International Journal of Scientific and Technological Research www.iiste.org
ISSN 2422-8702 (Online), **DOI:** 10.7176/JSTR/6-06-11
Special Issue of Educational Sciences, Vol.6, No.6, 2020

Can Exergames Use As an Educational Tool in Physical Education for Cognitive, Social, and Affective Domains?

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Abstract
The rapid growth of children's interest in the digital world leads educators to use this interest to meet learning outcomes. In this respect, the use of computer-based simulations and video games as educational tools is a necessity rather than an innovative method for educators. In recent years, school-based physical activity (PA) programs based on active video games/exergames (EG) have begun to be implemented. The aim of this review was to investigate the effects of EG as an educational tool in physical education (PE) lessons in terms of children's social, affective, and cognitive domains. The literature obtained by researching in Pubmed, Uludağ E-Library and Google Academic databases without date limitation was examined with systematic review methodology. In conclusion, EG creates the potential to have a positive impact on social, cognitive and affective domain skills such as PA perception, collaboration, leadership, self-management, motor learning, memory, awareness and peer learning. Even if EG alone does not replace a teacher or a lesson, it can enrich the learning environment in PE. EG can be not only an important source of motivation for active participation in PE lessons for children but also an effective educational tool for the teacher.

Keywords: Active Video Games, Exergames, Physical Education

Special Issue of Educational Sciences

DOI: 10.7176/JSTR/6-06-11

1. Introduction

According to the World Health Organization (WHO), health is defined as: `` Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity ". When considered in this respect, PE is an important health related area. Because it is an educational process that aims to improve the social, affective and cognitive fields of the person as well as physical development through body movements. PE creates an enriching learning environment. This learning environment includes taking different roles, recognizing strengths and weaknesses, feeling of justice, competition, leadership and respect, developing strategy and tactics, following rules and guidelines, memory, motivation, attention, analytical thinking and motor learning (Bailey et al., 2009). Thus, the educational environment of PE makes a very important contribution to the preparation process of children for life (Bailey et al., 2005; Lu & Buchanan, 2014).

The PE teacher does not just want the children to follow the instructions physically. At the same time, teachers should create different environments to activate cognitive domain. In order to influence the cognitive domain, the teacher should engage in a wide variety of activities that develop problem solving, strategy and creativity mechanisms. For social purposes, students can improve themselves in many fields such as cooperation, responsibility, leadership, peer communication. PE activities also contribute to the

affective field by enabling the person to experience processes such as self-control, self-discovery, entertainment and motivation (Dyson & Grineski, 2001; Tunçel, 2006). In this context, games play a very important role in supporting children's developmental areas. But the sedentary behavior has increased as traditional games and street games are not as popular among children as before (Tuğrul, et al., 2014). At the same time, the fatiguing and boring perception of the PA and the dramatic increase in screen addiction are gradually reducing children's interest in PE (Knowles et al., 2011; Whitehead and Biddle, 2008; Slater and Tiggemann, 2010). This situation also makes difficult for PE teachers to encourage their students to move. Some studies reveal that sedentary life not only leads to an increased risk of developing cardiovascular and metabolic diseases, but may also be associated with conditions such as depression, suicidal ideation, low self-esteem, bullying, anxiety, and low self-perception (Carpenter, 2000; Reulbach, 2013; Selewski et al., 2013; Vuuren et al., 2019). For this reason, the goal of making students acquire regular PA habits in PE at children and adolescents has gained great meaning today as a preventive health intervention.To overcome these challenges, teachers need to develop teaching methods using student-centered, interesting and fun teaching materials. While PE teachers encourage students to be an active, they have started to include technological devices that attract intense attention of students in their lessons.

One of these electronic devices, Exergames, are systems in which players perform various body movements in accordance with the instructions on the screen and that these movements are perceived by the device to control the game. EG are video games that contain physical exercise (Staiano & Calvert, 2011) and are very popular among children (O'Loughlin et al., 2012), including children who are overweight or who report being excluded from competitive team sports (Biddiss & Irwin, 2010; Staiano et al., 2019). During EG, children can consume a significant amount of energy by having PA while having fun (Lamboglia et al., 2013). Thus, children's PA levels may increase. Many studies demonstrate that EG have the potential to spend energy equal to children with moderate to high intensity PA (Gao & Chen, 2014; Gao et al., 2015). In addition, it is thought that the use of EG may be beneficial for the students who are reluctant to participate in the PA and have lower skill level to be included in the PE processes (Ennis, 2013; Çoknaz et al., 2019; Staiano et al., 2013).

