

Chapter 12

A Theoretical-Practical Framework for the Educational Uses of Pokémon GO in Children and Adolescents



Alberto Ruiz-Ariza, Sebastián López-Serrano, Manuel J. De la Torre-Cruz
and Emilio J. Martínez-López

Abstract The game, in its many facets, plays a key role in all stages of life, and especially in physical, social, emotional and intellectual development. Pokémon GO has managed to convert the environment that surrounds us into a space used by a video game, thanks to its combination of physical activity and augmented reality. But what does Pokémon GO involve within the educational system? In this chapter, we will address its impact on those players that were within the educational framework, as well as some practical proposals for its adaptation and use as a didactical tool.

12.1 Introduction

Nowadays, we live in a society in constant change and continued evolution, which requires us to use all our creative resources to transform and adapt the school of the 21st century to current needs. The current scientific literature reiterates the importance of including in the educational system a teaching methodology related to our society, which includes the use of technologies of information and communication (TIC), since the advantages offered are more attractive than those employed in a more traditional methodology (Sánchez et al. 2014). In addition, we must consider that children and adolescents of today are digital natives, that is, those generations of students who were born immersed in the digital language, such as smartphones, computers, or video games (Prensky 2011). Fortunately, in recent years, there has been a great change in the concept of innovation and its relevance in the field of education. In fact, educational innovation has broadened its perspective beyond the physical architecture of the spaces in which the teaching and learning process takes place, and reinforces the idea of creating new learning environments where pedagogical and psychosocial aspects are included (Davies et al. 2013). In this sense, and considering that educational innovation is subject to a permanent evolution, most researchers in the field agree that to create successful learning environments, teachers should take

A. Ruiz-Ariza (✉) · S. López-Serrano · M. J. De la Torre-Cruz · E. J. Martínez-López
Group HUM-943: Physical Activity Applied to Education and Health,
Faculty of Humanities and Educational Sciences, University of Jaen, Jaen, Spain
e-mail: arariza@ujaen.es

a step forward, leaving their comfort zones to the side and challenging themselves to generate innovation in the classroom. For this, the support of the administrations is very important, but, above all, we highlight the willingness on the part of the teachers to explore and experiment with these new teaching and learning spaces. In addition to this, recent research has indicated that a better development of students' abilities is, to a certain extent, related to these new learning environments, which support and improve the personal, social and academic achievements in young students (Davies et al. 2013).

This evolution in teacher praxis, along with new methodologies that can be developed within the educational system, guarantee the development of key skills through playful environments. For many years, the game has been considered as an element contrary to the teaching-learning process and separate from the dynamics that occurred within the classroom. In this sense, videogames have been labelled as distracting and harmful elements for users, when, in fact, their content has not been analysed, and consequently, certain benefits associated with them have been ignored, such as the development of problem-solving skills, logical thinking and decision making, among others. We should not forget that the school-age game is fundamental to making friends, overcoming fears, solving problems and, in general, taking charge of your life. They also use the game to practice and acquire the physical and intellectual skills that are fundamental to success in their society. What boys and girls learn of their own initiative, playing freely, cannot be taught in other ways.

Nowadays, we can emphasize some methodologies and tools that, when included in the educational frame, can produce a beneficial effect for the development of the process of education-learning. This is the case of Gamification: application of elements of a game in non-playful contexts (Deterding et al. 2011); Augmented Reality (AR): combination of physical and virtual worlds into one interface, replacing stationary play with active play by requiring users to explore their physical surroundings (Serino et al. 2016); or *Flipped Classroom*: to transfer part of the process of education and learning out of the classroom in order to use the classtime for the development of cognitive processes of major complexity (Bergmann and Sams 2012). This also includes *Learning Based on Projects*: utilization of realistic projects, based on a task or problem related directly to the context of the pupils, who develop competitions in a collaborative approach in search of solutions (Bell 2010); as well as the increasing trend of Escape Rooms: thematic games in which the players are enclosed in a room from which they must escape in a limited time (Wiemker et al. 2015); or the adaptation to the educational area known as Break Out: instead of escaping physically, they must open a box/boxes closed with different types of padlocks (Detwiler et al. 2018). Also, we can emphasize some tools that had been previously removed from education and that present a great potential if they are included in these spaces, such as mobile devices or "exergames": video games that need corporal movement for the game (LeBlanc and Chaput 2017), among others.

