RESUMEN:

El Trastorno por déficit de atención e hiperactividad (TDAH) es un trastorno del neurodesarrollo cuyos síntomas son la falta de atención, la impulsividad, hiperactividad, poca capacidad de adquisición del comportamiento normativo y bajo rendimiento académico. Estos problemas afectan de manera negativa al menor, impidiendo que se desenvuelva con normalidad en diferentes áreas de su vida diaria, ya que le cuesta concentrarse, controlar sus impulsos, prestar atención a lo que están haciendo o se aburre de ello (Llanos Lizcano, 2019). Existen nuevas herramientas que se están investigando para mejorar la vida de esos niños: los juegos serios (JS) y la gamificación como vía para mejorar el comportamiento. El objetivo de este estudio fue llevar a cabo una revisión sistemática para analizar la eficacia de los JS y la gamificación en niños con TDAH. Se siguieron las indicaciones del método PRISMA. Los criterios de inclusión fueron: Artículos científicos, estudios cuantitativos, en inglés o español, publicados entre 2016-2021, en niños de entre 3-16, con diagnóstico en TDAH. Se excluyeron los artículos cualitativos. Las búsquedas fueron realizadas en las bases de datos Pubmed y Scopus. Se descartaron los artículos duplicados y aquellos que no cumplían con los criterios de inclusión y exclusión, quedando un total de 7 artículos. En general, los resultados mostraron una mejora en los pacientes con TDAH tras el uso de los JS. Aunque algunos autores apuntan que el tratamiento del TDAH en niños con JS es más efectivo si se utiliza como complemento de la terapia tradicional y no como sustitución de los tratamientos. No obstante, es necesario llevar a cabo estudios controlados con mayor rigor metodológico para poder llegar a conclusiones más firmes.

Palabras clave: Gamificación; TDAH; Juego Serio; Juego educativo; Eficacia

ABSTRACT:

Attention Deficit Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder whose symptoms are inattention, impulsivity, hyperactivity, low capacity to acquire normative behaviour and low academic performance. These problems negatively affect the children, preventing them from developing normally in different areas of their daily life, as they find it difficult to concentrate, control their impulses, pay attention to what they are doing or get bored of it (Llanos Lizcano, 2019) (Llanos Lizcano, L. J et al., 2019)? There are new tools being investigated to improve the lives of these children: serious games (SG) and gamification as a way to improve behaviour. The aim of this study was to conduct a systematic review to analyse the effectiveness of SG and gamification in children with ADHD. The PRISMA method guidelines were followed. The inclusion criteria were: Scientific articles, quantitative studies, in English or Spanish, published between 2016-2021, in children aged 3-16, with a diagnosis of ADHD. Qualitative articles were excluded. Searches were conducted in Pubmed and Scopus databases. Duplicate articles and those that did not meet the inclusion and exclusion criteria were discarded, leaving a total of 7 articles. Overall, the results showed an improvement in ADHD patients after the use of SG. Although some authors point out that the treatment of ADHD in children with SG is more effective if it is used as an adjunct to traditional therapy and not as a substitute for treatment. However, controlled studies with greater methodological rigour are needed in order to reach firmer conclusions.

Key words: Gamification; ADHD; Serious Game; Education Game; Efficacy

EFFICACY OF SERIOUS GAMES IN THE ADHD TREATMENT: A SYSTEMATIC REVIEW

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INTRODUCTION

Attention Deficit Hyperactivity Disorder (ADHD) involves inattention, hyperactivity and impulsivity (Chen et al., 2018) and affects about 5% of children worldwide (Peñuelas et al., 2020). ADHD is a neurological syndrome in which difficulties in controlling behaviour, inhibiting impulses and focusing attention stand out, alterations that are inadequate for the correct development of the children as they experience a variety of difficulties in learning behaviour patterns and having good interpersonal relationships, and which even affect their self-esteem (Llanos Lizcano, 2019). One of the tools used in recent years to improve children's behaviour and social skills are serious games (SG), designed to educate or modify behaviour as well as to entertain and motivate players" (Lau et al., 2017) and gamification, which enhances competitiveness, adding rewarding elements such as badges, avatars comparison tables, among others, in order to get children involved and motivated (Edwards et al., 2016). The aim of this systematic review is to analyse the effectiveness of SG and gamification in treating children with ADHD.

METHODOLOGY

Inclusion Criteria: Scientific articles, quantitative studies, in English or Spanish, published between 2016-2021, in children aged 3-16, with a diagnosis of ADHD.
Exclusion criteria: Qualitative studies.
The search for the selection of articles was carried out using the databases: PubMed and Scopus
Keywords: ("Gamification" AND "ADHD") OR ("Serious Game" AND "ADHD") OR ("Education Game" AND "ADHD") OR ("Gamification" AND "Attention deficit hyperactivity disorder") OR ("Serious Game" AND "Attention deficit hyperactivity disorder") OR ("Education Game" AND "Attention deficit hyperactivity disorder"). Search terms were found in title, abstract, full text, keywords and year delimitation.
This process is explained through a flow chart (PRISMA).

