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Does the *Animal Fun* program improve social-emotional and behavioural outcomes in children aged 4–6 years?

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ABSTRACT

Animal Fun was designed to enhance motor and social development in young children. Its efficacy in improving motor skills was presented previously using a randomised controlled trial and a multivariate nested cohort design. Based on the Environmental Stress Hypothesis, it was argued that the program would also result in positive mental health outcomes, investigated in the current study. Pre-intervention scores were recorded for 511 children aged 4.83–6.17 years ($M = 5.42$, $SD = .30$). Intervention and control groups were compared 6 months following intervention, and again in their first school year. Changes in teacher-rated prosocial behaviour and total difficulties were assessed using the Strengths and Difficulties Questionnaire, and data analysed using Generalised Linear Mixed Models. There was a significant improvement in prosocial behaviour of children in the intervention group six months after initial testing, which remained at 18-month follow-up. Total difficulties decreased at 6 months for the intervention group, with no change at 18 months. This effect was present only for the hyperactivity/inattention subscale. The only significant change for the control group was an increase in hyperactivity/inattention scores from pre-intervention to 18-month follow-up. The *Animal Fun* program appears to be effective in improving social and behavioural outcomes.

1. Introduction

The importance of motor skills and physical activity for predicting school achievement has been a focus of study for some time (Fedewa & Ahn, 2011; Son & Meisels, 2006), and has been a key topic of discussion given the rising inactivity in children, which is also a known risk factor for health outcomes such as obesity and cardiovascular disease (Okely et al., 2012). There is now growing evidence indicating that motor competence and physical participation are also crucial for positive functioning in the social and emotional domains (Ahn & Fedewa, 2011; Cairney, Rigoli, & Piek, 2013). This suggests that children with

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poor motor coordination, who also withdraw from physical participation partly due to their movement difficulties, may be at significant risk for psychosocial problems.

Several studies have now revealed an important relationship between movement and internalising problems such as increased depressive symptomatology (e.g., Francis & Piek, 2003; Piek, Bradbury, Elsley, & Tate, 2008; Piek et al., 2007; Rigoli, Piek, & Kane, 2012) and anxiety (Pearsall-Jones, Piek, Rigoli, Martin, & Levy, 2011; Schoemaker & Kalverboer, 1994; Sigurdsson, Van Os, & Fombonne, 2002; Skinner & Piek, 2001) in children and adolescents. Other research has found a lower sense of self-worth (Skinner & Piek, 2001) and lower levels of perceived competence in children with motor skill difficulties (Piek, Baynam, & Barrett, 2006; Skinner & Piek, 2001). In fact, movement difficulties have been linked to various negative outcomes such as academic underachievement (Dewey, Kaplan, Crawford, & Wilson, 2002), attention deficit hyperactivity disorder (Pitcher, Piek, & Hay, 2003) and inattention and hyperactivity symptoms (Tseng, Howe, Chuang, & Hsieh, 2007), as well as difficulties in the social domain such as self-reported fewer playmates and being asked less often to play with other children (Schoemaker & Kalverboer, 1994), greater peer exclusion (Livesey, Lum-Mow, Toshack, & Zheng, 2011), and peer-victimisation (Campbell, Missiuna, & Vaillancourt, 2012; Losse et al., 1991). It is plausible that these psychosocial stressors play an important role in understanding the relationship between movement and emotional difficulties (Cairney et al., 2013).

The psychosocial difficulties often associated with poor motor coordination are generally thought to be a consequence of motor problems (Cairney et al., 2013), appearing once a child is challenged by social and peer demands in the school years (Piek et al., 2008). Piek et al. (2008) partly supported this notion when they found a significant link between motor ability and anxious/depressive behaviours in children as young as kindergarten age. Schoemaker and Kalverboer (1994) also established a link between motor coordination difficulties and social and affective problems in children as young as six years. Furthermore, Bart, Hajami, and Bar-Haim (2007) found a relationship between children's motor ability in kindergarten and scholastic, social and emotional development a year later in their first year of school. Other findings have shown that motor skill difficulties early in childhood are related to later psychosocial problems in adolescence (Lingam et al., 2012; Losse et al., 1991; Shaffer et al., 1985; Sigurdsson et al., 2002). Unfortunately, as children with motor difficulties avoid participation for fear of failure and/or peer criticism, they also limit their opportunity to practise skills and to participate in a social environment, creating a vicious circle (Skinner & Piek, 2001).