The game Pokémon GO (Fig. 12.1) takes part in a new age of immersed video games inside Augmented Reality Games (ARG), which are defined as a kind of "exergame" that requires participants to be physically active or to do exercise in order to play the game (Anderson et al. 2016; Clark and Clark 2016). Pokémon GO



Fig. 12.1 Game development *Source Ad hoc*

has been one of the major exponents of the expansion of the AR and gained significant fame in a very short time. From its launch in 2016, there have been more than 45 million users of this game. It is the first mass market app that is fully immersed into actual geographical space and that transcends the virtual, the spatial, the social and the physical (Clark and Clark 2016; Tateno et al. 2016). The aim is to catch and level up Pokémon and your avatar across various tasks and by visiting several physical locations using mobile GPS (Anderson et al. 2016). In this way, Pokémon GO allows young people to stay motivated by playing video games and, at the same time, to increase daily physical activity levels (Clark and Clark 2016; LeBlanc and Chaput 2017; Serino et al. 2016). Nowadays, we can find other applications on the market that also they work under this dynamic, such as *Zombies Run's*, or future scheduled launches, such as *Harry Potter: Wizards Unite*, or *The Walking Dead: Our World*.

On the other hand, we must emphasize that the game Pokémon GO may promote a social culture through visiting famous buildings, monuments and cultural places in the company of friends or playmates (Serino et al. 2016; Smith 2016). Nevertheless, there are not only social benefits; news articles also highlight potential social dangers to players by irresponsible gameplay (Sharma and Vassiliou 2016; Wagner-Greene et al. 2017). For example, this ARG may increase the risk of injuries due to walking distractedly, as well as abduction by strangers, spatial disorientation, addiction or social violence (McCartney 2016; Serino et al. 2016; Wagner-Greene et al. 2017). Furthermore, Ayers et al. (2016) and Barbieri et al. (2017) found that Pokémon GO is a hazardous distraction for drivers and pedestrians and may increase the risk of traffic accidents. A study showed that 33% of a random sample of 4000 Tweets indicated that a driver, passenger or pedestrian was distracted by Pokémon GO and that 80%

of Tweets indicated a person was simultaneously playing and driving (Ayers et al. 2016).

12.2 Pokémon GO and Its Relation to Physical Activity

One of the most significant aspects of the game Pokémon GO is that of avoiding sedentary behaviours, one of the principal problems which nowadays our company faces. Adolescents currently spend nearly 9 h per day in sedentary behaviours, mostly associated with the use of new technologies, such as watching television, using smartphones, using computers or playing videogames (Norris et al. 2016). The Global Monitoring Framework for Noncommunicable Diseases established a global objective of a 10% reduction of sedentarism by 2025 (WHO 2018). Physical fitness is defined as the capacity to perform physical activity and is composed of a set of physical components, such as cardiorespiratory fitness (capacity to carry out prolonged strenuous exercise), speed/agility (ability to move the body as fast as possible) and muscular strength (capacity to exert work against a resistance) (Ruiz et al. 2011). On the other hand, fatness refers to the weight status or level of body fat which can be measured in different ways, including body mass index, percentage of body fat and waist-hip index (Cadenas-Sánchez et al. 2017). Low levels of physical fitness in combination with fatness during adolescence have been associated with cardiovascular disease risk factors (Ruiz et al. 2014) and with a higher risk of reporting low life satisfaction and health risk behaviours, such as alcohol consumption or getting drunk occasionally (Grao-Cruces et al. 2014). Despite these factors, approximately 80% of adolescents do not reach the minimum recommended amount of 60 min of daily moderate to vigorous physical activity (WHO 2018).

If we focus on the literature that has investigated the effects of the game Pokémon GO, we might conclude that to allow young people to stay motivated by playing video games would increase daily physical activity levels (Clark and Clark 2016; LeBlanc and Chaput 2017; Serino et al. 2016), decrease sedentary behaviours (Nigg et al. 2016), enhance fitness and overall cardiometabolic health (Krittanawong et al. 2017; Sharma and Vassiliou 2016), prevent and treat many chronic diseases (Anderson et al. 2016) and decrease obesity (Smith 2016). As we can observe, there are numerous the studies that have investigated the effects of Pokémon GO and how it influences the physiological level its users. Taking into account that adolescence is a key stage in controlling physical fitness and fatness levels, there is an imperative need to find novel strategies aimed at motivating young people to go outside and move more. Also, adolescence is a key stage to consolidate healthy lifestyles and increase one's physical activity level.

