Table 1. Summary of the reviewed articles

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Studies	Design	Sample	Method	Exergaming features (if applicable)	Key findings
Fogel et al. 2010[15]	Alternating treatments design to compare regular PE class and exergaming	5th grade students who are physically inactive during PE class (N=4)	Regular PE condition: The teacher conducted class as usual in the standard format consistent with regular lesson plan. Exergaming condition: Also conducted by the PE teacher in an exergaming lab in which nine stations. Students rotated stations every 10 minutes.	Ten different exergames used in rotation.	Significantly more minutes of physical activity with exergaming comparing to regular PE. School-based exergaming was socially acceptable to the PE teacher and students in this study.
Liu et al. 2020[16]	Systematic review of nine randomized-controlled trials and one quasi-experimental study	3-12 years old healthy children or children with overweight/obesity	Interventions varied in duration (6-12 weeks), frequency (once per week to 5 days per week) for sessions of 3 to 60 minutes.	Studies with some type of active video games (e.g. Nintendo Wii, Xbox 360 Kinect, PlayStation).	Effective for targeting certain physical fitness components in children (e.g. reaction time, agility, and balance) Inconclusive evidence on the development of foundational motor skills, yet being promising.
Oppici et al. 2022[17]	Systematic review and meta-analysis of nine trials	3-12 years old typically developing children (N=783)	Interventions used exergaming.	Commercially available exergame stations (e.g. Xbox Kinect and Nintendo Wii) with sport games (e.g. tennis and baseball) were used in all but one study, which used a custom-built exergame station and goalkeeping game.	Small benefit of using exergames for improving foundational motor skills in children including balance and coordination.
Fu et al. 2019[18]	Longitudinal repeated measure design	6-7 years old healthy children (N=16)	Children played a series of exergames in their classroom over three separate 10 minute sessions daily (Monday–Friday) for 12 consecutive weeks, supervised by their full-time classroom teacher.	In each 10 minute AVG session, children played 5 minutes of "GoNoodle", then 2–3 minutes of "Adventure to Fitness," and ended with 2–3 minutes allocated to "Cosmic Kids Yoga," which was used as a cool-down activity.	Sedentary behaviour decreased while physical activity increased until 8-9 weeks. Enjoyment and social support from teachers increased across 12 weeks.
Rhodes et al. 2018[19]	Cross-sectional observational study	Parents of 6-14 years old children who own a videogame platform in their family home (N=483)	A cross-sectional survey was conducted.	-	Family exergame is preferred as a weekend activity for challenging weather conditions and colder seasons such as fall and winter. Entertainment-based multiplayer games such as sports and dance were preferred by most, however, more training-based exergames were also preferred in some families.
McMichael et al. 2020[20]	Qualitative study with thematic analysis of interviews	Parents or primary caregivers of 13-17 years old adolescents (N=18)	A semi-structured interview schedule developed to guide interviews to gather rich data on select topics including physical activity, gaming, virtual reality (VR), and the	-	Parents had concerns about VR exergaming may be a novelty that comes and goes. Importance of regulate and manage the use of VR exergaming expressed by parents. Parents

			potential for using VR in a physical activity intervention.		had preference for real-world physical activity, however viewed VR exergaming better than nothing, welcoming the potential of being active during screen time.
Bowling et al. 2021[21]	Randomized-controlled	12-17 years old adolescents (N=23) diagnosed with neurodevelopmental disorders: ADHD (N=13) and/or ASD (N=12)	Intervention group: A remotely delivered intervention using exergaming and virtual health coaching as components within a behaviour change intervention, Exergaming 3 days per week with a family member or friend (not required) for 10 weeks, while meeting physical activity goals on non-exergaming days (starting with 10 min in week 1, and increasing to as much as 40 min per day by week 4). Control group: wait-list condition maintaining their normal level of physical activity for 10 weeks	Exergames Just Dance 3, Shape Up 3, and Kinect Sports Season 2 using the XBOX Kinect.	The adaptation of evidence-based exergaming and telehealth coaching intervention for neurodevelopmental disorders increased sleep duration and decreased video game use time. Compliance was good with planned exergaming and excellent with attendance at coaching sessions.