In our recent review paper, we elaborated on a theoretical model, namely the Environmental Stress Hypothesis, in an attempt to understand the relationship between poor movement skills and the associated increased risk for mental health difficulties such as anxiety and depression (Cairney et al., 2013). The Environmental Stress Hypothesis was originally proposed by Cairney, Veldhuizen, and Szatmari (2010) to highlight the role that negative exposure to personal and interpersonal stressors might play in accounting for higher rates of emotional symptoms in children with movement difficulties. In addition to the stressors and protective factors (e.g., self-esteem and social support) originally proposed, we elaborated further on the model by considering the role that physical inactivity and obesity might play in this process, given the important links found between movement ability and these physical health outcomes (Cairney et al., 2013). We argued that incorporating physical inactivity and obesity alongside measures of psychosocial stressors and resources, provides a comprehensive framework from which to explore mediating and moderating influences on the association between movement and psychosocial problems in children. Recent studies examining the Environmental Stress Hypothesis have also demonstrated the application of the model using normative samples, for example, social skills and self-perceptions were found to be important mediating variables for the link between motor ability and emotional outcomes in child and adolescent samples respectively (Rigoli et al., 2012; Wilson, Piek, & Kane, 2012).

Based on the Environmental Stress Hypothesis, and given the evidence showing that children who feel confident about their movement skills engage in physical activity more often than those children who lack confidence in this area (Hay, Hawes, & Faught, 2004; Mandich, Polatajko, & Rodger, 2003), it is plausible that targeting motor skills development may be a suitable approach to increasing physical activity participation in children, ultimately promoting positive social and emotional development. Furthermore, given the increase in social, motor, and other demands upon transitioning to formal schooling, it appears that targeting motor skill development prior to children commencing school may have many beneficial consequences for children.

The preschool age of 2–6 years is a period where basic movements achieved in infancy are refined and extended. Fundamental movement skills (e.g., running, climbing, catching), considered essential for motor development (Gallahue & Ozmun, 2005), are developing at this stage, although children still have difficulties with sequencing and coordination. It is also an important stage for fine motor development through drawing and other tasks involving object manipulation (e.g., jigsaw puzzles, building blocks), which are important precursors to essential skills needed in the school years such as writing and self-grooming. It is now recognised that practice plays an important role in the development of a child's motor competence and can lead to considerable variability in performance (White, Hayes, & Livesey, 2010).

Evidence suggests that most preschool children aged 2–5 years do not meet recommended guidelines published in Australia, the USA, and the United Kingdom for daily physical activity (Howie, Brown, Dowda, McIver, & Pate, 2013). Yet there are few physical activity programs targeting this age group despite the evidence suggesting that the first year of formal schooling is a critical period in terms of a child's development (Entwisle & Alexander, 1998; La Paro, Pianta, & Cox, 2000). Interventions that provide increased participation in physical activities and practice of movement skills are essential for motor skill development. Furthermore, it may also lead to social skill development by providing opportunities to interact with other children in a play situation, ultimately promoting positive mental health outcomes.

The *Animal Fun* program (Piek et al., 2010) is based on key principles relating to motor skill development (Sugden & Chambers, 2003), and was developed to improve physical activity participation and promote both fine and gross motor skills as well as social development in young children aged 4–6 years. It is an inclusive, universal program involving all children within the class. The program is administered by pre-school/kindergarten teachers and involves the imitation of movements of animals. It is based on the notion that children need to enjoy their participation in order to continue to practice and improve the skills (Chambers & Sugden, 2006).

The *Animal Fun* program has been evaluated using a randomised cluster controlled trial, registered in the Australian and New Zealand Clinical trials registry (ACTRN1209000869279). We have previously presented findings showing a significant improvement in motor ability for children in the intervention group compared to controls (Piek et al., 2013). The current paper presents the findings of the impact of *Animal Fun* on children's prosocial behaviour and total emotional difficulties including peer, emotional, and behavioural problems across pre-intervention, six months following the intervention and then 18 months after the initial testing.