12.3 Pokémon GO and Its Relation to Cognition

Physical activity not only presents benefits at a physiological level. The relationship of physical activity practice with improvements in cognition has been verified by cross-sectional (Cadenas-Sánchez et al. 2017; Laborde et al. 2016; Vanhelst et al. 2016) and longitudinal studies (Laborde et al. 2016; Stephan et al. 2014). Cognitive performance is the mental capacity affected by inhibitory control and executive functions, which are the factors responsible for the planning, intellectual organization and control the behaviour (Diamond 2013; Ruiz-Ariza et al. 2017). Memory, selective attention, concentration and numerical-linguistic reasoning skills appear among the most important variables in cognitive performance (Esteban-Cornejo et al. 2015; Ruiz-Ariza et al. 2017). One has thought that the young persons with high place cognitive performance have a high level of self-esteem and self-awareness (Fati-Ashtiani et al. 2007). When cognition interacts with emotional aspects, behaviour's answers appear to compose the emotional intelligence (Salovey and Mayer 1990). For some authors, emotional intelligence is a construction consisting of well-being, self-control, emotions and sociability (Petrides et al. 2016). A good level of emotional intelligence is associated with adaptive conduct and social skills (Frederickson et al. 2012), with qualities of leadership and with limited disruptive, aggressive and dependent behaviour in the school context (Mavroveli et al. 2009). Cognitive performance (Esteban-Cornejo et al. 2015; Ruiz-Ariza et al. 2017) and emotional intelligence (Petrides et al. 2016), are highly important for academic performance in school and work success in the future (Laidra et al. 2007). If we focus on a specific game like Pokémon GO and its impact to cognitive level, we can observe that this game helps to carry out family activities (De Oliveira-Roque 2016), increase socialization and outdoor activity (Serino et al. 2016), prevent depression and anxiety (McCartney 2016) and increase selective attention, concentration and sociability levels (Ruiz-Ariza et al. 2018). In this sense, Kato et al. (2016) and Tateno et al. (2016) have concluded that Pokémon GO may help youths with severe social withdrawal. In addition, during this period, there is a high degree of plasticity in the brains of young people, which is decisive in enhancing cognitive performance and emotional intelligence, improving academic performance, securing appropriate behaviours and fostering future social success (Esteban-Cornejo et al. 2015; Ruiz-Ariza et al. 2017).

A good way of summarizing these aspects would be by means of the study published by Ruiz-Ariza et al. (2018), by means of which they indicated that the players of Pokémon GO who played for 8 weeks significantly increased their selective attention (13.26%; $p = 0.003$), their levels of concentration (19.40%; $p < 0.001$) and their levels of sociability (9.87%; $p = 0.003$), in contrast to those who did not play the game (independent of age, sex, socioeconomic level, mother's education and the body mass index). In addition, it is also noteworthy that boys reached a level of game higher than the girls, concluding hereby that playing Pokémon GO, makes it possible to increase in a direct way the quantity of physical exercise as well as having a positive effect on cognitive performance and social relations. These authors also

reveal in this study that normally, the players play approximately 40 min a day and they do so accompanied by other players, feeling happier and motivated.

12.4 Augmented Reality as a Didactic Tool

AR might be an effective method for the creation of an environment in which the users interact. AR combines the worlds physically and virtually in a single interface, replacing the stationary reproduction with the active game, requiring the users to explore their physical environment (Serino et al. 2016). To increase the interaction presented by the technological tools in education, allowing funny learning, offering opportunities to increase motivation and making the learning process more motivating, active and effective. Some recent research has shown that augmented reality could also increase other educational development characteristics in young people, such as the quality of writing (Wang 2017), mathematical abilities (Sommerauer and Müller 2014) or learning a foreign language (Hsu 2017). Inside the AR, we can distinguish between two technologies: the geolocalization with recognition of royal images (as is the case in Pokémon GO's) and the stocks in scoreboards, like QR codes. Both are perfectly adaptable to the school area in general and especially to the classroom, as we observe in the following section.

