of ASD diagnoses continues to rise (Ministry of Education, 2009). Current data suggests that individuals with ID and ASD have been shown to be less active than regular developing peers (Foley, Bryan, & McCubbin, 2008; Pan & Frey, 2006), and that type of disability may be related to PA accrual (Longmuir & Bar-Or, 2000). The lack of information on PA levels of Taiwanese students with ASD and ID during PE makes it difficult to develop specific strategies to increase PA levels. Through better understanding of the environments in which students with disabilities accrue PA, effective intervention strategies can be developed.

Research by Foley et al. (2008) investigated the daily PA levels of elementary school-aged students with mild ID using the Actiwatch AW 16 accelerometer, and found that students with mild ID were significantly less physically active than their peers without disabilities at any PA settings including PE. However, Faison-Hodge and Porretta (2004) used the System for Observing Fitness Instruction Time (SOFIT) to measure the PA levels of children with and without mild ID during PE and recess, and found that children with mild ID performed similarly in PE as compared to those of children without disabilities. All children engaged in higher moderate-to-vigorous PA (MVPA) during recess than during PE. Although there was no difference between groups, children with mild ID spent only 23% of lesson time in MVPA. Another direct observation study using the SOFIT also found low engagement in MVPA during PE in special schools for children with disabilities including ID (42%) (Sit, McManus, McKenzie, & Lian, 2007).

Other studies of students with various developmental disabilities have shown that they were less physically active than their peers without disabilities. Objectively measured PA studies using

accelerometry found that children with Prader-Willi syndrome had lower PA levels than their peers without a disability (van den Berg-Emons, Festen, Hokken-Koelega, Bussmann, & Stam, 2008). A study describing PA patterns in children with Down syndrome compared to their unaffected sibling using the Actitrac activity monitor (Whitt-Glover, O'Neill, & Stettler, 2006) found that children with Down syndrome participated in less PA and had a higher body mass index (BMI) level compared to their siblings. Shield, Dodd, and Abblitt (2009) used triaxial accelerometer to measure MVPA in youths with Down syndrome aged 7 ~ 17 and found less than 50% engaged in at least 60 minutes of MVPA each day and lower amounts of PA were associated with older youths.

Related research using accelerometers in the students with ASD also found that during PE their activity levels were lower than 50% of the recommendation, similar to the results found from the direct observation studies in students with mild ID. Rosser-Sandt and Frey (2005) examined daily PA levels of the students with and without ASD aged 5 to 12 and found that there were no differences between children with and without ASD at any PA setting. Both groups were more active during recess compared to after school, and children with ASD were similarly active in PE (41%) and recess. However, Pan (2008b) compared MVPA of students with and without ASD (aged 7 ~ 12) during inclusive PE and recess in Taiwan, and results were somewhat different from previous findings (Faison-Hodge & Porretta, 2004; Rosser-Sandt & Frey, 2005). Both students with (46%) and without ASD (47%) in this study (Pan, 2008b) spent a higher proportion of time in MVPA during PE than during recess, although there were no significant differences between group PA levels at any setting. This suggests that structured PE may offer opportunities to increase students' MVPA engagement in Taiwan.

Well-taught PE is believed to provide children opportunities to engage in PA, learn motor skills and knowledge, and develop fitness that will enable them to have an active lifestyle into adulthood. Numerous methods have been used to assess PA in children (Welk & Wood, 2000), but there were at least two benefits from using the SOFIT for this young population. First, it allows simultaneous recording of the type, intensity, and duration of PA as well as selected environmental factors (e.g., lesson context and teacher behavior). Second, it has been used extensively to assess PA during PE. It is obvious that the activity levels during PE tend to vary considerably as a function of geographic region, school, teacher training, instructor behavior, and lesson context. The aforementioned studies examined the MVPA of students with varying developmental disabilities, but they did not explore these factors, which have been shown to directly affect MVPA levels during PE (Chow et al., 2009; Sit et al., 2007). Fewer studies of PA during PE have been conducted in the secondary schools rather in elementary schools (Fairclough & Stratton, 2005, 2006). Since PA declines rapidly during adolescence (Trost et al., 2002), it is a critical time for PA accrual during PE participation. Therefore, the purposes of this study were to use a validated observation instrument (SOFIT) to (a) investigate the PA levels in the secondary school-aged students with ASD and mild ID during inclusive PE classes, and (b) assess the potential influence of lesson context, teacher behavior, lesson location, and teacher specialty on students PA levels during those lessons.

Method

Participants

Participants were 56 male adolescents enrolled in grades 7 to 9 in 24 general schools in southern Taiwan. Only male students were included in the study because of (a) gender differences in the PE levels, and (b) gender ratio disparities in the majority of research on youths with disabilities. Number of students with ASD or ID recruited per school was ranged from 1 to 3. All participants were recruited from different regular PE classes and were taught by different PE teachers. There were no classes that included both students with ASD and students with ID simultaneously. A convenience sampling design was implemented from intact classes.

All participants were diagnosed through medical and psychological assessment by experienced and knowledgeable physicians in the public hospitals (Department of Health, Executive Yuan, 2009a), and were identified as meeting the American Psychiatric Association Diagnostic and Statistical Manual of Mental Disorder criteria for ASD and ID (American Psychiatric Association, 1994). Diagnoses included mild or high-functioning autistic disorder (n = 13), Asperger's syndrome (n = 13), and mild ID (n = 30).