2. Method

2.1. Participants

A total of 511 children (257 boys and 254 girls) were included in this study ranging in age from 4 years 10 months to 6 years 2 months (M = 5 years 5 months, SD = 3.58 months) at initial testing. They were recruited from 12 schools across both metropolitan and regional Western Australia in low socio-economic areas. Six schools were randomly allocated to intervention and six to control conditions. The Procedure section outlines the randomisation procedure, and the full study protocol for the randomised control trial has been detailed in Piek et al. (2010). The recruitment description and design for the current study are presented graphically in Fig. 1.

All children enrolled in Pre-Primary classes (i.e., the year before year 1 of formal schooling) at the selected schools, together with their parents, were invited to participate in the study. Teacher ratings were available for 486 children at pre-test (221 Control; 265 Intervention), 456 children at the 6-month follow-up (194 Control; 262 Intervention), and 337 children at the 18-month follow-up (130 Control; 207 Intervention) when children were in their first school year. Although only 337 children were rated at all three assessments, data were analysed with a full information estimation procedure that used all the data present at each assessment point. This reduced sampling bias and the need to replace missing data.

2.2. Materials and measures

2.2.1. Animal Fun program

The *Animal Fun* program provides a large set of activities that imitate the movements of animals in a fun, non-competitive way (Piek et al., 2010) in order to promote motor and social development and increase children's confidence in their physical abilities. It is an inclusive program as the entire class engages in the program regardless of individual levels of competence.

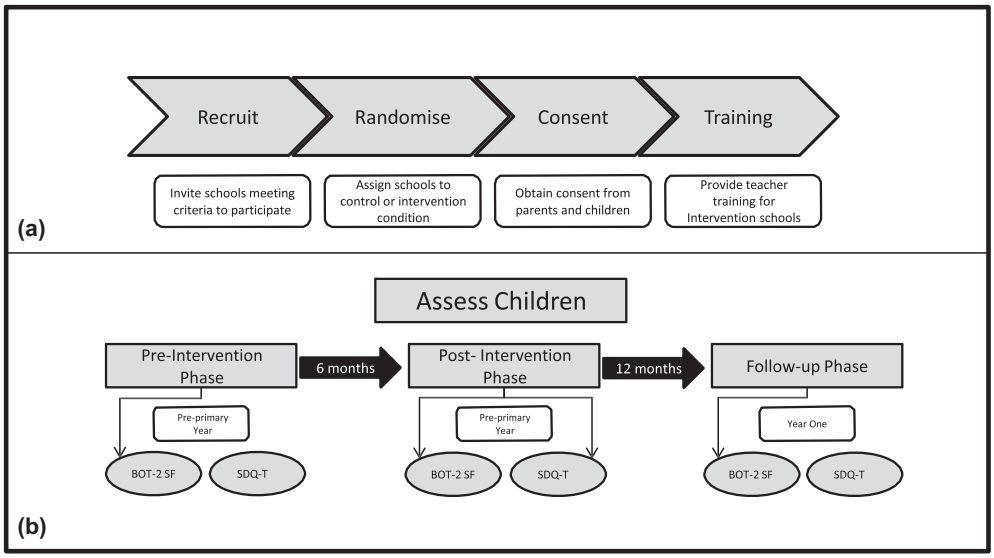

Fig. 1. A flow chart describing (a) the study recruitment and (b) the design of the current study (adapted from Fig. 1, Piek et al., 2013, page 1088).

Activities are grouped into nine modules. The first four focus on gross motor development involving trunk and lower limb body management, locomotion (walking, jumping, hopping, skipping), object control (throwing, catching, kicking) and body sequencing of the trunk and lower limbs. The second four involve fine motor development including trunk, shoulder and pelvic girdle stability and upper body strength, sequencing of fine motor activities, object control in manual skills and functional use of hand skills (e.g., use of pencils, scissors, keyboard). The last module addresses social-emotional development and includes skills promoting laughter, relaxation, and identifying and labelling feelings. A full description is available in Piek et al. (2010). All activities are rated for difficulty level giving teachers the freedom to graduate children's learning, group children according to their skill level, and challenge more competent children with more difficult and complex movements. Teachers are encouraged to increase the difficulty level of the activities according to the level of competence of their class and to creatively embed *Animal Fun* activities into other curriculum areas of learning.

