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Original article

Does playing a sports active video game improve object control skills of children with autism spectrum disorder?

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Abstract

Background: Active video games (AVGs) encourage whole body movements to interact or control the gaming system, allowing the opportunity for skill development. Children with autism spectrum disorder (ASD) show decreased fundamental movement skills in comparison with their typically developing (TD) peers and might benefit from this approach. This pilot study investigates whether playing sports AVGs can increase the actual and perceived object control (OC) skills of 11 children with ASD aged 6–10 years in comparison to 19 TD children of a similar age. Feasibility was a secondary aim.

Methods: Actual (Test of Gross Motor Development) and perceived OC skills (Pictorial Scale of Perceived Movement Skill Competence for Young Children) were assessed before and after the intervention (6×45 min).

Results: Actual skill scores were not improved in either group. The ASD group improved in perceived skill. All children completed the required dose and parents reported the intervention was feasible.

Conclusion: The use of AVGs as a play-based intervention may not provide enough opportunity for children to perform the correct movement patterns to influence skill. However, play of such games may influence perceptions of skill ability in children with ASD, which could improve motivation to participate in physical activities.

Keywords: Autism spectrum disorder; Child; Exergaming; Fundamental movement skills; Physical self-perception; Xbox

1. Introduction

Autism spectrum disorder (ASD) is a lifelong neurodevelopmental disorder that is characterized by significant impairments in social communication, the presence of restricted or repetitive behaviors, and in many cases significant motor impairments.[1] ASD affects around 1% of the population worldwide, impacting on relationships, quality of life, and well-being.[1]

Interventions that target physical activity (PA) in individuals with ASD are beginning to gain an increased focus. PA provides numerous physical and psychological benefits to children[2] and can have a positive influence on behaviors specific to ASD, such as reducing stereotypical behaviors and positively influencing social functioning, communication, and academic performance.[3] Current recommendations state that children should participate in 60 min or more of developmentally appropriate moderate-to-vigorous PA on most days of the week.[2] However, only 1 in 5 typically developing (TD) Australian children reaches the recommended levels of activity,[4] and children with disabilities, including ASD, are even less likely.[5,6] Children with ASD can also have a strong preference for sedentary and indoor activities and activities that involve visual-spatial skills, such as screen-based activities.[7]

Not achieving PA recommendations may reduce the opportunity for children with ASD to improve their fundamental movement skills (FMS). FMS includes object control (OC) (i.e., controlling implements and objects using the hand, foot, or other parts of the body, such as catching or throwing a ball), locomotor (i.e., running, jumping), and stability or balance skills.[8] These skills are necessary in the development of more complex movement skills required for participation in sports or

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PA later in life.[8,9] A positive relationship between early childhood FMS level and PA later in life has been demonstrated.[10] Additionally, low FMS is associated with lower cardiorespiratory fitness and an increased rate of obesity.[9] Perceived physical competence is also an important positive correlate of PA behavior in children and adolescents.[11] Stodden and colleagues[12] described in their conceptual model a positive spiral of engagement where children's PA participation influences movement skill development, which increases perceptions of competence and in turn encourages more PA, thereby increasing their movement competence.

Approximately 80% of children with ASD show decreased FMS mastery in comparison with their TD peers.[8,13] Poor movement skills can impact the ability of children with ASD to participate in group activities[14] and to develop social relationships with their peers.[15] Impairments in FMS, particularly ball skills and balance, are also associated with emotional or behavioral disturbance in children with ASD.[16]

Yet few evidenced-based interventions specifically target FMS for children with ASD. Group-based interventions can result in significant stress due to physical skill and social interaction requirements.[17] Along with technological advancements came the rise of active video games (AVGs), such as the Nintendo Wii (Nintendo, Taipei, China) and Xbox Kinect (Microsoft, Redmond, WA, USA), which can be played alone. AVGs require the player to engage in whole body movements to interact within a virtual world,[18,19] and can increase time of being physically active,[18] increase energy expenditure,[18,20–23] and can be enjoyable and motivating.[24,25]