identification
PubNet:14
Scopus: 70
↓
escreenin
Records Screened (n=90)
↓
Records after duplicate removed (n=89) → Records excluded (n=34)
↓
elegibility
Full-test articles assessed for elegibility (n=55) → Full articles excluded Review: n=6 No SG: n=3 Only design: n=9 Other reason: n= 28 (n=48)
↓
included
Studies included (n=7)

DISCUSSION

- There is a large literature regarding ADHD but finding studies on SG and gamification has been complicated as work with these tools is just beginning and there is not much research.
- Most of the research focuses on the development of the video game and less on evaluating its effectiveness or explaining the benefits of its use.
- The results of the 7 studies included in this review show, in general, an improvement in patients after the use of SGs. There is little empirical evidence of the benefit of the use of SG in children with ADHD.
- We can conclude that SG help to improve the symptoms of ADHD. Although some authors point out that the treatment of ADHD with SG is effective if it is used as an adjunct to traditional therapy and not as a substitute for treatment.
- The major limitation we have found in conducting this review has been the few experimental studies that have been conducted and the poor methodological quality of some of them (e.g., case studies).
- Controlled studies with greater methodological rigour need to be carried out in order to reach firmer conclusions.

AUTHORS	SAMPLE	DESIGN	INTERVENTION	RESULTS
Kollins et al. (2020)	EG=169 CG=160	Randomised, double-blind, parallel-group, double-blind trial	AKL_T01: is a software that uses a proprietary algorithm to improve attention and cognitive control processes by training interference management with a high degree of adaptive and personalised difficulty.	Significant pre-post intervention improvements in attention and cognitive processes (TOVA, API).
Bul et al. (2018)	EG=68 CG=71	Randomised trial of virtual Twins analysis to identify subgroups where treatment is improved	"Plan-it Commander" video game is a complement to the usual treatment to improve behavioural problems in: planning/organisation, time management, and cooperation.	No significant improvements in time management (ECA) and cooperation skills (SSRS). Significant improvements in planning/organisation by two of the subgroups (BRIEF), (girls n=26) and (boys EC n=47).
Crepaldi et al. (2020)	EG = 8 CG = 8	Experimental	Video game "Antonyms?". It aims to enable inhibitory mechanisms by training three aspects: Inhibition, impulsivity, cognitive flexibility.	There was no correlation in the results of the pre-post intervention tests (STROOP and RANETTE of the BIA battery). The findings indirectly support the possibility of using Antonyms as a tool in assessment and rehabilitation programmes.
Dovis et al. (2015)	EG1 = 31 EG2 = 28 CG = 30	Multicentre, double-blind, placebo-controlled, parallel-group, multicentre study.	Gamified game "Braingame Brian" trains executive functions: Visuospatial Management, Behavioural Inhibition and Cognitive Flexibility.	Improvements in EG1 in visuospatial management (the only group that worked in this condition). Inhibitory performance and interference control improved in EG1 and EG2. No improvement in cognitive flexibility
García-Redondo et al. (2019)	EG = 24 CG = 20	Quasi-experimental study with a control and experimental group.	Three of Intelligences Method (TOL). It is a SG based on Gardner's multiple intelligences and the theoretical assumptions of video games, with 10 sub-games covering at least one key skill from each of the 8 intelligences.	Overall improvement of each group in attention. Increase in concentration and accuracy in EG. No significant differences in symptoms over time (ADHD).
Yang-Ku et al. (2020)	N = 3	Case study	SG immersive virtual reality exercises, based on rehabilitation and improving attention, cognitive abilities and abstract processing focused on training hand-eye and hand-foot coordination through software and hardware.	Significant improvements for all three participants (TONI, ATESC and SNAP-IV). In WCTS, Participant A obtained improvements, Participant B obtained the same score and Participant C worsened the results.
Avila-Pesantez et al. (2018)	N = 11	Case study	ANTHYONS is a SG created with augmented reality that aims to improve attention.	Significant improvements in daily life functioning and in time management and social skills. Improved concentration.

EG= Experimental Group; CG= Control Group; SG= Serious Gaming; TOVA= Test of Variables of Attention; API= Attention Performance Index; EC= children with lower hyperactivity/impulsivity score and higher symptom score; VT= Virtual twins; ECA= Time Management Questionnaire (created by authors); BRIEF= Behaviour Rating Inventory for Executive Function; SSRS=Social Skills Rating System; STOP TASK=Stop Signal Task; STROOP=Colour and Word Test; CBTT. forward=Corsi tapping task for forward visual short-term memory; CBTT.backward=Corsi tapping task for backward visual short-term memory; SLD=Specific Learning Disorder; ADHD=Attention and Hyperactivity Rating Scale.
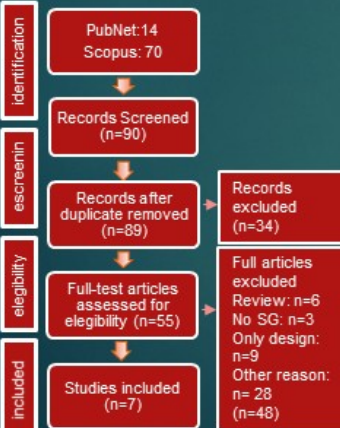
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