2.2.2. Bruininks-Oseretsky Test for motor proficiency-version 2 short form (BOT-2SF)

The short form of the revised Bruininks-Oseretsky Test of Motor Proficiency (Bruininks & Bruininks, 2005) was used to measure motor performance. Described as the most widely used test of motor proficiency (Slater, Hillier, & Civetta, 2010), the long form which has 53 items has excellent test–retest and inter-rater reliability. The long form takes at least 40–60 min to administer, but given the young age of the children in the current study, the short form containing 14 items was chosen instead. Although few studies have examined the psychometric properties of the short form, inter-rater reliability was reported by the authors of the test to be greater than .90, test–retest reliability greater than .80, and internal consistency greater than .80. According to Dietz, Kartin, and Kopp (2007), the short form is generally a reliable and valid measure of general motor ability. In the current study, the recommended BOT scale score cut-offs (Bruininks & Bruininks, 2005) were used to transform the measure into a categorical variable with five levels, namely, well below average motor skills (5 or less), below average motor skills (6–10), average motor skills (11–19), above average motor skills (20–24), well above average motor skills (25 or greater).

2.2.3. Teacher version of the Strengths and Difficulties Questionnaire (SDQ-T; Goodman, 1997)

The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) is a 25-item screening questionnaire for psychological adjustment, designed for children aged 3–16 years. The SDQ comprises five subscales including hyperactivity/inattention, emotional symptoms, conduct problems, peer relationship problems and prosocial behaviour. A total difficulties score is generated by summing all the subscale scores, except the prosocial scale. Lower scores indicate fewer difficulties. In the current study, the total difficulties score and its subscales (assessing behavioural, emotional, and peer problems) and the prosocial (higher scores representing greater prosocial behaviour) scores were analysed. The SDQ is a widely used measure and has shown to be psychometrically sound, with satisfactory reliability and validity (Goodman, 2001).

2.3. Procedure

This study adhered to the ethical guidelines set out by the National Health and Medical Research Council of Australia and was granted ethics approval from the Human Research Ethics Committee of Curtin University and the Western Australian Department of Education.

Government schools located in areas of low socio-economic status (SES) with more than 50 students in their pre-primary classes were identified. Twenty-four of these schools yielded pairs that were matched for geographical location, SES and enrolled student numbers. Of these 12 pairs, six agreed to participate. Schools from each pair were randomly assigned to either the intervention or control condition using a coin toss. Apart from the three testing sessions, schools assigned to the control condition followed their normal curriculum, and were offered the *Animal Fun* program and teacher training at the conclusion of the assessment.

Parents of all children in the pre-primary classes of the 12 schools were invited to participate in the study. They were provided with a detailed written description of the purpose and procedures of the project together with information about possible risks and benefits of participation. Although all children in the class participated in the *Animal Fun* program, data were only collected from children and their parents who gave consent to participate in the study.

Teachers participated in a 1-day intensive training course prior to embedding the program into their normal curriculum for 30 min a day, four days a week for a minimum of 10 weeks. The trainers also visited the class several times to observe the *Animal Fun* activities in progress and to provide support to teachers as required. Teachers were asked to complete a weekly dosage report to indicate which modules/activities they had completed within class and to monitor progress across the modules.

2.4. Data analysis

Prior to the analyses, the 5-category BOT variable (well below average motor skills, below average motor skills, average motor skills, above average motor skills, well above average motor skills) was reduced to a 3-category variable (below average motor skills, average motor skills, above average motor skills) by collapsing across the first two and last two categories. This was deemed statistically appropriate due to the relatively small number of students in the well above average and well below average groups. Data were analysed with Generalised Linear Mixed Models (GLMM) as implemented through SPSS's

(Version 22) GENLINMIXED procedure. GLMM tested for intervention effects within the context of a hierarchical design in which time (3 levels) was nested within children, children were nested within teachers, and teachers were nested within schools. The GLMMs included one ordinal fixed effect (time [pre, post, follow-up]), three nominal fixed effects (condition [intervention versus control], motor problems [below average motor skills, average motor skills, above average motor skills], and sex [male, female]), and three random effects (children, teacher, and school). The analysis examined all 2-way and 3-way interactions. The 4-way interaction would be difficult to interpret in terms of pre-existing theory and was therefore omitted from the analysis. The GLMM robust statistics option was used to accommodate violations of normality and homogeneity of variance, and the covariance matrix was changed from the default of compound symmetry to autoregressive to accommodate violations of sphericity.