Besides physical benefits, EG has options that allow socialization, increase motivation, provide feedback, active learning, transfer knowledge and skills. Having various difficulty levels suitable for everyone has made it technological equipment compatible with the educational process (Oblinger, 2004). According to Winn (2002), considering today's digital world, the use of such games in education is not only an alternative for educators, but also a requirement for ensuring student motivation. Indeed, considering the new generations born in a technological world, the teachers' inadequacy in technology and being unable to adapt these contents to their own area may result in the problem of not meeting student needs. Since positive emotions and feelings have an impact on learning, the teacher needs to increase student motivation by turning interest in technology into an advantage. Self-efficacy perception and entertainment are also important sources of motivation for participation in PA (McNeille, 2019). PE efficiency will increase when the teacher avoids repetitive activities and creates activities where children can experience the feeling of success and fun. When considered from this point of view, it is thought that it may be important to use EG as a teaching material for PE teachers.

Although technologies such as EG are loved by the students, it is thought that they cannot replace the whole PE (Sheehan & Katz, 2010; Sun, 2012) and student interest can be lost by repeating it too much (Sun, 2013). PE teachers should pay attention to the types of games, the playing time per student, the electronic infrastructure of the school and environmental safety while using EG.

The aim of this review was to investigate the effects of EG as an educational tool in physical education lessons in terms of children's social, affective, and cognitive domains.

2. Method

This systematic review, which was made especially to determine the effectiveness of EG used during PE, consists of two separate sections. In this systematic review, "What are the effects of EG included in PE in terms of social, cognitive and affective domains on children?" started with the question. Systematic review method was used in the present study. This method is frequently used in terms of revealing important relationships in the literature, offering recommendations for further studies and being a resource (Nacakcı et al., 2017). Review was prepared under the guidance of Center for Reviews and Dissemination (CRD) 2009, developed by the University of York National Institute for Health Research. Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA) was used as a methodology in electronic database research (Moher et al., 2009).

A literature review was conducted between February and March 2020 in the Pubmed, Uludağ University E-library, Google Scholar databases without any restrictions in terms of years. During the search, 5 keywords were used in 3 English and 2 Turkish. "aktif video oyunları", "aktif video oyunları ve beden eğitimi", "active video games", "exergames", "exergames and physical education" are the keywords used in the screening. The number of articles accessed from all databases within the scope of scanning is 3556. Apart from electronic scanning, articles obtained from the sources of related articles were also investigated. 135 studies were reached when repeated, written in other languages, reviews, irrelevant and non-full text were excluded. As a result of the articles evaluated for suitability, the number of articles examined within the scope of the study was 29 (Figure 1).

Inclusion criteria

i. focus on educational outcomes of exergames,
ii. usage of commercially home-based video games consoles,
iii. publications limited in English and Turkish language,
iv. the experimental intervention group is school-age children,
v. the type of game suitable for school use.

Exclusion criteria

i. studies on technological aspect of the video game such as software development and hardware specifications,
ii. physiological, sensorimotor functioning and skill training outcomes,
iii. reviews.

The methodological approaches and sample size in the studies were not considered.