Individuals having a range of IQ from 50 to 55 to about 70 are classified as mild ID. IQs of the students with mild ID in the current study were M = 62.67, SD = 6.94. Level of severity (mild, moderate, severe, and very severe) for ASD is based on functioning in the social adaptive skill areas and language comprehension and expression (Department of Health, Executive Yuan, 2009b). All participants with mild ID and 22 students with ASD were usually assigned to the resource classroom on a regularly scheduled basis while continuing their other studies in the regular classrooms during the rest of each school day. PE is one of the few curricular areas in which students with a mild disability are often integrated with their typically developing peers. No one had multiple co-occurring conditions nor gross motor difficulties. All reside in urban settings and 30 live in a two parent household. None were enrolled in a segregated or inclusive school-based PA programs or sports teams.

Table 1 provides background information on the participating schools. The schools were located in the same geographical area in a large urban city. Each school provided two 45-minute PE lessons per week, with the number of students in classes varying. Students were required to take 2 PE lessons each week. Facilities for lessons included a playground and a gymnasium in schools. Data were collected in one PE lesson for each participant in spring. A total of 56 PE lessons were observed. Approval for the study was granted by the institutional ethics committee, and only students who agreed to participate and returned parental consent forms were observed.

Table 1. Characteristics of the Participants

Characteristic	ASD (n = 26)				MID (n = 30)			
	M	*SD*	*Mdn*	Range	*M*	*SD*	*Mdn*	Range
Age (yrs)	13.42	0.99	13.00	3.00	13.50	1.17	13.50	4.00
Height (cm)	162.07	9.05	162.25	33.50	158.77	9.99	157.50	44.00
Weight (kg)	53.18	12.53	51.60	58.00	52.97	15.66	49.50	70.00
Number of BMI Classification								
Underweight			7				8	
Recommended			11				14	
Overweight			4				3	
Obese			4				5	
Number of students								
Grade 7			11				14	
Grade 8			9				5	
Grade 9			6				11	
Scheduled PE lessons (per class)								
Number per week			2				2	
Length (min)			45				45	
Total PE min per week			90				90	
Number of PE teachers								
Male			14				16	
Female			12				14	
Teacher qualification								
PE certificate			17				28	
Non-PE certificate			9				2	
Lesson location								
Outdoors			21				28	
Indoors			5				2	

Note. M = Mean; SD = standard deviation; Mdn = median; ASD = autism spectrum disorder; MID = mild intellectual disability; PE = physical education; BMI Classification is based on Taiwan Ministry of Education, Physical Fitness website: http://www.fitness.org.tw/model08.php

Observation System

The SOFIT (McKenzie, Sallis, & Nader, 1991) was used to assess students' activity levels during PE classes as well as lesson context and teacher behavior in which they were observed. The instrument has been widely used for measuring PA levels of students with and without disabilities (e.g., Faison-Hodge & Porretta, 2004; McKenzie et al., 2006; Sit et al., 2007), and the activity codes have been validated for use with heart rate monitoring (McKenzie, Prochaska, Sallis, & LaMaster, 2004; van den Mars, Rowe, Schuldheisz, & Fox, 2004) and accelerometry (Pope, Coleman, Gonzalez, Barron, & Heath, 2002; Taylor & Yun, 2006).

For the present study, procedures were modified so that observers tracked the activity of each student with a disability as he participated in school PE lessons rather than the activity of all students in the class. During SOFIT coding, the observed activity of the target student was categorized using momentary time sampling (10-second/10-second observe/record). For each interval, the student's PA level was coded by entering one of five codes: (1) lying down, (2) sitting, (3) standing, (4) walking, and (5) very active. Walking and very active are combined to form MVPA. The lesson context was coded as management (M), general knowledge (K), PE knowledge (P), fitness (F), skill practice (S), game play (G), or others (O) such as free play. Teacher behavior was also coded to indicate what the instructor was doing during the observation interval including promotes fitness (P), demonstrates fitness (D), general instruction (I), manages (M), observes (O), and off-task (T). Guidelines for observation method, definition of codes, observer training, and data collection using the instrument were based on the technical descriptions of the SOFIT training manual (McKenzie, 2002).

Observer training and reliability. All 56 lessons were videotaped and coded. Four observers received training prior to the start of data collection that included a copy of definitions for all behaviors, explanations about each behavior, and its critical elements. Observers then practiced coding from videotapes previously made by the researcher for youths with mild ID and ASD in PE classes and received feedback. To be certified on the use of the SOFIT, observers were required to reach 85% of the criterion on all three major categories of precoded videotaped lessons. During subsequent reliability checks, two independent observers coded the same students simultaneously. Fourteen lessons (25% of the total) were coded for reliability. Interobserver agreement scores for student activity levels, lesson context, and teacher behavior were 97%, 93%, and 94%, respectively. Results also showed a high level of intraobserver agreement (all above 0.90).

Data Analysis

Dependent variables were SOFIT codes expressed as total minutes (with 3 observe/record intervals making up a minute) and as percentage of intervals observed. In addition, the time students spent in MVPA was calculated by summing the walking and very active categories. An energy expenditure rate (EER) for each student during the PE class was calculated following the formula of McKenzie et al. (1995): proportion of time lying down × 0.029 kcal/kg per minute + proportion of time sitting × 0.047 kcal/kg per minute + proportion of time standing × 0.051 kcal/kg per minute + proportion of time walking × 0.096 kcal/kg per minute + proportion of time very active × 0.144 kcal/kg per minute. Lesson energy expenditure (LEE) (kcal/kg) was also obtained using the following calculation: EER (kcal/kg per minute) × lesson length (minutes). The independent variables were student disability (mild ID or ASD), teacher type (PE specialist or Non-PE teacher), and lesson location (outdoors or indoors).