3. Results

3.1. Descriptives

Table 1 presents the means and standard deviations for the prosocial and total difficulties scores for both the control and intervention groups over the three testing times. Table 2 presents the means and standard deviations for the subscales of the total difficulties score, namely emotional symptoms, conduct problems, hyperactivity/inattention, and peer problems.

3.2. GLMM analysis for teacher-reported prosocial behaviour

There was a significant Group × Time interaction ($F[2,1262] = 4.34$, $p = .013$). Post-hoc LSD contrasts were conducted to investigate the source of the interaction. There was a significant Time 1 (T1)–Time 2 (T2) increase for the intervention group ($t[1262] = 5.21$, $p < .001$) but no T1–T2 change for the control group ($t[1262] = 1.08$, $p = .196$). There was no change between T2 and T3 for either the intervention group ($t[1262] = 1.44$, $p = .151$) or the control group ($t[1262] = 1.65$, $p = .098$).

The 3-way Group × Time × Sex interaction was significant ($F[2,1254] = 7.61$, $p = .001$), indicating that the 2-way Group × Time interaction – which embodies the intervention effect – was moderated by sex. Post-hoc LSD contrasts were conducted to investigate the nature of the moderation effect. As can be seen in Fig. 2, for the control children, there were no changes from T1 to T2 for either females ($t[1254] = 0.98$, $p = .328$) or males ($t[1254] = 1.06$, $p = .151$), and no T2 to T3 changes for either females ($t[1254] = 1.23$, $p = .219$ or males ($t[1254] = 1.65$, $p = .099$). For the intervention children, however, there were significant increases from T1 to T2 for both females ($t[1254] = 7.56$, $p < .001$) and males ($t[1254] = 2.68$, $p = .008$), but no T2 to T3 changes for either females ($t[1254] = 1.62$, $p = .105$) or males ($t[1254] = 1.26$, $p = .208$). The pattern of significant effects was the same for females and males. The significant Group × Time × Sex interaction, therefore, emerges from the T1–T2 intervention effect being significantly stronger for females.

The three-way BOT × Group × Time interaction was non-significant ($F[4,1232] = 0.02$, $p = .999$), indicating that the 3-category BOT variable (below average motor skills, average motor skills, above average motor skills) did not moderate the intervention effect. The significant intervention effect reported above therefore applies to all children regardless of their level of motor skills.

3.3. GLMM analysis for teacher-reported total difficulties

There was a significant Group × Time interaction ($F[2,1273] = 4.67$, $p = .009$). Post-hoc LSD contrasts were conducted to investigate the source of the interaction. There was a significant T1–T2 decrease for the intervention group ($t[1273] = 8.31$,

Table 1
Adjusted means and standard deviations (SD) for teacher-reported prosocial, and total difficulties scores at Time 1 (pretest), Time 2 (posttest), and Time 3 (follow-up) for boys and girls in each condition.

	Time 1 ($n = 486$) Mean *SD*		Time 2 ($n = 456$) Mean *SD*		Time 3 ($n = 337$) Mean *SD*	
Pro-social behaviour						
Intervention						
Males	5.83	2.49	6.29	2.27	6.78	2.59
Females	6.78	2.37	7.81	2.05	8.31	2.20
Control						
Males	6.49	2.98	6.92	2.78	6.17	2.18
Females	8.01	2.24	8.35	2.17	7.71	1.98
Total difficulties						
Intervention						
Males	8.45	5.77	6.84	5.17	8.64	7.38
Females	6.45	4.38	4.49	3.93	5.85	6.73
Control						
Males	9.19	7.51	8.63	7.74	8.60	6.00
Females	5.23	5.52	4.89	6.12	6.44	4.88

Table 2
Adjusted means and standard deviations (SD) for teacher-reported emotional symptoms, conduct problems, hyperactivity/inattention and peer problems at Time 1 (pretest), Time 2 (posttest), and Time 3 (follow-up) for boys and girls in each condition.