Benzing et. al. 2018[22]	Randomized-controlled	8-12 years old children with ADHD (N=46)	Experiment group: 15 minutes of one-session moderate to high levels of acute exergaming intervention (N= 24) Control group: Watching a documentary (N=22)	The Beatmaster Training Quest consisting of six different exercise (e.g. jump, run, learn to imitate a sequence of movements, skate, perform squats) in an exergame named Shape UP, using the XBOX Kinect.	Positive effects of acute exergaming intervention observed on inhibition and switching reaction times. No significant effects on accuracy scores or working memory performance.
Benzing & Schmidt 2019[23]	Randomized-controlled	8-12 years old children with ADHD (N=51)	Experiment group: 8-week exergaming intervention including three training sessions per week for 30 minutes (N= 28) Control group: Waiting list (N=23)	The Beatmaster Training Quest consisting of six different exercise (e.g. jump, run, smash objects with knees, skate, and learn to imitate a sequence of movements) in an exergame named Shape UP, using the XBOX Kinect.	Positive effects of 8-week exergaming intervention were observed on inhibition and switching reaction times, motor ability performance, and general psychopathology. No significant effects on accuracy scores, working memory performance, and ADHD symptoms.
Ji et al. 2023[24]	Randomized-controlled	8-12 years old children with ADHD (N=30)	Exergaming group (N=16) Traditional bicycle exercise group (N=14) 4-week exercise sessions for both groups including three training sessions per week for 50 minutes (30 minutes of main exercise with 10 minutes of warm-up and 10 minutes of cooldown)	Alchemist's Treasure (D&J Humancare), in which participants need to run or jump, using the ExerHeart devices consisting of a running/jumping board and a screen (D&J Humancare).	Improved selective attention, self-control, and sustained attention in both groups. however attentional assignment of the anterior cingulate improved only in exergaming group as exhibited with improvements of N2 amplitudes in event-related potentials during Go/No-go Task.
Kou et al. 2024[25]	Systematic review and meta-analysis of 37 randomized-controlled studies	3-18 years old children and adolescents, healthy or with conditions	Interventions: Intervention with varying frequencies (once to five times in a week) and durations (minimum lasting 3 weeks, lasting 1	Physically engaging exergames or active video games with no restriction on frequency, intensity, duration or type	Improvements in cognitive flexibility and inhibitory control but non-significant effect on working memory of children and adolescents.

		including ASD, ADHD, DCD, obesity, and cerebral palsy (N=2,771)	year at max) for sessions of 3 to 60 minutes (N=1383) Controls: No intervention, waiting list, conventional exercise, or video watching (N=1388)		For children and adolescents with ADHD, subgroup analysis revealed enhanced inhibitory control while no significant effect on cognitive flexibility and working memory.
Zhu et al. 2023[26]	Systematic review and network meta-analysis of 59 studies	4-18 years old children and adolescents with ADHD (N=1757)	Interventions: Physical activity interventions including closed-skill activities with a focus on aerobic exercises (e.g., swimming, running, and cycle ergometer), open-skill activities (e.g., racket sports, football, and equestrian), multicomponent exercise, exergaming exercise or HIIT. The median length of intervention was 12 weeks with 45 min sessions	Only 3 of the included studies used exergames as physical activity interventions.	Although based on very limited number of studies included on the effects of exergaming interventions, results of network meta-analysis suggest that exergaming is not superior to other exercises, albeit leading to improvements in executive functions and ADHD symptoms.
Sun 2012[27]	Experimental study of within subject design	9-12 years old children (N=74)	Experimental protocol: Pre and post measurements of situational interest by sources including attention, challenge, exploration, enjoyment, and novelty; besides a traditional cardiovascular fitness unit with jump rope, running and jogging, and endurance training.	Eight different stations including various exergames that require players to interact physically (using arm, leg, or whole-body movements) with onscreen images in various activities, such as tennis, baseball, football, boxing, biking, dancing, snowboarding, kicking, and stepping.	Moderate level of physical activity recommended for health benefits reached in cardiovascular fitness unit, but not in exergaming unit. Total initial situational interest and total retained situational interest were higher for the exergaming unit than the fitness unit. Decreased ratings on situational interest dimensions in both units. However, all initial situational interest dimensions (i.e. attention demand, challenge, exploration opportunity, instant enjoyment, and novelty), and three of retained situational interest dimensions (i.e. challenge, exploration opportunity, and instant enjoyment) were higher for the exergaming unit than the fitness unit.