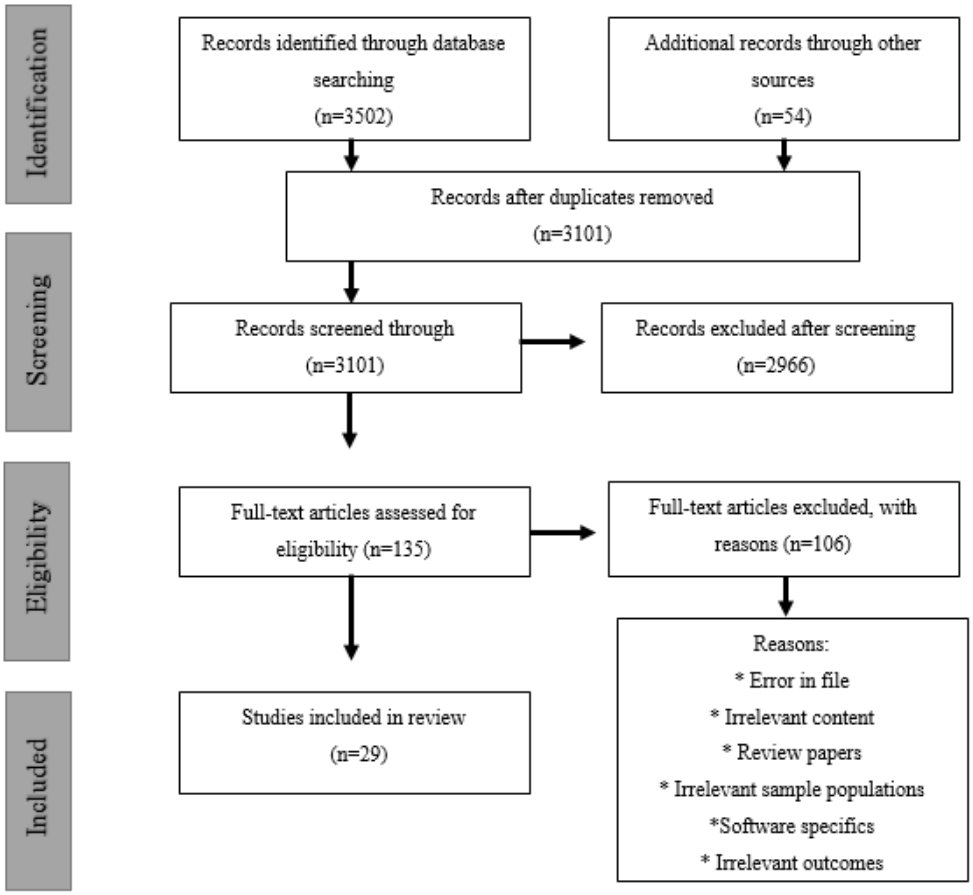

Figure 1. PRISMA flow chart

3. Results

Table 1. *Exergames studies*

Author/year/country	Purpose	Study design/ intervention/population	Instruments/Tools	Conclusion
Cebolla i Marti et al., (8), 2015, Spain	To compare the effort, self-efficacy, positive expectations and satisfaction of normal and obese children in an EG platform.	Wii-Fit running exercise n= 42, 9-14 aged	satisfaction, self-efficacy, expectation surveys	*Increase in expectations, satisfaction *No changes self-efficacy
Chen & Sun, (10), 2017a, USA	Effect of EG on perceived children's enjoyment and moderate PA levels	Pre-post-test Just Dance Kids, Zumba Kids 6 w/17 sessions/40m n=35,9-11 aged	PACES	*No changes of EG feedback
Chen & Sun, (11), 2017b, USA	Effects of EG intervention on health status and PA enjoyment of children	Pre-post-test Just Dance Kids, Zumba Kids 6w/3d/40m n=65, 8-11 aged	PACES	*Increase at enjoyment
Çoknaz et al., (12), 2019, Turkey	evaluate whether parameters as physical fitness, reaction times, self-perception and enjoyment levels, as well as parental and children perspectives, were affected by active video games in inactive and technologically preoccupied children.	RCT Nintendo Wii 12w/3d/50-60m N=106, 8-11 aged	Children and Youth Physical Self Perception Profile (CY-PSPP) Short form of physical activity enjoyment scale (PACES-SF) Semi-structured questions	*Increase in (CY-PSPP) *No changes in (PACES-SF)
Di Palma et al., (15), 2019, Italy	Pedagogical benefits in terms of education level and motivation in students who have EG and traditional PE.	Pre-post-test DDR- Your Shape Fitness Evolved- EA Sports Active 2 Just Dance 12w/2d/60m n=22, 13-15 aged	Educational development: 3-level structured evaluation protocol (their elaboration)	*No student did two levels of success. *increase educational development. *It was stated that the combined trainings (PE + EG) would be efficient. * EG is a positive tool for motivation.
Finco et al., (19), 2015, Brasil	To establish an EG laboratory focusing on children and adolescents who show signs of dissatisfaction with PE and to show that EG may be an alternative option for PE.	Xbox Kinect(sports-adventures) 12w/1d No time specified n=24, 8-14 aged	Qualitative Observation Approach	* It was determined that the reluctant students in participation in the PE have positive changes and cooperated with their peers.
Gao et al., (27), 2016, USA	The effect of EG on classroom homework behavior, academic performance and physical condition of disadvantaged children.	Pre-post-test Wii sports, Xbox Just Dance 6w/50m n=95, 9-11 aged	Academic Effort: Likert scale Homework behaviors: Observation	*development in academic effort *positive change in homework behavior