	Time 1 (n = 486) Mean *SD*		Time 2 (n = 456) Mean *SD*		Time 3 (n = 337) Mean *SD*	
Emotional symptoms						
Intervention						
Males	1.55	1.75	1.25	1.62	1.75	2.76
Females	1.55	1.80	1.18	1.80	1.48	2.31
Control						
Males	1.55	2.31	1.63	2.47	1.19	2.00
Females	1.43	2.00	1.38	2.36	1.52	1.46
Conduct problems						
Intervention						
Males	1.48	1.64	1.25	1.66	1.54	1.83
Females	0.84	1.36	0.54	1.01	0.94	2.00
Control						
Males	1.92	2.23	1.71	2.11	1.51	1.72
Females	0.78	1.49	0.78	1.43	1.24	2.05
Hyperactivity/inattention						
Intervention						
Males	4.07	3.04	3.28	2.64	3.94	3.23
Females	2.69	2.23	1.75	1.88	2.38	2.93
Control						
Males	3.94	3.24	3.69	3.19	4.49	3.18
Females	1.89	2.20	1.70	2.24	2.75	2.49

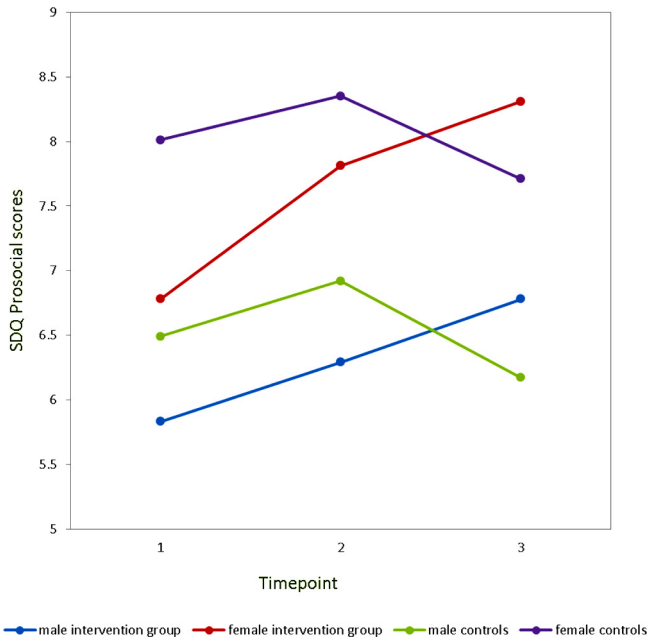

Fig. 2. Teacher-reported SDQ prosocial behaviour (mean scores) at Time 1 (pretest), Time 2 (posttest), and Time 3 (follow-up) for boys and girls in each condition.

$p < .001$) but no significant T1–T2 change for the control group ($t[1273] = 0.88$, $p = .381$) There was no change between T2 and T3 for either the intervention group ($t[1273] = 1.34$, $p = .181$) or the control group ($t[1273] = 0.49$, $p = .627$).

The three-way Group × Time × Sex interaction was non-significant ($F[2,1265] = 1.45$, $p = .235$), indicating that the intervention effect was not moderated by sex. The significant intervention effect reported above therefore applies to both girls and boys.

The three-way BOT × Group × Time interaction was non-significant ($F[4,1242] = 0.29$, $p = .882$), indicating that the 3-category BOT variable (below average motor skills, average motor skills, above average motor skills) did not moderate the intervention effect. The significant intervention effect reported above therefore applies to all children regardless of their level of motor skills.

An analysis of the four components of the total SDQ (namely: emotional symptoms, conduct problems, hyperactivity/inattention, and peer problems) revealed that hyperactivity/inattention was the only one to show a significant Group × Time interaction ($F[2,1273] = 8.09$, $p < .001$). The three-way Group × Time × Sex interaction was non-significant ($F[2,1265] = 0.46$, $p = .632$), as was three-way BOT × Group × Time interaction ($F[4,1242] = 1.57$, $p = .179$), indicating that the intervention effect embodied in the Group × Time interaction was not moderated by sex or level of motor skill. Post-hoc LSD contrasts were conducted to investigate the source of the Group × Time interaction. As can be seen in Fig. 3, there was a significant T1–T2 decrease for the intervention group ($t[1273] = 5.43$, $p < .001$), but no significant T1–T2 change for the control group ($t[1273] = 1.20$, $p = .230$) There was no change between T2 and T3 for the intervention group ($t[1273] = 1.50$, $p = .135$), but a significant T1–T3 increase for the control group ($t[1273] = 2.29$, $p = .022$). It appears that the intervention effect for the Total Difficulties was carried by the intervention's impact on hyperactivity/inattention.