Descriptive statistics including means, standard deviations, frequencies, and percentages were obtained for all variables. One-way MANOVAs were used to test significant differences between groups for PA (the five coded levels) as well as lesson context and teacher behavior during PE. Follow-up ANOVAs were undertaken if significant differences were observed. Independent 2-tailed t tests were used to differentiate lesson length, LEE, EER, and minutes and proportion in MVPA as a function of student disability, teacher type, and lesson location. The effect size was computed and reported as ES (Cohen's $d = M_1 - M_2 / \sigma_{pooled}$) and partial η^2 for independent t test and MANOVA, respectively. Data were analyzed using SPSS 13.0., and alpha level was set at $p < .05$ for all statistical tests.

Results

General

Mean scheduled lesson length was 45 minutes, and mean actual (observed) lesson length was 40.15 minutes (ranging from 28.67 to 46.00 minutes). The actual length did not differ significantly for student disability (t = -1.01, p = .32), teacher type (t = -0.66, p = .51), and lesson location (t = 0.44, p = .66). PE specialists taught 65% of the lessons (17 of 26) in students with ASD and 93% of the lessons (28 of 30) for students with mild ID. Approximately 81% (21 of 26) and 93% (28 of 30) of the lessons were taught outdoors for students with ASD and mild ID, respectively. Overall, students with a disability accrued 2.68 very active and 14.28 MVPA minutes per PE lesson (6.65% and 35.76% of lesson time, respectively). Skill practice and general instruction were the lesson context and teacher behavior that accounted for the largest number of minutes and proportion of lesson time. Table 2 presents mean values for minutes of PE lesson length, LEE, and minutes for student activity, lesson context, and teacher behavior by student disability, teacher type, and lesson location. Table 3 provides EER and proportion of lesson activities, context, and teacher involvement by student disability, teacher type, and lesson location.

Student's and Teacher's Behavior

Results of the one-way MANOVA revealed significant multivariate effect for student disability on PE lesson activity level, lesson context, and teacher behavior (Tables 2 & 3). Follow-up ANOVAs indicated significant differences in standing (minutes, $F_{(1, 54)}$ = 9.92, p < .01, Partial η^2 = 0.16; proportion, $F_{(1, 54)}$ = 7.97, p < .01, Partial η^2 = 0.13), walking (minutes, $F_{(1, 54)}$ = 14.38, p < .01, Partial η^2 = 0.21; proportion, $F_{(1, 54)}$ = 14.54, p < .01, Partial η^2 = 0.21), management (minutes, $F_{(1, 54)}$ = 24.45, p < .01, Partial η^2 = 0.31; proportion, $F_{(1, 54)}$ = 23.37, p < .01, Partial η^2 = 0.32), PE knowledge (minutes, $F_{(1, 54)}$ = 12.51, p < .01, Partial η^2 = 0.19; proportion, $F_{(1, 54)}$ = 12.92, p < .01, Partial η^2 = 0.19), skill practice (minutes, $F_{(1, 54)}$ = 4.63, p < .05, Partial η^2 = 0.08; proportion, $F_{(1, 54)}$ = 4.72, p < .05, Partial η^2 = 0.08), and demonstrates fitness (minutes, $F_{(1, 54)}$ = 12.13, p < .01, Partial η^2 = 0.18; proportion, $F_{(1, 54)}$ = 12.28, p < .01, Partial η^2 = 0.19). In other words, students with ASD spent more time walking and engaged in more MVPA than students with mild ID, while students with mild ID spent more time standing than students with ASD. EER was higher for students with ASD as compared to those with mild ID, but LEE revealed no significant group difference. Teachers in the classes of students with ASD spent more time demonstrating fitness compared to counterparts in mild ID classes. The classes with students with ASD allocated more time to PE knowledge and skill practice, but less time on management for mild ID classes.

Teacher Type

Most observed lessons (80%) were taught by PE specialists, but lessons taught by PE specialists were similar to those taught by non-PE teachers. There were no significant differences by teacher type for any PA and lesson context or teacher behavior variables. Also, EER, LEE, and MVPA did not differ significantly by teacher type.

Lesson Location

There was a significant difference between lesson location for very active (minutes, $F_{(1, 54)}$ = 14.29, p < .01, Partial η^2 = 0.21; proportion, $F_{(1, 54)}$ = 15.22, p < .01, Partial η^2 = 0.22). Very active minutes and proportion of time were higher in lessons held outdoors than indoors (Tables 2 & 3). No significant differences were observed for lesson location on the other variables.

Discussion

The results of this study using direct observation of students with a disability in 24 general schools from southern Taiwan showed that secondary school students with ASD and mild ID averaged about 3 minutes of vigorous PA (7% of lesson time) and about 14 minutes of MVPA (36% of lesson time) per class, accumulating only about 28 minutes of MVPA per week in school PE classes. With PE scheduled only twice per week, students in these schools had few opportunities to accrue PA. Modifying school policies such as providing more PE lessons per week might help students meet recommended standards within current PE time. However, even with this new policy

Table 2. Mean (*SD*) Lesson Length, Energy Expenditure, and Minutes for Student Activity, Lesson Context, and Teacher Behavior during Physical Education