Rhodes et al. 2018[28]	Two-arm, nonrandomized control trial of single-player and multi-player conditions	9-12 years old children (N=72)	Single-player condition: Participants played against or cooperatively with AI opponents (N=32). Multi-player condition: Participants played against or cooperatively with each other, connected to each other by network and speaking to each other using headsets (N=40).	Participants played games using Vision Fitness R10 recumbent bike with Liberi exergame system, originally developed to provide a moderate-to-vigorous intensity exercise stimulus for children with cerebral palsy.	No theory of planned behavior construct showed significant differences by condition. All theory of planned behavior constructs, with the exception of injunctive norm, showed a significant decline in the large effect size range from baseline to two weeks and then to four weeks into the trial. Affective attitude showed the largest decline over time.
Anzeneder et al. 2023[29]	Experimental study of within-subject crossover design	10-13 years old children (N=104)	Experimental protocol includes weekly exergaming sessions for four weeks as the duration of an acute, cognitively challenging,	A cognitively challenging exergame, Sphery Racer, which requires jumps, squats or punches while being immersed in a rapid race game scenario.	The 15-minute bout of physical exercise benefited children's overall information processing speed the most, whereas the efficiency of executive control and other

			exergame-based physical exercise was manipulated to be 5, 10, 15, or 20 minutes.		attention networks (alerting and orienting) was unaffected by the duration of the bout. More active children seem better able to capitalize on an optimal (15 min) acute exercise duration for maintaining executive control efficiency also under more complex spatial attention conditions.
Chen et al. 2023[30]	Systematic review and meta-analysis of 11 experimental studies	4-12 years old children, healthy or special children with ASD, ADHD (N=508)	Interventions: Interventions with varying frequencies (once to five times in a week) and durations (minimum once, lasting 12 weeks at max) for sessions of 15 to 60 minutes (N=254). Controls: No intervention, conventional exercises, or others (e.g. medication) (N=254).	Exergames or active video games, using Microsoft Kinect, or Nintendo Wii exergaming console.	Improvements in executive functioning among healthy and special children. Sessions lasting for 20-30 minutes at minimum, frequency of at least twice weekly, interventions lasting over 6 weeks seem necessary for cognitive improvements. Efficacy of exergaming appears more consistent for children with ASD or ADHD comparing to healthy children.
Anzeneder et al. 2023[31]	Experimental study of within subject design	10-13 years old children (N=103)	Experimental protocol includes weekly exergaming sessions for three weeks as the cognitive challenge of an acute bout of exergaming was manipulated to be low, mid, or high; each level individually adapted according to the ongoing performance	A cognitively challenging exergame, Sphery Racer, which requires jumps, squats or punches while being immersed in a rapid race game scenario.	The cognitively high-challenging bout benefited children's executive control the most, whereas the efficiency of alerting and orienting networks was unaffected by the cognitive challenge level. In males only, the benefit for executive control seemed to be due to a transiently increased ability to maintain executive control efficiency also when spatial attentional resources could not be allocated in advance to support conflict resolution.
Best 2012[32]	Experimental study of within subject design	6-10 years old children (N=33)	Children participated in four separate experimental sessions, each lasting approximately 1 hour long.	Children completed four scenarios with varying levels of cognitive engagement and physical activity: low cognitive engagement and love physical activity (video), high cognitive engagement and low physical activity (sedentary video game), low cognitive engagement and high physical activity (exergame), high cognitive engagement and high physical activity (exergame).	Only physical activity component of the exergames, not cognitive engagement or not the combination of physical activity and cognitive engagement, leads to improved executive functioning
Verhoeven et al. 2015[33]	Experimental study of within subject design	12-16 years old children (N=43)	Children participated in six different exergames in which player mode was manipulated: single-player mode and multi-player mode competitively (12 play sessions in total).	Dancing, boxing, bowling, tennis, golf, and baseball games with Xbox Kinect console.	Children consumed more energy in a two-player mode than in single-player mode when playing boxing, tennis, and dancing, this was not the case for baseball, golf, and bowling. No differences in game enjoyment were found between single-play and duo-play.