4. Discussion

Animal Fun, a universal movement program designed to enhance motor development in young children, has been shown to improve motor ability (Piek et al., 2013). The program also aims to promote the social development of children, which is supported by the current findings. The results of this study revealed that, according to teacher ratings, the intervention group improved in the prosocial domain six months following initial testing (Time 2) and that this improvement was maintained at 18 month follow-up (Time 3), whereas the control group did not demonstrate any improvement. A plausible explanation for these results is that the *Animal Fun* program promotes positive social skill development by providing important opportunities to interact with other children in a positive play context. Such opportunities are particularly important for children with motor skill difficulties who are known to withdraw from physical participation, consequently reducing their engagement in a social environment as well as the opportunity to improve their social skills. The current results, however, demonstrated that the improvement in teacher-rated prosocial skills for the intervention group occurred regardless of initial level of motor ability. This highlights the efficacy of the universal program in enhancing the social development of all children. The results are particularly promising as the improvement remained following the transition to Grade 1, a period that introduces new challenges and demands to a child, such as the formal schooling demands of the curriculum as well as increased demands in terms of socialisation (e.g., forming positive and meaningful relationships with teachers and peers) (Bart et al., 2007).

The results of this study also demonstrated that the improvement in pro-social skills was seen across both males and females, although, interestingly, the intervention effect was significantly stronger for females. These results seem to support previous research by Bart et al. (2007) which revealed that movement difficulties in kindergarten children significantly contributed to lower pro-social behaviour in grade one for girls, but not for boys. This is somewhat inconsistent with the notion that movement is of greater importance in predicting social adjustment in boys given its focus in their play behaviour. However, it is also possible that this varies according to age, for example, physical ability and participation may become more important for positive social functioning in boys during adolescence.

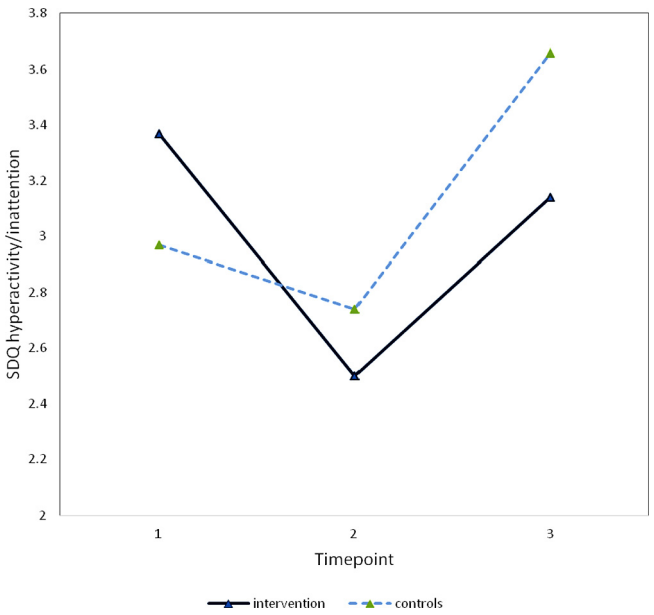

Fig. 3. Teacher-reported SDQ hyperactivity/inattention (mean scores) at Time 1 (pretest), Time 2 (posttest), and Time 3 (follow-up) in each condition.