	Student Disability				Teacher Type				Lesson Location			
	ASD (n = 26)		MID (n = 30)		Non-PE Specialist (n = 11)		PE Specialist (n = 45)		Outdoors (n = 49)		Indoors (n = 7)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Lesson length, min [a]	39.67	3.04	40.58	3.66	39.55	3.08	40.30	3.47	40.23	3.24	39.62	4.54
LEE, kcal/kg [b]	286.46	39.62	272.58	36.60	284.14	42.28	277.77	37.70	282.07	35.08	257.67	54.84
Student activity, min [c]												
Lying down	0.03	0.13	0.03	0.13	0.00	0.00	0.04	0.15	0.03	0.14	0.00	0.00
Sitting	7.13	6.72	6.97	3.85	5.67	4.32	7.38	5.53	6.88	5.22	8.14	6.35
Standing	15.67	8.20	21.52	5.62	17.15	8.14	19.21	7.35	18.78	7.45	18.95	8.27
Walking	14.50	5.75	9.09	4.93	14.76	7.06	10.83	5.45	11.54	5.88	12.00	6.79
Very active	2.35	1.84	2.97	1.74	1.97	1.47	2.85	1.84	2.99	1.67**	0.52	1.02
MVPA [d]	16.85	6.42	12.06	5.44	16.73	7.32	13.68	6.01	14.53	6.22	12.52	7.37
Lesson context, min [e]												
Management	5.68	3.56**	13.12	6.92	6.42	4.03	10.46	7.02	9.59	6.89	10.19	5.66
General knowledge	0.67	1.24	1.27	2.16	1.15	1.15	0.95	1.94	0.84	1.79	2.05	1.62
PE knowledge	2.95	4.57**	0.00	0.00	1.55	2.35	1.33	3.66	1.13	2.53	3.05	7.22
Fitness activity	5.19	6.52	6.78	6.56	6.36	3.38	5.96	7.12	6.35	6.77	3.90	4.33
Skill practice	20.86	11.11*	14.74	10.17	23.55	8.13	16.13	11.13	17.20	11.14	20.24	9.94
Game play	3.63	8.64	1.89	5.65	0.39	1.31	3.26	7.90	3.08	7.60	0.00	0.00
Other	0.79	2.57	2.80	6.23	0.12	0.40	2.30	5.44	2.11	5.25	0.19	0.50
Teacher behavior, min [f]												
Promotes fitness	2.77	4.71	0.94	1.60	1.52	2.10	1.86	3.79	1.84	3.68	1.48	2.12
Demonstrates fitness	1.65	2.05**	0.27	0.70	0.85	1.46	0.93	1.68	0.88	1.48	1.10	2.62
General instruction	13.64	9.46	16.77	9.28	11.21	7.78	16.32	9.58	15.37	9.37	14.95	10.44
Manages	5.87	3.50	7.01	2.97	5.91	2.98	6.62	3.33	6.47	3.28	6.57	3.27
Observes	11.67	11.52	11.63	9.21	13.12	13.44	11.29	9.47	12.24	9.63	7.52	14.10
Other tasks	4.06	7.54	3.98	5.91	6.94	10.57	3.30	5.22	3.45	5.97	8.00	9.99

Note. LEE = lesson energy expenditure; ASD = autism spectrum disorder; MID = mild intellectual disability; MVPA = moderate to vigorous physical activity (walking + very active); PE = physical education; *p < .05; **p < .01.

[a] Independent t test, for disability, t = -1.01, p = .32; for teacher type, t = -0.66, p = .51; for lesson location, t = 0.44, p = .66.

[b] Independent t test, for disability, t = 1.36, p = .18; for teacher type, t = 0.49, p = .63; for lesson location, t = 1.60, p = .12.

[c] MANOVA (Wilks's Lambda Criterion), for disability, $F_{(5, 50)} = 3.76$, $p < .01$, Partial $\eta^2 = 0.27$; for teacher type, $F_{(5, 50)} = 1.70$, $p = .15$; for lesson location, $F_{(5, 50)} = 2.72$, $p < .05$, Partial $\eta^2 = 0.21$.

[d] Independent t test, for disability type, $t = 3.02$, $p < .01$, ES = 0.81; for teacher type, $t = 1.44$, $p = .16$; for lesson location, $t = 0.78$, $p = .44$.

[e] MANOVA (Wilks's Lambda Criterion), for disability, $F_{(7, 48)} = 5.06$, $p < .01$, Partial $\eta^2 = 0.43$; for teacher type, $F_{(7, 48)} = 1.06$, $p = .40$; for lesson location, $F_{(7, 48)} = 1.18$, $p = .33$.

[f] MANOVA (Wilks's Lambda Criterion), for disability, $F_{(6, 49)} = 3.19$, $p < .05$, Partial $\eta^2 = 0.28$; for teacher type, $F_{(6, 49)} = 0.94$, $p = .48$; for lesson location, $F_{(6, 49)} = 0.68$, $p = .67$.

Table 3. Energy Expenditure Rate and Proportion of Lesson Time (%) for Student Activity, Lesson Context, and Teacher Behavior during Physical Education