AVGs may also have potential for skill improvement.[26,27] Yet the use of AVGs to target FMS in the TD population has had varying results. A randomized control trial using coaching (2 experimental groups: traditional approach (specifically designed lesson plans focusing on FMS skills) or AVG use, such as Xbox Kinect play and skill coaching) found that post-test OC scores were greater in both experimental groups in comparison with the control group.[28] In contrast, 2 other interventions in TD children using a play-based approach did not improve actual or perceived OC skill proficiency.[29,30] Both studies utilized a 2-group pre–post experimental design in which children, aged 4–8[29] and 6–10[30] years old, engaged in AVG play once a week for 6 weeks. It is possible that in TD children, a play-based AVG intervention is not enough to promote skill development. Children may need to have a lower baseline skill level to be able to benefit from such an unstructured intervention.

The use of AVGs for skill development has also been investigated in non-TD children. One study demonstrated that AVG use allowed 17 children with cerebral palsy (aged around 10 years) to participate in PA and practice complex movement skills.[31] Similarly, a study with 14 children with spastic hemiplegic cerebral palsy reported improvements in balance after a 3-week AVG intervention.[32] In children with ASD, 2 American studies reported that AVGs had potential to decrease repetitive behaviors and improve executive functioning in children.[33,34]

To date, no research has investigated whether the use of AVGs can influence the actual or perceived FMS of children with ASD. Therefore, this study aims to investigate whether a play-based AVG intervention can improve the actual or perceived OC skills of children with ASD relative to TD children. A secondary aim was to explore whether AVGs are a feasible intervention for children with ASD. Given children with ASD generally have lower FMS than TD children, it was hypothesized that the AVG intervention would have a greater impact on actual or perceived FMS in children with ASD relative to TD children.

2. Materials and methods

2.1. Participants

Participants for the ASD group were recruited using purposive sampling through poster and newsletter advertisements displayed at established local referrers or through direct letters of invitation, sent to the parents of previous unrelated study participants who gave written informed consent to be contacted about future studies. Participants were required to meet the following inclusion criteria: (1) Diagnostic and Statistical Manual of Mental Disorders (DSM)-V diagnosis of ASD or DSM-IV diagnosis of autistic disorder, Asperger disorder, or pervasive developmental disorder not otherwise specified confirmed by a pediatrician or psychologist, with an intelligence quotient (IQ) score of >70; (2) ASD range on the Autism Diagnostic Observation Schedule; (3) in Grades 1–5 of primary school at the time of the study; and (4) no genetic conditions (i.e., fragile X syndrome) or a condition that impacts their PA performance (i.e., cerebral palsy).

A total of 11 children with ASD aged 6–10 years (in Grades 1–5 of primary school) had written permission from their parents to participate. Three of the participants were diagnosed with autistic disorder, 3 with Asperger disorder, 1 with pervasive developmental disorder not otherwise specified, and 4 with ASD. The mean IQ was 104.18 ± 17.79, and the range was 73–142.

The TD sample was drawn from a previously completed study in which children did not improve their actual or perceived OC skills.[30] In the said study, informed written consent was obtained from the school (via the principal) and parents. Children aged 6–10 years were randomly allocated into either an intervention ($n = 19$) or control group ($n = 17$). For the purpose of this study, only data from the intervention group were included. All procedures were carried out with ethical approval from Deakin University Human Research Ethics Committee.

2.2. Measures

Demographic information of both sets of participants was collected at the time of consent through a parent survey asking for demographic information (including their relationship to the child, country of birth, language spoken at home, highest level of education attained, and current employment level), and also child participation in ball sports outside of school, ownership of an AVG console, time (min) of electronic leisure use per week, and diagnosis and full-scale IQ (ASD group only). Additionally, the ASD group completed any further required diagnostic assessments, including the Wechsler Intelligence Scale for Children[35] and the Autism Diagnostic Observation Schedule-2.[36]