In addition, the SDQ total difficulties decreased at Time 2 for the intervention group, an effect that was maintained at Time 3. Again, the decrease in SDQ total difficulties was found regardless of initial level of motor ability in both boys and girls. There was no significant change in the total difficulties score for the control group. Further analysis of the separate subscales of the total difficulties score identified that the intervention effect was only present for the hyperactivity/inattention subscale. The intervention group reduced its hyperactivity/inattention score at 6 months, whereas the control group did not change. Also, the hyperactivity/inattention score increased for the control group from pre-testing to the 18 month followup whereas there was no change for the intervention group. It appears that children who were involved in the *Animal Fun* intervention improved in terms of their hyperactivity and inattention symptoms. The improvement in motor skills found for children who were involved in the *Animal Fun* program (Piek et al., 2013) may be linked to the decrease in hyperactivity and inattention found in the current study. Tseng et al. (2007) found that children with motor skill difficulties were more likely to have problems with inattention and hyperactivity. Indeed, the important relationship between motor skills and ADHD symptomatology is well known, for example, evidence has demonstrated a strong overlap between ADHD and motor skill difficulties of up to 50% (Pitcher et al., 2003). However, research continues to overlook the significant link between these areas, including intervention studies.

The current study suggests that intervention that focuses on enhancing movement ability and physical participation may in turn, reduce hyperactivity/inattention symptomatology. These findings support recent evidence highlighting the potential role for physical activity intervention in improving ADHD symptoms. For example, Cerrillo-Urbina et al. (2015) conducted a meta-analysis of randomised control trials to examine the effects of physical exercise on children with ADHD and found that short-term physical exercise (including aerobic and yoga) had a moderate to large effect on core ADHD symptoms, as well as on other areas including anxiety, social disorders and executive function. These are important findings particularly when considered in the context of the Environmental Stress Framework. It is known that combined movement and ADHD difficulties lead to increased risk for emotional problems such as depression compared to ADHD or movement problems-alone (Piek et al., 2007). It has been hypothesised that the comorbid presentation consequently exacerbates the psychosocial stressors experienced by the individual, which in turn may increase the likelihood for developing mental health difficulties. Therefore, it appears that movement programs, such as *Animal Fun*, that enhance physical participation may have a crucial role in mitigating not only movement ability (Piek et al., 2013) and ADHD symptomatology, but also psychosocial and emotional outcomes.

The results of this study provided partial support for the Environmental Stress Hypothesis (Cairney et al., 2013), which predicts that an intervention program aiming to improve movement skills and physical participation in children may also, in turn, promote improvement in psychosocial areas such as pro-social behaviour. There is still very limited research investigating the pathways proposed in the Environmental Stress Model. For example, Wilson et al. (2012) demonstrated that social skills mediate the relationship between motor ability and emotional outcomes in a normative sample of 4–6 year old children. Rigoli et al. (2012) examined the model in an adolescent sample and found that self-perceptions played an important role in explaining the link between motor coordination and emotional symptoms. However, these cross-sectional studies cannot imply causality or the direction of the relationships. To our knowledge, this appears to be the first intervention study to examine some of the pathways proposed in the Environmental Stress Framework. Given the significant improvements in pro-social behaviour for the intervention group, the findings suggest that universal programs such as *Animal Fun* may have a crucial role in prevention and early intervention efforts for important psychosocial outcomes in children. Although no significant improvement in emotional symptoms was identified, it is possible that this may be an effect that occurs over time for the children. Future studies, including intervention efforts, are needed to investigate the important relationships between movement difficulties, physical participation, psychosocial and mental health outcomes proposed in the Environmental Stress model, and at various developmental ages in order to further elucidate these plausible causal relationships (Cairney et al., 2013).

In addition to the previously identified motor benefits of the program (Piek et al., 2013), the current results highlight the potential social and behavioural benefits of the *Animal Fun* program for all children, with important implications particularly at this transitional schooling period. The results of this study suggest that this program may provide crucial intervention and preventative efforts, reducing the likelihood of the development of future psychosocial problems in children. It should be noted that teachers were not blind to the condition and this may have influenced the findings. However, this would be difficult to control given that the students' teachers are responsible for administering the program. In addition, schools in low SES areas were chosen for this study as it was deemed that these were in most need of such programs. It is important for future research to examine its impact in schools of all SES levels in addition to private and public schools. Also, further research is needed to determine the long-term effects of the program, and also to determine whether children in the clinical range for psychosocial difficulties would benefit from such a program. However, this is an important first step to identifying a program that may prove effective in improving motor and psychosocial outcomes for young children.

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