	Student Disability				Teacher Type				Lesson Location			
	ASD (n = 26)		MID (n = 30)		Non-PE Specialist (n = 11)		PE Specialist (n = 45)		Outdoors (n = 49)		Indoors (n = 7)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
EER, kcal/kg/min [a]	7.22	0.87*	6.73	0.75	7.18	0.87	6.90	0.83	7.03	0.83	6.46	0.80
Student activity, % [b]												
Lying down	0.07	0.34	0.08	0.34	0.00	0.00	0.09	0.37	0.09	0.36	0.00	0.00
Sitting	17.60	16.23	17.17	9.42	14.23	10.74	18.14	13.37	16.91	12.59	20.58	15.65
Standing	39.94	21.22**	52.74	12.06	43.69	20.82	47.56	17.38	46.51	17.59	48.82	21.92
Walking	36.40	13.77**	22.79	12.93	37.04	16.94	27.17	13.85	29.08	15.12	29.29	14.14
Very active	5.99	4.72	7.22	3.99	5.03	3.81	7.04	4.42	7.41	4.01**	1.30	2.60
MVPA [c]	42.39	15.86**	30.01	14.01	42.08	17.78	34.21	15.38	36.50	16.08	30.59	15.77
Lesson context, % [d]												
Management	14.46	9.64**	32.08	16.26	16.75	12.08	25.65	16.62	23.44	16.12	27.12	17.13
General knowledge	1.63	3.00	3.17	5.51	2.94	2.91	2.34	4.88	2.03	4.46	5.41	4.32
PE knowledge	7.28	11.12**	0.00	0.00	3.96	5.99	3.24	8.87	2.81	6.29	7.37	17.32
Fitness activity	13.08	16.47	16.57	16.00	16.23	8.66	14.64	17.58	15.68	16.73	9.83	10.99
Skill practice	52.65	28.24*	37.00	25.65	58.80	18.12	40.71	28.70	43.47	28.72	49.86	20.72
Game play	8.96	20.94	4.48	13.44	1.06	3.50	7.91	19.03	7.50	18.33	0.00	0.00
Other	2.17	7.42	6.75	15.04	0.27	0.89	5.69	13.45	5.23	12.98	0.42	1.11
Teacher behavior, % [e]												
Promotes fitness	7.32	13.24	2.35	3.82	3.84	5.48	4.86	10.49	4.82	10.19	3.49	5.02
Demonstrates fitness	4.25	5.35**	0.64	1.69	2.21	3.82	2.34	4.35	2.27	3.93	2.65	6.27
General instruction	34.39	23.71	41.35	22.76	29.02	20.47	40.34	23.57	37.88	22.59	39.81	29.57
Manages	14.90	9.01	17.49	7.93	15.03	7.37	16.59	8.76	16.23	8.63	16.67	7.84
Observes	29.11	27.79	28.50	22.34	32.73	32.05	27.82	23.01	30.37	23.65	17.72	37.52
Other tasks	10.02	18.60	9.72	13.85	17.17	26.07	8.07	12.32	8.46	14.46	19.65	23.84

Note. EER = energy expenditure rate; ASD = autism spectrum disorder; MID = mild intellectual disability; MVPA = moderate to vigorous physical activity (walking + very active); PE = physical education; *p < .05; **p < .01.

[a] Independent t test, for disability, t = 2.30, p < .05, ES = 0.60; for teacher type, t = 0.97, p = .33; for lesson location, t = 1.72, p = .09.

[b] MANOVA (Wilks's Lambda Criterion), for disability, $F_{(4, 51)}$ = 4.46, p < .01, Partial η^2 = 0.26; for teacher type, $F_{(4, 51)}$ = 2.14, p = .09; for lesson location, $F_{(4, 51)}$ = 3.68, p < .05, Partial η^2 = 0.22.

[c] Independent t test, for disability, t = 3.10, p < .01, ES = 0.83; for teacher type, t = 1.47, p = .15; for lesson location, t = 0.91, p = .37.

[d] MANOVA (Wilks's Lambda Criterion), for disability, $F_{(7, 48)}$ = 4.82, p < .01, Partial η^2 = 0.41; for teacher type, $F_{(7, 48)}$ = 1.00, p = .44; for lesson location, $F_{(7, 48)}$ = 1.30, p = .27.

[e] MANOVA (Wilks's Lambda Criterion), for disability, $F_{(6, 49)}$ = 2.87, p < .05, Partial η^2 = 0.26; for teacher type, $F_{(6, 49)}$ = 0.74, p = .62; for lesson location, $F_{(6, 49)}$ = 0.64, p = .70.

schools should also consider providing additional PA opportunities throughout the day for students to accumulate 60 minutes of MVPA daily.

Activity levels of students with ASD and mild ID spent approximately 42% and 30% of lesson time in MVPA, respectively, which is far lower than that of the Healthy People 2020 recommendation. This is consistent with findings from previous studies showing that engagement time in MVPA of students with disabilities during PE is limited (Faison-Hodge & Porretta, 2004; Lieberman, Dunn, van der Mars, & McCubbin, 2000; Pan, 2006, 2008b; Rosser-Sandt & Frey, 2005; Stanish & Mozzochi, 2000). MVPA in these ASD classes, compared to studies using accelerometry, were less active than students with ASD (46%) (Pan, 2008b) assessed during PE in Taiwan elementary school but similar with the U.S. children with ASD (41%) (Rosser-Sandt & Frey, 2005). In the current mild ID classes, students were similarly active than Taiwan secondary school students with mild ID (29%) (Pan, 2006).

When compared to direct observation studies using the SOFIT instrument, their overall activity levels (36%) were similar to those of students without disabilities in the U.S., including third graders in the baseline study (36%) (McKenzie et al., 1995) and middle school girls at baseline (38%) (McKenzie et al., 2006). They were more active than those of students with disabilities, including children with hearing impairments (22%) (Lieberman et al., 2000), developmental delays (33%) (Stanish & Mozzochi, 2000), and mild ID (23%) (Faison-Hodge & Porretta, 2004). However, their activity levels were lower than Hong Kong special school students with mild ID (49%) (Sit, McKenzie, Lian, & McManus, 2008). Although making direct comparisons with other studies that have included children with ASD or ID would not be appropriate because of varied methodologies, students in the current study are at risk for health problems associated with inactivity to accumulate 60 minutes or more of MVPA each day. Nonetheless, a national consensus on students' PA during PE in Taiwan must be established as a guideline for counseling and education.

As in other studies, the PA levels of students varied substantially during lessons reflecting the influence of numerous contextual and pedagogical factors. Students with ASD spent more time walking but less time standing than students with mild ID. This finding is associated with differences in lesson contexts and teacher behaviors. The extra time spent standing in students with mild ID can be attributed to teachers spending considerably more time on general content (e.g., management). Increased walking in students with ASD resulted from teachers spending substantially more time transmitting PE knowledge and for students to practice skills, and therefore, leading to higher MVPA engagement. Teachers interested in promoting their students PA during class should focus on selecting appropriate content (e.g., game play and fitness activity) and deliver it in an efficient manner (e.g., promotes fitness). PE has many additional objectives, including knowledge, skill, and social outcome dissemination, which require teachers to allocate time for management and instruction that are frequently inactive (McKenzie et al., 1995). To allow students participating in a wider range of structured physical activities, teachers might take into consideration environmental barriers that influence the PA levels of students with disabilities such as space, facilities (Mihaylov, Jarvis, Colver, & Beresford, 2004; Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004), equipment, programming, time, and professional preparation (Lieberman, Houston-Wilson, & Kozub, 2002), and enhancing in-school and out-of-school PA participation and developing PA or sports skills for this population (An & Goodwin, 2007).