					No relationship occurred between energy expenditure and game enjoyment
Nekar et al. 2023[34]	Randomized-controlled trial	6-16 years old children (N=36)	8 week of exergaming intervention with two sessions of 30 minutes per week. The cooperative exergame group (N=12) The competitive exergame group (N=12) The solitary exergame group (N=12)	The UINHEALTH, a commercially available exergame system, was used. Cooperative exergame group: A farm protection game and a table tennis game played cooperatively. Competitive exergame group: A basketball ball shooting game and balloons boxing game. Solitary exergame group: A car race game with obstacles to avoid and a soccer striker game.	Memory, attention, and visual perception improved in all groups regardless of the type of the exergame, language was only improved in the cooperative exergame group. The cooperative exergames had positive effects on all anxiety subscales including panic attack and agoraphobia, separation anxiety, physical injury fears, social phobia, obsessive-compulsive and general anxiety disorder.
Xiong et al. 2019[35]	Randomized pilot trial	4-5 years old preschool children in childcare center (N=60)	Exergaming intervention: School-based exergaming sessions provided in 20-minutes recess during weekdays, 5 days of the week for 8 weeks (N=30). Traditional physical activity condition (N=30)	Four exergaming stations consisting Nintendo Wii consoles with a number of games such as Nickelodeon Fit, Just Dance for Kids, Wii Sports.	Preschool children in both the exergaming intervention and traditional PA groups had improved executive functions and perceived social acceptance over the course of eight weeks
Gao et al. 2019[36]	Randomized controlled	4-6 years old preschool children	Exergaming intervention: Home-based educational exergaming for at least 30 minutes of play each session 5 times/week for 12 weeks (N=18) Control group: Maintaining regular physical activity pattern (N=14)	Different exergames on the LeapTV console.	Participation in a home-based exergaming program has the potential to improve preschool children's cognitive flexibility.
Gashaj et al. 2021[37]	Longitudinal observational study	T1: kindergarten children with a mean age of 6.47 T2: second grade children with a mean age of 8.02	Questionnaires were used to obtain information about the type, frequency, and duration of play behaviour.		Playing exergames may contribute to executive function development among preschool children.
Yamamoto et al. 2023[38]	Cohort study	9-13 years old children with fetal alcohol spectrum disorder (FASD) and ADHD (N=8)	6-week supervised, personalized exergaming program including two training sessions per week for 50 minutes, using individualized exercise intensity prescription according to baseline cardiovascular assessment.	Obie, a multimodal platform providing hundreds of games with the ability to run, jump, and move their extremities freely, allowing children to be engaged in a vast array of physical exercises.	All 12 sessions were completed with %100 compliance among the participants, leading to increased aerobic capacity. Exergaming intervention is feasible and safe in improving cardiovascular fitness in children with FASD and ADHD.
Anderson et al. 2011[39]	Experimental study of within subject design	10-18 years old young individuals with autism (N=22)	Control sessions: 20 minutes of watching video	Dance dance revolution in pilot I. Cybercycling interconnected with a video-game called Dragon Chase in pilot II.	Exergaming may be useful for the management of behavioral disturbance and for

			Exergaming in Pilot I and II: 20 minutes of acute exergaming bouts		increasing cognitive control in children with autism.
Hou et al. 2024[40]	Network meta-analysis	3-18 years old children and adolescents with autism spectrum disorder (N=427)	Interventions with varying frequencies (twice to five times in a week) and durations (lasting 2 to 12 weeks) for sessions of 35 to 70 minutes.		Physical activity with exergaming improves executive functioning in children with autism, consistently in the dimensions of inhibitory control and cognitive flexibility.
Lee & Jin 2023[41]	Experimental study	7-12 years of children diagnosed with developmental disability including intellectual disability, autism spectrum disorder, or Down syndrome (N=23)	Experimental group: VR-based physical activity in 40 minutes of sessions, twice a week, 24 sessions in total (N=12). Control group: No intervention (N=11)	VZFit platform with 11 different games of VR-based cycling with a stationary bike	Intervention program yielded positive and significant changes on scaled locomotor scores and gross motor index scores. VR-based cycling exergame have a potential to increase physical activity in children with a developmental disability.