(continued)

Table 1. *Continued*

Author/year/country	Purpose	Study design/ intervention/population	Instruments/Tools	Conclusion
Gao et al.,[29] 2019, USA	Impact of EG on students' EE during the school day and to investigate PA related self-efficacy, social support, outcome expectancy	RCT, Just Dance, Wii Fit, Gold's Gym Cardio Workout, ve Kinect Sports 36w/1d/50m n=81, Grade 4 students	self-efficacy, outcome expectancy, social support (psychometrically-validated tests)	*increase social support *no change self-efficacy *decrease outcome expectancy
Hammond et al.,[34] 2014, UK	Effect of short term EG use on both motor and psychosocial areas in children with developmental coordination disorders	Crossover, Wii Fit, 4w/3d/10m n=18,7-10 aged	Bruininks-Oseretsky (2. Short Version) The Coordination Skills Questionnaire	*no changes perceived motor ability *increase motor proficiency
Hansen & Sanders[21] 2010, USA	Effect of 5th grade students participating in 8 weeks EG in PE	Qualitative Phenomenological case study DDR, Game Bike, Dogfight Flight Simulators, Game Cycle, Gamercize Steppers, XrBoards, Wii Sports, Xavix sports, 3-kick 8w/2d/30m, n=6	Interview, observational note, logging	*EG can be used to increase children's PAs in 21st Century' PE.
Kociman & Sheehan[42] 2014, USA	Comparison of online EG and EG. Evaluate in terms of the online PE curriculum.	Pre-post-test, Xbox Live, Microsoft Kinect Sports, 20m with CPU, 20m with online human, n=124, 6-12 aged	The Bender Visual-Motor Gestalt Test, Second Edition (BVMGT- 2)	*(+) results in terms of cognitive skills *Adding EG to the curriculum can be effective.
Kociman & Sheehan[43] 2015, USA	Effect of online EG on online curriculum PE in terms of social interaction needs	Pre-post-test, Xbox Live, Microsoft Kinect Sports, 20m with CPU, 20m with online human, n=124, 11-18 aged	Intrinsic Motivation Inventory (IMI)	*EG intervention against the online opponent has had a positive effect on students in terms of social experience.
Lee et al.,[45] 2017	Effects of acute EG on children's mood change	EG station (12 games) 2y/2-3d/w/30m + 2d/w PE n=134,8-11 aged	Brunel Mood Scale (BRUMS)	*The 30-minute EG session has a positive acute effect on children's mood.
Lindberg et al.,[47] 2016, South Korea	Effect of wearable technology EG on learning, exercise and motivation in PE	Running Otello 2 15m acute session n=61, 10 aged	Learning: survey and interview Motivation: Observation	*positive effects on learning * increase in motivation and attendance

(continued)