Outdoor lessons have been found to be more physically active than those taught indoors (McKenzie et al., 2006; McKenzie et al., 1995; McKenzie, Marshall, Sallis, & Conway, 2000), and the current study supports this notion. Although outdoor spaces for PE in Taiwan do not often include large multipurpose field such as the U.S., the present investigation found that outdoor lessons were more intense and provided more vigorous PA minutes. Outdoors usually have more space than indoors, and teachers usually implemented a highly active subject matter as well as increased lesson time for promoting fitness activity; therefore, outdoor lessons were found to be positively associated with student activity levels (Chow et al., 2009). It should be noted that higher intensity activities are important for cardiovascular development, but low intensity activities still provide a health benefit such as controlling for weight gain. In addition to large enough space, weather-related conditions may

account for why lessons taught outdoors were more physically active than those held indoors. The current study was conducted in spring, the weather was always sunny, and the temperature in southern Taiwan ranged from warm (23 ~ 27°C) to hot (28 ~ 32°C). This may explain why the majority of lessons should be held outdoors rather than indoors because the temperate climate permitted outdoor PE lessons. Furthermore, children were found to engage in more intensely in PA when the temperature was hot (Chow, McKenzie, & Louie, 2008). Temperature may be a variable to be considered for subsequent analysis.

Teacher type which was found to be associated with PA among third graders (McKenzie et al., 1995) was not related to activity variables in this investigation. However, this is consistent with findings from a previous middle school study reflecting that no teacher specialty on student activity variables was significant (McKenzie et al., 2000). Despite the trend to include most students with disabilities especially those requiring fewer supports in regular PE classes, Taiwanese university-level teacher preparation programs have been slow to modify their curricula and address the increasing role of the regular physical educator (Chen, 2002). Even now, most university undergraduate PE teacher preparation programs still do not require any course in adapted PE, and there is no certified adapted PE specialists exist in Taiwan. Therefore, specialist training in adapted PE teaching method is strongly needed for the regular physical educators in order to meet the needs of students with disabilities in regular PE classes. Nonetheless, these findings of no significant differences by teacher specialty for any student PA variable, lesson context or teacher behavior are from a small sample of students with a disability who participated in inclusive PE and, therefore, may restrict the generalizability of these findings to the secondary school PE teacher population as a whole.

Although this study is the first to examine PA and related factors during inclusive PE in adolescents with a disability in Taiwan, it is limited to the convenience sampling, the low sample size, and only one PE lesson was observed. Validity estimates for the SOFIT observational data were not verified using objective PA measures. All lessons were observed in southern Taiwan, and there may be local geographical as well as environmental factors and school policy that influence how PE is conducted. It remains possible that teachers selected different content and modified their behavior when their lessons were being observed. It is also possible that the cultural and educational settings may have produced potential differences from the previous research. Furthermore, student differences in social skills, behaviors, cognitive abilities, gross motor skills, and types of medication were also not evaluated and might have influenced findings. Finally, student PA levels within other school settings (e.g., recess and lunch time) or beyond the school day (e.g., before and after school) were not studied, and it is possible that two groups of students had different PA levels at different in- and out-of-school PA settings. Nevertheless, the current study makes a contribution by identifying related factors of PA during secondary school PE which is important because physical educators must be aware of promoting PA in inclusive settings.

In conclusion, students with ASD and mild ID gained less MVPA at school during inclusive PE. Students with disabilities may need even more PA than those without disabilities. With the current policy of two days PE per week in Taiwan, it seems that more opportunities to promote PA with age-appropriate peers for adolescents with disabilities are urgent. These could involve programs offered during nonclass time on campus (e.g., early morning, lunch period, and after-school recreational, and club programs) and time in community and home settings. School environments should be restructured to specifically encourage students to engage in PA, including informing them about community programs. Further investigations of these variables on student PA levels in other settings are recommended. More research with a larger sample of students with disabilities in a longitudinal design is necessary to properly identify the factors that might encourage increased PA during inclusive PE.

Acknowledgements

This research was partially supported by NSC 97-2410-H-017-027-SSS. The authors wish to thank all adolescents and PE teachers as well as special education teachers who participated in this study, parents of adolescents for their supports, and research assistants who helped with data collection and other contributions.

References

American Psychiatric Association. (1994). *Diagnostic and statistical manual of mental disorders* (4th ed.). Washington, DC: Author.

An, J., & Goodwin, D. L. (2007). Physical education for students with spina bifida: Mothers' perspectives. *Adapted Physical Activity Quarterly*, *24*(1), 38-58.

Chen, L. Y. (2002). Inclusive physical education. *Guo Jiao Shi Ji*, *203*, 21-24.

Chow, B. C., McKenzie, T. L., & Louie, L. (2008). Children's physical activity and environmental influences during elementary school physical education. *Journal of Teaching in Physical Education*, *27*(1), 38-50.

Chow, B. C., McKenzie, T. L., & Louie, L. (2009). Physical activity and environmental influences during secondary school physical education. *Journal of Teaching in Physical Education*, *28*(1), 21-37.