12.5 Didactic Proposal

The new technologies are transforming the world in which we live and communicate. This in turn involves a change in our cognitive activity and in the form in that we learn. When the persons brain has been analysed without any experience in digital environments, it has been shown that his cerebral activation is similar to that shown when reading a book. People with experience in digital environments and searching of information across the Internet, activate a major quantity of cerebral regions as the prefrontal area, which is the responsible of executive functions (Small et al. 2009). In this case, and under the increasing demand and use of the new technologies, these can turn out to be useful and applicable, to allow new methods of education, in turn encouraging learning in a more dynamic way and offering a major range of opportunities.

Fig. 12.2 HP reveal app
(Source www.hpreveal.com)



Fig. 12.3 WallaMe app
(Source <http://walla.me>)



12.5.1 Gymkhana by Means of AR in Physical Education Classes

A good way to work the curricular contents within Physical Education classes is through AR. The students could make groups to move around the educational centre, looking for the different places to perform the recommended physical actions. For example, the use of *HP Reveal* is an interesting option (Fig. 12.2).

12.5.2 The Hidden Message

Inside a space delimited in the centre, every pupil will take a photo during the activity, to check the challenge. In the aforementioned photo, they will add images or drawings in which he will share a history or message. In this way, students will create a wall of AR to see the creations in real time with their smartphones (Fig. 12.3).

12.5.3 Roald Dahl GO

This experience comes gathered in the personal page of the teacher Raúl Diego, (www.rauldiego.es/roald-dahl-go/). This activity was inspired by Pokémon GO. This

explains to the student body the disappearance of the prominent figures of the books of the popular novelist Roald Dahl. The students had to look for the books with their smartphones and “catcher them”. In this way, the game was trying to also promote the habit of reading in the participants. It might adapt to different authors, books and ages (Fig. 12.4).

12.5.4 Creation of Escape Room or Educational Break Out

The possibility of working curricular elements by means of the game or even being able to evaluate them is highly attractive for the student body. These offers consist

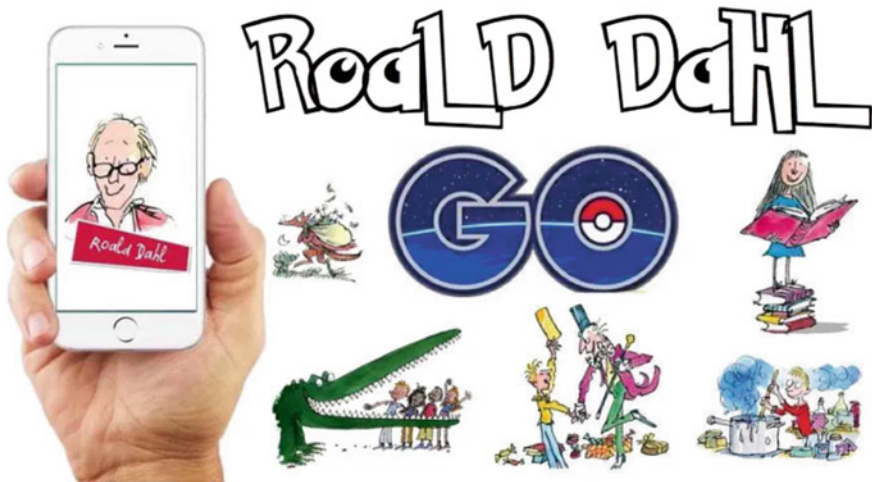


Fig. 12.4 Roald Dahl proposal (Source www.rauldiego.es/roald-dahl-go/)



Fig. 12.5 Padlock and digital unlock code (Source Own elaboration)

of the fact that the students must solve cruxes, tests, or challenges of a topic in order to learn playing. In the Escape Room, they must escape a physical room, whereas in Break Out, it is necessary to open boxes to discover what they hide. Even in Break Out, there might be digital padlocks that need QR codes or AR videos that explain how to continue in the development of the activity (Fig. 12.5).

12.6 Some Limitations of These Proposals

With regard to the limitations of these offers, it is necessary the implication and collaboration of the teachers, since it supposes to have control over the space where the activity takes place, which can be more restricted depending on the environment in which the educational centre is located. In addition, it is presupposed that the whole student body or most of it has a mobile phone, but there could some cases where this is not possible. A principal solution is that those who do not have a mobile phone could play with some companions, taking advantage of the socialization of those who are more excluded. Equally, as soon as we use AR inside the school context, it is necessary to mention that for the correct execution of a gymkhana with AR or creation of a Scape Room, it is necessary a previous preparation, and to prepare the material. Since the teachers are the principal persons in charge of introducing these innovative methods in order that the student body learns in a different way, the teachers need previous instruction about the use of technological didactic tools.