Table 1. *Continued*

Author/year/country	Purpose	Study design/ intervention/population	Instruments/Tools	Conclusion
Lwin & Malik [50] 2012, Singapore	Efficacy of incorporating exergaming into PE among children and pre-adolescents in influencing the social cognitive factors and behaviors of PA based on the theory of planned behavior	RCT, Nintendo Wii: DDR, Wii Sports 6w/45m per session, n=112, 9-13 aged Intention, perceived behavioral control, subjective norm and attitude 5 point scale	Godin-Shephard Leisure-Time Physical Activity Questionnaire (GSLTPAQ)	*Incorporating EG into PE lessons can be more effective than regular PE in enhancing PA beliefs and behaviors, particularly among younger children.
Nyberg & Meckbach[68] 2017, Sweeden	investigate the awareness of movement for the student who play EG (dance games).	Video observation method., Nintendo Wii Total 60m video record, n=20, 7-16 aged	Video observation as a data collection	*Using EG as a pedagogical tool in PE can teach students how to move.
Quennersted[69] 2015, USA	Educational aspect of EG integrated into PE	Text analysis, Wii Sports, Wii Fit 10w/d/90m, n=25, Unspecified aged	Text analysis	*EG is more effective in creating social opportunities than competing
Paw et al.,[66] 2008, Holland	Effects of EG on children's motivation	Pre-post-test, Wii Fit, 12w n=16, 9-12 aged	Perceived Compentence Scale Motivation:Interview	*EG can increase children's motivation.
Perlman et al.,[67] 2012, Australia	Educational opportunities provided by EGs in PE	Qualitative research, Nintendo Wii 14w/d/45m per session	Observation and logging	*Increase sports-specific skills *Increase fine motor skills *Positive impact on decision-making
Pope et al.,[65] 2015, USA	Effects of an EG program on children's Transtheoretical method-based PA correlates and PA levels.	Pre-post-test, DDR, 18w/d/30m n=212, 11 aged	Decisional Balance Scale Physical Activity Confidence Scale	*Increase decisional balance and PA confidence
Rhodes et al.,[72] 2018, Canada	Effect of EG on motivational change	RCT, Hoggan Health n=73, 10-14 aged	Regulation in Exercise Questionnaire 2 (BREQ-2)	*Higher perceived behavior control *Increase intrinsic motivation
Robertson et al.,[73] 2016, Scotland	How and why FitQuest (EG) can change children's PA perceptions and self-efficacy in the school environment	RCT, FitQuest Application, 5w/d/60m 10-12 aged	Self-efficacy, Enjoying the game, interest, (Interview, observation)	*use of EG in schools will be effective in the future.
Shewmake & Calleja[77] 2015, USA	Perceived enjoyment and exercise levels of children for EG regarding PE	Pre-post-test, Microsoft Kinect Sports 30m EG + 30m PE, n=148	Survey: 10 questions 1-5 degrees likert first 7 questions perceived level of enjoymnet, last 3 questions perceived exertion	* EG had more fun than PE * PE was perceived more exertion than EG

(continued)

Table 1. *Continued*

Author/year/country	Purpose	Study design/ intervention/population	Instruments/Tools	Conclusion
Staiano et al.,[82] 2013, USA	Obese African American adolescents' weight loss and psychosocial consequences of EG intervention	RCT , Nintendo Wii Active 20w/5d/30-60m, n=54, 15-19 aged	Exercise Confidence Survey Rosenberg Self-Esteem Scale Friendship Quality Questionnaire	*Increase in self-efficacy levels of cooperative EG players *Increase peer support.
Sun[85] 2012, USA	Effects of EG on primary school-age children' PA intensity levels and perceived situational interest in PE	Pre-post-test, Gamebikes, Xavic boxing, DDR, 3-kick, XrBoards, 8w/2d/30m PE+EG, n=74, 9-12 aged	15-item Situational Interest Scalee Elementary School	*Students are more active in PE than EG. Although EG is interesting for children's PAs, it is not sufficient.
Sun[86] 2013, USA	Effects of EG on primary school-age children' PA intensity levels and perceived situational interest in PE	Follow-up, Gamebikes, Xavic boxing, DDR, 3-kick, XrBoards, 54w/2d//30m PE+EG, n=70, 9-12 aged	15-item Situational Interest Scalee Elementary School	*More active PA with EG+PE session *It is not seen as a permanent resource for children's motivation to PA.
Sun & Gao[87] 2016, USA	Effectiveness of EG on primary school students' scientific knowledge, PA and interest-based motivations	Pre-post-test, Gamercize GZ Pro-Sport 2w/2d, n=53	Standardized knowledge test 15-item Situational Interest Scalee Elementary School	*increase in scientific knowledge both groups * EG group are higher in perceived situational interests
Vaghetti et al.,[84] 2012, Brasil	Use of online EG as an opportunity for PE education with flow theory in cyberspace	Post-test, Xbox 360, Kinect Sports Games, n=25, 15m No detailed information was given	Long Flow State Scale Questionnaire (FSS-2)	*no changes on flow state *Students had fun and included social activities such as sharing their photos, skills and scores.
Wagener et al.,[84] 2012, USA	Impact of dance-based exergaming on a diverse sample of obese adolescents' perceived competence to exercise, psychological adjustment	Pre-post-test, 10w/3d/40-75m n=40, 12-18 aged	The Behavior Assessment System for Children-2 (BASC-2) The Behavior Assessment System for Children-2 (BASC-2) Self-Report Scales (SRP-A)	*Increase in dance-based EG group in terms of psychological adjustment and ability to maintain regular exercise.