Department of Health, Executive Yuan. (2009a). *Hospitals for the identification of disabilities*. Retrieved December 31, 2009, from http://www.doh.gov.tw/CHT2006/DM/DM2_p01.aspx?class_no=211&now_fod_list_no=6753&level_no=3&doc_no=41058

Department of Health, Executive Yuan. (2009b). *Levels of disabilities*. Retrieved December 31, 2009, from http://www.doh.gov.tw/CHT2006/DM/DM2_p01.aspx?class_no=211&now_fod_list_no=6753&level_no=3&doc_no=41058

Fairclough, S., & Stratton, G. (2005). Physical activity levels in middle and high school physical education: A review. *Pediatric Exercise Science*, *17*(3), 217-236.

Fairclough, S., & Stratton, G. (2006). A review of physical activity levels during elementary school physical education. *Journal of Teaching in Physical Education*, *25*(2), 239-257.

Faison-Hodge, J., & Porretta, D. L. (2004). Physical activity levels of students with mental retardation and students without disabilities. *Adapted Physical Activity Quarterly*, *21*(2), 139-152.

Foley, J. T., Bryan, R. R., & McCubbin, J. A. (2008). Daily physical activity levels of elementary school-aged children with and without mental retardation. *Journal of Developmental and Physical Disabilities*, *20*(4), 365-378.

Gidlow, C. J., Cochrane, T., Davey, R., & Smith, H. (2008). In-school and out-of-school physical activity in primary and secondary school children. *Journal of Sports Sciences*, *26*(13), 1411-1419.

Levinson, L., & Reid, G. (1991). Patterns of physical activity among youngsters with developmental disabilities. *Canadian Association for Health, Physical Education, and Recreation*, *56*, 24-28.

Lieberman, L. J., Dunn, J. M., van der Mars, H., & McCubbin, J. (2000). Peer tutors' effects on activity levels of deaf children in inclusive elementary physical education. *Adapted Physical Activity Quarterly*, *17*(1), 20-39.

Lieberman, L. J., Houston-Wilson, C., & Kozub, F. M. (2002). Perceived barriers to including students with visual impairments in general physical education. *Adapted Physical Activity Quarterly*, *19*(3), 364-377.

Longmuir, P. E., & Bar-Or, O. (2000). Factors influencing the physical activity levels of youths with physical and sensory disabilities. *Adapted Physical Activity Quarterly*, *17*(1), 40-53.

McKenzie, T. L. (2002). *SOFIT: Overview and training manual*. San Diego, CA: San Diego State University.

McKenzie, T. L., Cetellier, D. J., Conway, T., Lytle, L. A., Grieser, M., Webber, L. A., et al. (2006). Girls' activity levels and lesson contexts in middle school PE: TAAG baseline. *Medicine and Science in Sports and Exercise*, *38*(7), 1229-1235.

McKenzie, T. L., Feldman, H., Woods, S. E., Romero, K. A., Dahlstrom, V., Stone, E. J., et al. (1995). Children's activity levels and lesson context during third-grade physical education. *Research Quarterly for Exercise and Sport*, *66*(3), 184-193.

McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Student activity levels, lesson context, and teacher behavior during middle school physical education. *Research Quarterly for Exercise and Sport*, *71*(3), 249-259.

McKenzie, T. L., Prochaska, J. J., Sallis, J. F., & LaMaster, K. J. (2004). Coeducational and single-sex physical education in middle schools: Impact on physical activity. *Research Quarterly for Exercise and Sport*, *75*(4), 446-449.

McKenzie, T. L., Sallis, J. F., & Nader, P. R. (1991). SOFIT: System for observing fitness instruction time. *Journal of Teaching in Physical Education*, *11*(2), 195-205.

McKenzie, T. L., Sallis, J. F., Prochaska, J. J., Conway, T. L., Marshall, S. J., & Rosengard, P. (2004). Evaluation of a two-year middle-school physical education intervention: M-SPAN. *Medicine and Science in Sports and Exercise*, *36*(8), 1382-1388.

Mihaylov, S. I., Jarvis, S. N., Colver, A. F., & Beresford, B. (2004). Identification and description of environmental factors that influence participation of children with cerebral palsy. *Developmental Medicine and Child Neurology*, *46*(5), 299-304.

Ministry of Education. (2004). *Get on the same page of establishing physical activity guidelines for elementary and secondary school students: Final report*. Retrieved November 11, 2009, from http://140.122.72.62/history/index?id=169899c40ec1058498f4a9bc4dc5131b4812c5fe7a121

Ministry of Education. (2009). *Annual statistics in special education*. Retrieved January 5, 2010, from http://163.21.111.100/tlearn/book/BookAll.asp?BookMainID=7

Nader, P. R., Bradley, R. H., Houts, R. M., McRitchie, S. L., & O'Brien, M. (2008). Moderate-to-vigorous physical activity from ages 9 to 15 years. *Journal of the American Medical Association*, *300*(3), 295-305.

Pan, C. Y. (2006). Frequency and intensity of physical activity in students during intergrated physical education: Using the accelerometry. *Journal of Physical Education, National Taitung University*, *5*, 77-90.

Pan, C. Y. (2008a). Objectively measured physical activity between children with autism spectrum disorders and children without disabilities during inclusive recess settings in Taiwan. *Journal of Autism and Developmental Disorders*, *38*(7), 1292-1301.

Pan, C. Y. (2008b). School time physical activity of students with and without autism spectrum disorders during PE and recess. *Adapted Physical Activity Quarterly*, *25*(4), 308-321.

Pan, C. Y., & Frey, G. C. (2006). Physical activity patterns in youth with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *36*(5), 597-606.

Pope, R. P., Coleman, K. J., Gonzalez, E. C., Barron, F., & Heath, E. M. (2002). Validity of a revised system for observing fitness instruction time (SOFIT). *Pediatric Exercise Science*, *14*(2), 135-146.