12.7 Conclusion

The incorporation of the AR or this modality of active video games and its adjustment to the educational area appears to be a great attraction for the student body and the teaching community. Its incorporation in the educational area will lead to a great revolution, since it allows us to transform the classroom, incorporating more original new spaces and motivating the acquisition of necessary competition in our current company, allowing a more integral development of the student body. The schools can be an ideal scene to offer to the children opportunities that might develop thanks to the AR, inciting enjoyment, promotion of health, social relations and, especially, educating in a person to use new technologies. We must be aware about the purpose of the education to students understand the world, and know their own talents, aimed to develop their competences and become active and critical citizens. To facilitate this, the game in its multiple facets plays a fundamental role in all the stages of life and, especially, in physical, social, emotional and intellectual development. The children use games to make friends, overcome fears, solve problems and, in general, to take the reins of their life. Also, they use games to practise and to acquire the physical and intellectual skills that are fundamental for success in their culture. What children learn on their own initiative, playing freely, is not possible to teach in other ways.

The insertion of AR into educational environments stirs up the relations between the curricular content, the practice of exercise, new technologies, social relations, etc. The stimulation and motivation that it generates allows new learning processes, offering much more satisfactory new experiences. This tool might be raised as a useful resource for educational centres, ideally to include in the classrooms, in physical education, playtime and even as complementary activities. In addition, these new strategies are ideal vehicles to reduce the high rates of sedentary lifestyles and to influence in a positive way a more healthy way of life, since it favours increasing the caloric expenditure and reducing the high levels of infantile and juvenile obesity, as we have observed in this chapter. Also, it facilitates increasing the cardiac frequency, to improve coordination and other physical attributes. It definitively facilitates improvement of the general physical condition of the users who have practised Pokémon GO in a specific way during a period of time, whether extended or brief. In terms of cognitive aspects, the development of this practice includes a very favourable tool to improve cognitive and academic performance of the players. Also, it is necessary to bear in mind the possible adverse effects as a consequence of the negligence of the users. To finish, due to the fact that these new tools suppose a great change in the company and, more concretely, in education, it is worthy of future research in educational centres.

References

- Anderson N, Steele J, O'Neill LA, Harden LA (2016) Pokémon go: Mobile app user guides. *Br J Sports Med* 2016:e096762. <http://doi.org/10.1136/bjsports-2016-096762>
- Ayers JW, Leas EC, Dredze M, Allem JP, Grabowski JG, Hill L (2016) Pokémon GO da new distraction for drivers and pedestrians. *JAMA Intern Med* 176(12):1865–1866. <https://doi.org/10.1001/jamainternmed.2016.6274>
- Barbieri S, Vettore G, Pietrantonio V, Snenghi R, Tredese A, Bergamini M et al (2017) Pedestrian inattention blindness while playing Pokémon go as an emerging health-risk behavior: a case report. *J Med Internet Res* 19(4):e86. <https://doi.org/10.2196/jmir.6596>
- Bell S (2010) Project-based learning for the 21st century: skills for the future. *Clearing House* 83(2):39–43
- Bergmann J, Sams A (2012) Flip your classroom: reach every student in every class every day. International Society for Technology in Education, Washington
- Cadenas-Sánchez C, Vanhelst J, Ruiz JR, Castillo-Gualda R, Libuda L, Labayen I et al (2017) Fitness and fatness in relation with attention capacity in European adolescents: the HELENA study. *J Sci Med in Sport* 20(4):373–379. <https://doi.org/10.1016/j.jsams.2016.08.003>
- Clark AM, Clark MTG (2016) Pokémon GO and research: qualitative, mixed methods research, and the super complexity of interventions. *Int J Qual Methods* 15(1):1609406916667765. <https://doi.org/10.1177/1609406916667765>
- Davies D, Jindal-Snape D, Collier C, Digby R, Hay P, Howe A (2013) Creative learning environments in education. a systematic literature review. *Thinking Skills Creativity* 8:80–91
- De Oliveira-Roque F (2016) Field studies: could Pokémon GO boost birding? *Nature* 537(7618):34. <https://doi.org/10.1038/537034e>
- Deterding S, Sicart M, Nacke L, O'Hara K, Dixon D (2011) Gamification. Using game-design elements in non-gaming contexts. In: CHI'11 extended abstracts on human factors in computing systems, pp 2425–2428