Abbreviations: PE: Physical Education, DDR: Dance Dance Revolution, w: week, d: day, m: minute, EG: Exergames, EE: Energy Expenditure, PA: Physical Activity, PACES: Physical Activity Enjoyment Scale, RCT: Randomized Controlled Trial

In this section, the effect of EG on the social, cognitive and affective domains of children will be examined with the studies in the literature. Because learning domains are interrelated and can be included in PE learning objectives (Figure 2).

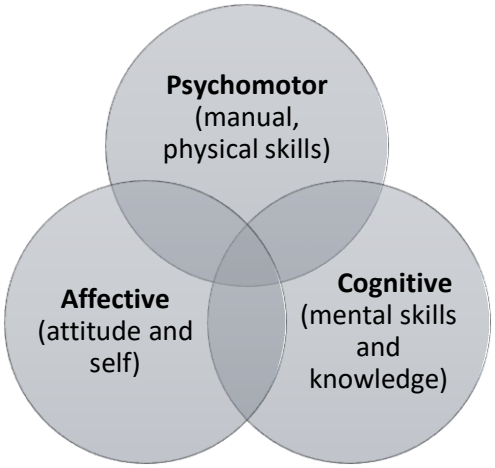

Figure 2. Learning Domains (McKenzie et al., 2017)

3.1. The effects of exergames on social domain. EG and other video games are often played with peers, due to this they can provide opportunities for social interaction. EG interaction can have a positive effect on friend choice, friendship, self-esteem, mood and motivation. Thus, it can reduce the risk of social isolation and loneliness (Coknaz et al., 2019; Di Palma et al., 2019; Mueller et al., 2003; Staiano & Calvert, 2011). According to the study of Lieberman (2006), children stated that fun is the main reason for playing dance-based EG. In addition, social interaction, dancing, enjoying the difficulties of the game and admiring their own skills are other reasons for preference. In particular, with an interactive multimedia curriculum; positive development can be observed in psychosocial outcomes such as self-efficacy, social support and the PA attitude. Therefore, children are more likely to increase their PA levels in the future (Gao & Chen, 2014; Goran & Reynolds, 2005). Today, children are reluctant to games which adults are authoritarian and can rule. On the contrary, they prefer collaborative games with the rule-setter themselves or their peers. Considering this point of view, EG is an important assistant in terms of peer counseling (Kooiman & Sheehan, 2015).

According to Lee et al. (2017), the multi-mode feature of EG can enable players to enjoy competition and cooperation. Finco et al. (2015) observed that students who are not motivated to participate in PE have changed their attitudes after the EG added to the lessons. It is stated that they show this motivation of participation in cooperation with their peers. Similarly, Paw et al. (2008) demonstrated that the cooperative multiplayer mode EG has the potential to increases the time spent with PA. Staiano et al. (2011) and Epstein et al. (2007) showed that self-confidence and willingness to participate in PA have increased due to the social interaction provided by EG in obese children. Vaghetti et al. (2012) revealed that children playing EG in online classes can share photos, icons, files, motion experiences and abilities with other players on the network. They thought that interactions with EG from many different cultures and geographies can enrich the learning environment. According to Hansen and Sanders (2010), students can socialize positively during EG by staying in constant peer relationships. They also observed that the students discussed the strategies and instructions about the game, made competitive speeches, participated in the group or included their peers.