Rimmer, J. H., & Braddock, D. (2002). Health promotion for people with physical, cognitive, and sensory disabilities: An emerging national priority. *American Journal of Health Promotion*, *16*(4), 220-224.

Rimmer, J. H., Riley, B., Wang, E., Rauworth, A., & Jurkowski, J. (2004). Physical activity participation among persons with disabilities: Barriers and facilitators. *American Journal of Preventive Medicine*, *26*(5), 419-425.

Rosser-Sandt, D., & Frey, G. C. (2005). Comparison of physical activity levels between children with and without autistic spectrum disorders. *Adapted Physical Activity Quarterly*, *22*(2), 146-159.

Schleien, S. J., Germ, P. A., & McAvoy, L. H. (1996). Inclusive community leisure services: Recommended professional practices and barriers encountered. *Therapeutic Recreation Journal*, *30*(4), 260-273.

Shields, N., Dodd, K. J., & Abblitt, C. (2009). Do children with down syndrome perform sufficient physical activity to maintain good health? A pilot study. *Adapted Physical Activity Quarterly*, *26*(4), 307-320.

Sit, C. H. P., McKenzie, T. L., Lian, J. M. G., & McManus, A. (2008). Activity levels during physical education and recess in two special schools for children with mild intellectual disabilities. *Adapted Physical Activity Quarterly*, *25*(3), 247-259.

Sit, C. H. P., McManus, A., McKenzie, T. L., & Lian, J. (2007). Physical activity levels of children in special schools. *Preventive Medicine*, *45*(6), 424-431.

Stanish, H. I., & Mozzochi, M. (2000). Participation of preschool children with developmental delay during gross motor activity sessions. *Research Quarterly for Exercise and Sport*, *71*(1, Suppl.), A111-A112.

Strong, W. B., Malina, R. M., Blimkie, C. J. R., Daniels, S. R., Dishman, R. K., Gutin, B., et al. (2005). Evidence based physical activity for school-age youth. *Journal of Pediatrics*, *146*(6), 732-737.

Taylor, C. A., & Yun, J. (2006). Psychometric properties of two systematic observation

techniques for assessing physical activity levels in children with mental retardation. *Pediatric Exercise Science*, *18*(4), 446-456.

Trost, S. C., Pate, R. R., Sallis, J. F., Freedson, P. S., Taylor, W. C., Dowda, M., et al. (2002). Age and gender differences in objectively measured physical activity in youth. *Medicine and Science in Sports and Exercise*, *34*(2), 350-355.

U.S. Department of Health and Human Services. (2000). *Healthy people 2020: Physical activity and fitness*. Retrieved January 5, 2010, from http://www.health.gov/healthypeople/Document/HTML/Volume2/22Physical.htm

U.S. Department of Health and Human Services and Department of Agriculture. (2005). *Dietary guidelines for Americans*. Retrieved September 15, 2009, from http://www.health.gov/dietaryguidelines/dga2005/document/html/chapter4.htm

van den Berg-Emons, R., Festen, D., Hokken-Koelega, A., Bussmann, J., & Stam, H. (2008). Everyday physical activity and adiposity in Prader-Willi syndrome. *Journal of Pediatric Endocrinology and Metabolism*, *21*(11), 1041-1048.

van den Mars, H., Rowe, P., Schuldheisz, J. M., & Fox, S. (2004). Measuring students' physical activity levels: Validating SOFIT for the use with high-school students. *Journal of Teaching in Physical Education*, *23*(3), 235-251.

Welk, G. J., & Wood, K. (2000). Physical activity assessment in physical education: A practical review of instruments and their use in the curriculum. *Journal of Physical Education, Recreation and Dance*, *71*(1), 30-40.

Whitt-Glover, M. C., O'Neill, K. L., & Stettler, N. (2006). Physical activity patterns in children with and without Down syndrome. *Pediatric Rehabilitation*, *9*(2), 158-164.

World Health Organization. (2004). *Global strategy on diet, physical activity and health*. Geneva, Switzerland: Author.

大專體育學刊
第14卷 第3期，296-309頁（2012年9月）
DOI:10.5297/ser.1403.003

泛自閉症與智能障礙青少年在融合式體育課中的身體活動

蔡俊賢、朱嘉華、謝凱玟、潘倩玉
臺灣 高雄市 802 國立高雄師範大學體育學系

通訊作者：潘倩玉
地址：802 高雄市苓雅區和平一路 116 號
傳真號碼：(07)711-4633
電子郵件：chpan@nknucc.nknu.edu.tw
投稿日期：2011 年 3 月
接受日期：2012 年 5 月

摘要

本研究目的主要分析自閉症與智能障礙青少年在融合式體育課之身體活動及其相關因素。以體適能教學時間觀察系統 (system for observing fitness instruction time, SOFIT) 分析 56 位研究參與者（自閉症，n = 26；智能障礙，n = 30）一節融合式體育課之身體活動、課程內容及教師教學行為。主要結果顯示：一、自閉症與智能障礙青少年在融合式體育課從事中等費力以上身體活動的時間 (35.76%) 遠低於美國所建議的 50%；二、戶外體育課之費力身體活動顯著高於室內體育課；三、教師之專業背景在學生身體活動、課程內容及教師教學行為上並無顯著不同。本研究結論：體育教師若欲提升自閉症與智能障礙學生體育課之身體活動，可以從上課地點（如：戶外）、課程內容之時間分配（如：多給學生技巧練習的時間）以及教師教學行為（如：多示範體適能）等三方面思考。除了學校體育課以外，也應提供其它有助於提升自閉症與智能障礙學生身體活動的機會。

關鍵詞：活動量、廣泛性發展障礙、智力缺陷、適應體育