- Detwiler S, Jacobson T, O'Brien K (2018) BreakoutEDU: helping students break out of their comfort zones. *College & Research Libraries News* 79(2):62
- Diamond A (2013) Executive functions. *Annu Rev Psychol* 64:135–168. <http://doi.org/10.1146/annurev-psych-113011-143750>
- Esteban-Cornejo I, Tejero-Gonzalez CM, Sallis JF, Veiga OL (2015) Physical activity and cognition in adolescents: a systematic review. *J Sci Med Sport* 18(5):534–539. <http://doi.org/10.1016/j.jsams.2014.07.007>
- Fati-Ashtiani A, Ejei J, Khodapanahi M, Tarkhorani H (2007) Relationship between self-concept, self-esteem, anxiety, depression and academic achievement in adolescents. *J Appl Sci* 7(7):995–1000. <http://doi.org/10.3923/jas.2007.995.1000>
- Frederickson N, Petrides KV, Simmonds E (2012) Trait emotional intelligence as a predictor of socioemotional outcomes in early adolescence. *Pers Individ Differ* 52(3):323–328. <http://dx.doi.org/10.1016/j.paid.2011.10.034>
- Grao-Cruces A, Fernández-Martínez A, Nuviala A (2014) Association of fitness with life satisfaction, health risk behaviors, and adherence to the Mediterranean diet in Spanish adolescents. *J Strength Conditioning Res* 28(8):2164–2172. <https://doi.org/10.1519/JSC.0000000000000363>
- Hsu T-C (2017) Learning english with augmented reality: do learning styles matter? *Comput Educ* 106:137–149. <http://doi.org/10.1016/j.compedu.2016.12.007>
- Kato TA, Teo AR, Tateno M, Watabe M, Kubo H, Kanba S (2016) Can “Pokémon GO” rescue shut-ins (hikikomori) from their isolated world? *Psychiatry Clin Neurosci* 71:75–76. <https://doi.org/10.1111/pcn.12481>
- Krittawanong C, Aydar M, Kitai T (2017) Pokémon GO: digital health interventions to reduce cardiovascular risk. *Cardiol Young* 1–2. <http://doi.org/10.1017/S1047951117000749>
- Laborde S, Dosseville F, Allen MS (2016) Emotional intelligence in sport and exercise: a systematic review. *Scand J Med Sc Sports* 26(8):862–874. <http://doi.org/10.1111/sms.12510>
- LeBlanc AG, Chaput JP (2017) Pokémon GO: a game changer for the physical inactivity crisis? *Prev Med* 101:235–237. <https://doi.org/10.1016/j.ypmed.2016.11.012>
- Laidra K, Pullman H, Allik J (2007) Personality and intelligence as predictors of academic achievement: a cross-sectional study from elementary to secondary school. *Pers Individ Differ* 42(3):441–451. <http://dx.doi.org/10.1016/j.paid.2006.08.001>
- Mavroveli S, Petrides KV, Sangareau Y, Furnham A (2009) Exploring the relationships between trait emotional intelligence and objective socioemotional outcomes in childhood. *Br J Educ Psychol* 79:259–272. <http://doi.org/10.1348/000709908X368848>
- McCartney M (2016) Game on for Pokémon GO. *BMJ* 354. <http://dx.doi.org/10.1136/bmj.i4306>
- Nigg CR, Mateo DJ, An J (2016) Pokémon GO may increase physical activity and decrease sedentary behaviors. *Am J Publ Health* e1–e2. <http://doi.org/10.2105/AJPH.2016.303532>
- Norris E, Hamer M, Stamatakis E (2016) Active video games in schools and effects on physical activity and health: a systematic review. *J Pediatr* 172:40–46. <https://doi.org/10.1016/j.jpeds.2016.02.001>
- Petrides KV, Mikolajczak M, Mavroveli S, Sanchez-Ruiz MJ, Furnham A, Perez-Gonzalez JC (2016) Developments in trait emotional intelligence research. *Emot Rev* 8(4):335–341. <https://doi.org/10.1177/1754073916650493>
- Prensky M (2011) Enseñar a nativos digitales. SM, Madrid, pp 26–27
- Ruiz-Ariza A, Grao-Cruces A, Loureiro NEM, Martínez-López EJ (2017) Influence of physical fitness on cognitive and academic performance in adolescents: a systematic review from 2005–2015. *International Review of Sport and Exercise Psychology* 10(1):108–133. <https://doi.org/10.1080/1750984X.2016.1184699>
- Ruiz-Ariza A, Casuso RA, Suárez-Manzano S, Martínez-López EJ (2018) Effect of augmented reality game Pokémon GO on cognitive performance and emotional intelligence in adolescent young. *Comput Educ* 116:49–63. <https://doi.org/10.1016/j.compedu.2017.09.002>
- Ruiz JR, Castro-Piñero J, España-Romero V, Artero EG, Ortega FB, Cuenca M et al (2011) Field-based fitness assessment in young people: the ALPHA health-related fitness test battery for children and adolescents. *Br J Sports Med* 45:518–524. <https://doi.org/10.1136/bjism.2010.075341>