3.2. The effects of exergames on cognitive domains. Cognition defines inner mental process activities such as remembering, understanding, applying, analyzing, evaluating and creating (Figure 3). Cognitive development refers to the child's thinking about the objects they see, hear, touch and taste. That is why it is very important for children to obtain, store, interpret, evaluate and transform their own knowledge. PE provides children with a chance to experience their knowledge through physical exercises. It is important that the physical exercises in the lesson are rich in cognitive stimuli. Physical exercise, which creates a cognitively rich environment, is more beneficial in terms of cognitive development than simple physical exercise (Best, 2010). From this point of view, EG develops spatial orientation, attention, memory, and executive function skills by providing aerobic activity. EG can also improve children's ability to respond to

visual stimulus, decision-making, understand spatial constraints, create a cognitive map of body movements and problem-solving (De Lisi & Wolford, 2002; Höysniemi, 2006; Ko, 2002; Staiano et al., 2012). It is seen that using EG-style games in disciplines such as mathematics, science, language and computer science shows positive outputs in relation to curriculum activities in terms of student motivation and learning effectiveness (Hwang et al., 2013; Papastergiou, 2009; Rosas et al., 2003).
A limited number of studies show that EG can improve academic performance and skills in the game can be transferred to other cognitive activities. For example, Weir (2008) showed that math teacher helps children learn to count by wii bowling game. Similarly, Kooiman and Sheehan (2014) revealed that the use of EG may have a positive effect on cognitive functions.

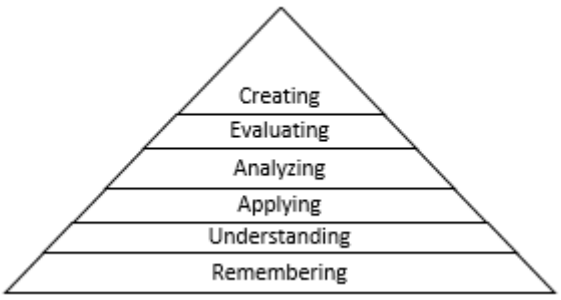

Figure 3. Cognitive domain chart, Revised Taxonomy (Hoque, 2016)

3.3. The effects of exergames on affective domains. Most people think of learning as an intellectual or cognitive functions. However, learning is not a just a mental function. You can also learn attitudes, behaviors, and physical skills. The affective domain involves our feelings, emotions and attitudes (Casey & Fernandez-Rio, 2019; Hoque, 2016). Frequently more difficult is the development and assessment of affective-domain objectives (Figure 4). It is known that factors such as the diversity of the curriculum they are exposed to, the gender, past PA experiences and general motor ability are affected by children's views on PE (Finn & McInnis, 2014). At the same time, it is seen that the ridicule and criticism made by their peers and teachers are important obstacles to the positive PA perceptions of children (O'Dea, 2003). So educators may rely on peer-mediated and sportsmanship-related objectives in this area. Affective learning domain also may be easily targeted through non-traditional activities, specifically through the use of challenge course-like innovative activities in the PE (McKenzie et al., 2017). So, can EG provide this innovative situation?
In most studies, it was revealed that PE, in which EG were added, was perceived as more fun and exciting for students (Finco et al., 2015; Graves et al., 2010; Robertson et al., 2016; Shewmake et al., 2015; Thembelihle, 2017). Coknaz et al. (2019) reported that inactive and tech-savvy children had positive emotions such as fun, happiness, excitement, energetics and being active after 12 weeks of EG intervention. EG can improve psychological well-being, including exercise self-efficacy, motivation, enjoyment, and mood in overweight children (Baranowski et al., 2008; Gao et al., 2013; Staiano & Calvert, 2011). EG can contribute to self-confidence during PA by enabling students to take their eyes from their peers and direct their attention to the screen during the movement (O'Dea, 2003). According to Sun & Gao (2016) and Watson et al., 2013; EG can be used as an educational tool that makes the curriculum interesting, creating a fun learning environment and attracting student motivation to physical activities. Lee et al. (2017) found a decrease in anger and depression levels in children after 18 weeks of EG intervention in PE. According to Hayes and Silberman (2007), the fact that the games provide unlimited repetition causes them to exhibit less anxiety. In addition, traditional sports have restrictions such as gender differences, different skill levels and safety issues. But with EG, games can be chosen that best meet the talents and fun of children. This can increase children's sport knowledge, perceived abilities, motivation and enjoyment (Wagener et al., 2012). The studies of Danielle et al., (2014) and Sun (2012), reported that approximately 80-90% of children between the ages of 7-11 prefer PE which integrated EG. While the students who play the game for the first time are more willing to play, but if the game variety is not provided in the future, a decrease in active participation may occur in the PE (Sun, 2013; Gao, 2013; Rhodes et al., 2018).
Unlike these, Vallabhajosula et al. (2016) reported that EG added to PE does not change the perceived fatigue and enjoyment level of students. Coknaz et al. (2019) reported that during EG, few children had negative emotions because of finding the games boring and difficult. And also some children felt depressed and jealous when they lost the game.

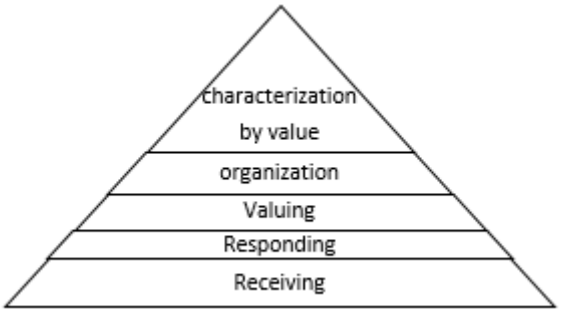

Figure 4. Affective domain chart (Hoque, 2016)

4. Discussion

The aim of this review was to investigate the effects of EG as an educational tool in physical education (PE) lessons in terms of children's social, affective, and cognitive domains. In this section, the Republic of Turkey Ministry of National Education's (MNE) educational purposes determined by the scope of PE will be examined. Afterwards, the potential of EG in meeting these objectives will be evaluated. Because in order to use EG as an educational tool, we think that EG should meet the expectations of the country's PE lesson. It is considered that EG can be useful in achieving the general objectives of the Ministry of National Education. Below, it is seen that the objectives planned to be gained in PE lessons match the EG study results in the literature;

* to participate in physical activities and sports regularly to improve health (Gao & Chen, 2014; Gao et al., 2015; Goran & Reynolds, 2005; Staiano & Calvert, 2011),

* acknowledging the existence of others and always behaving honestly and respectfully in their "fair play" behavior and making it a habit (Quennerstedt et al., 2016),

* improving communication skills, collaboration, fair play, social responsibility, leadership, nature awareness and respect for differences (Finco et al., 2015; Lee et al., 2017; Mueller et al., 2003; Staiano & Calvert, 2011; Paw et al., 2008),

* developing self-management skills (Baranowski et al., 2008; Watson et al., 2013),

* developing movement knowledge and skills by participating in physical activities and making these skills a habit (Robertson et al., 2016; Rudella & Butz, 2015; Shewmake et al., 2015; Thembelihle, 2017).

In conclusion; EG, has positive effects on social, cognitive and affective domains such as friendship, cooperation, peer support, self-esteem, leadership, loneliness, depression, anger, motivation, creating, problem-solving, memory, sports knowledge, physical exercise perception and motor learning. The use of EG can create motivation to participate in exercise, especially in overweight, obese and unwilling children to participate in PE. It has been observed that children perceive EG as fun and exciting. EG can be an important educational technology support for PE. Even if EG alone does not replace a teacher or a lesson, it can enrich the learning environment in PE. EG can be not only an important source of motivation for active participation in PE lessons for children, but also an effective educational tool for the teacher.

The use of EG can provide effective results in PE, especially in cold weather and adverse environmental conditions, in the design of interdisciplinary lessons, in encouraging individuals to participate in PA, in courses where collaborative learning and self-evaluation are central. Despite all these potential benefits, the increase in randomized controlled experimental studies designed with long-term interventions with large sample groups may provide detailed information about the educational effectiveness of EG. At the same time, studies evaluating the relationship between game types and learning outcomes can be important for the future of the literature.

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