- Ruiz JR, Huybrechts I, Cuenca-García M, Artero EG, Labayen I, Meirhaeghe A et al (2014) Cardiorespiratory fitness and ideal cardiovascular health in European adolescents. *Heart (Br Cardiac Soc)* 101:766–773. <https://doi.org/10.1136/heartjnl-2014-306750>
- Sánchez J, Ruiz J, Sánchez E (2014) Las clases invertidas: beneficios y estrategias para su puesta en práctica en la educación superior. Retrieved from <https://www.uam.es/gruposinv/dim/assets/jose-uned-14.pdf>
- Salovey P, Mayer JD (1990) Emotional intelligence. *Imagination Cogn Pers* 9(3):185–211. <http://doi.org/10.2190/DUGG-P24E-52WK-6CDG>
- Serino M, Cordrey K, McLaughlin L, Milanaik RL (2016) Pokémon GO and augmented virtual reality games: A cautionary commentary for parents and pediatricians. *Curr Opin Pediatr* 28(5):673–677. <http://doi.org/10.1097/MOP.0000000000000409>
- Sharma P, Vassiliou V (2016) Pokémon GO: Cardiovascular benefit or injury risk? *Oxford Med Case Rep* 10:omw085. <http://doi.org/10.1093/omcr/omw085>
- Sommerauer P, Müller O (2014) Augmented reality in informal learning environments: a field experiment in a mathematics exhibition. *Comput Educ* 79:59–68. <http://doi.org/10.1016/j.compedu.2014.07.013>
- Small GW, Moody TD, Siddarth P, Bookheimer SY (2009) Your brain on Google: patterns of cerebral activation during internet searching. *Am J Geriatr Psychiatry* 17(2):116–126
- Smith DR (2016) A walk in the park: is Pokémon GO foreshadowing the future of biodiversity research and scientific outreach? *EMBO Rep* 17(11):1506–1509. <http://doi.org/10.15252/embr.201643213>
- Stephan Y, Sutin AR, Terracciano A (2014) Physical activity and personality development across adulthood and old age: evidence from two longitudinal studies. *J Res in Pers* 49:1–7. <http://doi.org/10.1016/j.jrp.2013.12.003>
- Tateno M, Skokauskas N, Kato TA, Teo AR, Guerrero APS (2016) New game software (Pokémon GO) may help youth with severe social withdrawal, hikikomori. *Psychiatry Res* 246:848–849. <http://doi.org/10.1016/j.psychres.2016.10.038>
- Vanhelst J, Béghin L, Duhamel A, Manios Y, Molnar D, De Henauf S et al (2016) Physical activity is associated with attention capacity in adolescents. *J Pediatr* 168:126–131. <http://doi.org/10.1016/j.jpeds.2015.09.029>
- Wang Y-H (2017) Exploring the effectiveness of integrating augmented reality-based materials to support writing activities. *Comput Educ* 113:162–176. <http://doi.org/10.1016/j.compedu.2017.04.013>
- Wagner-Greene VR, Wotring AJ, Castor T, Kruger J, Mortemore S, Dake JA (2017) Pokémon GO: healthy or harmful? *Am J Publ Health* 107(1):35–36. <http://doi.org/10.2105/AJPH.2016.303548>
- Wiemker M, Elumir E, Clare A (2015) Escape room games. *Game Based Learn* 55
- WHO (2018) Prevention and control of noncommunicable diseases: formal meeting of member states to conclude the work on the comprehensive global monitoring framework, including indicators, and a set of voluntary global targets for the prevention and control of noncommunicable diseases. Report by the Director-General. World Health Organization, Geneva