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Navigating Serious Games in corporate learning: an overview

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Abstract

Objective: To analyse the impact and applications of Serious Games in the corporate realm, evaluating both benefits and challenges associated with their adoption.

Methodology: A literature review is conducted through a descriptive bibliometric analysis. The distribution of publications and citations of studies by year, affiliations and authors with the highest productivity rate, and most cited articles are analysed.

Results: A marked increase in publications on Serious Games is observed, indicating a growing interest in research. Citation analysis shows an upward trend, with the year 2022 standing out as the most prolific. INRAE and Wageningen University Research are leading institutions in this field, and prominent authors include Mayer, Dumont, and Russell-Bennett.

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Limitations: There is potential bias in article selection and a narrow focus on the benefits and challenges of Serious Games in enterprises, overlooking long-term sustainability. This could be addressed by comparing the effectiveness of Serious Games in employee training versus customer interaction and evaluating their applicability across different sectors.

Practical implications: Serious Games are useful for simulating business creation, developing entrepreneurial skills through a playful approach, as well as citizen decision-making and its impact on carbon emissions. In the tourism sector, the effectiveness of gamification through Serious Games is evidenced by increased brand loyalty. The article provides an understanding of the landscape of Serious Games and their implementation in companies across different sectors. It observes the practical implications of this learning tool and its interaction with consumers, to enhance their experience.

Keywords: systematic review; serious game; game-based learning; gamification; employee training

JEL Codes: M31; O33; I23; I20

1. Introduction

Playing is an inherently human aspect, an activity that has been part of our history since time immemorial. From strategy games in ancient Mesopotamia to team sports in classical Greece, play has been a constant in human evolution, reflecting and shaping our cultures and societies (Huizinga, 1955). Although the benefits of using games in learning are widely recognized and supported by scientific literature (Prensky, 2003), and there are numerous studies highlighting their effectiveness in the academic field (Clark et al., 2016), the relationship between play and the corporate world has historically been complex. From the Industrial Revolution to the 21st century, this relationship has evolved significantly, reflecting changes in cultural and organisational perceptions of the role of play in work (Smith, 2011).

In the current era, characterised by rapid technological changes and constant evolution in work dynamics, companies face unique challenges in training and developing their employees. Serious Games emerge as an innovative solution, merging learning with entertainment to create engaging and effective educational experiences. This methodology has proven to be particularly valuable in the business sector, where the need for updated and adaptive skills is critical (Michael & Chen, 2005).

Serious Games, defined as games designed with a primary purpose other than mere entertainment (Abt, 1987), have found fertile ground in the corporate world. These games are used for various purposes, from soft skills training to simulating complex decision-making scenarios (Lean et al., 2023; Aubert et al., 2022; Djaouti, Alvarez, & Jessel, 2011). The effectiveness of Serious Games in the business environment has been demonstrated in multiple studies, highlighting their ability to improve knowledge retention, foster engagement, and facilitate experiential learning (Wouters et al., 2013).

Furthermore, the integration of emerging technologies such as virtual reality and artificial intelligence has expanded the possibilities of Serious Games, allowing

for more immersive and personalised experiences (Beh et al., 2022; Loh, Sheng, & Ifenthaler, 2015). These innovations enhance not only the quality of learning, but also make it more accessible and appealing to a generation of workers accustomed to digital interaction. However, despite its evident benefits, the implementation of Serious Games in the corporate environment is not without challenges (Acharya & Gupta, 2020). These challenges include resistance to change, the need for significant initial investment, and the difficulty of measuring return on investment concretely (Connolly et al., 2012).

As mentioned, within the framework of Game-Based Learning (GBL), Serious Games are gaining increasing importance as they involve learning and cognitive development for players. The goal of this research is to analyse trends in the development and use of Serious Games in companies. To achieve this, we analyse existing literature to draw conclusions about the effectiveness of Serious Games in companies, both in terms of employee training and the distribution of Serious Games across different industrial sectors. Finally, best practices and recommendations for the successful implementation of Serious Games are identified.

The paper is structured around a robust theoretical framework that delves into the requisites of modern businesses, traces the evolution of gamification, game-based learning, and Serious Games, and examines their practical applications within the business landscape. Following this theoretical foundation, the methodology utilised in this study is elaborated upon, followed by the presentation of results, discussion, and conclusive insights.

Therefore, this paper seeks to explore the impact and applications of Serious Games in the corporate world, analysing both benefits and challenges associated with their implementation. Through a comprehensive review of literature and case studies, we will provide a holistic view of how Serious Games are redefining learning and development in the contemporary business environment.

2. Theoretical framework

2.1. Main themes of Serious Games

Serious Games encompass a broad range of applications, with four primary categories being particularly prevalent and significant. In the military domain, Serious Games provide simulations allowing users to make strategic decisions without facing real consequences, crucial for soldier training and combat scenarios (Wassila & Tahar, 2012). Health-related Serious Games are used in medicine, physiotherapy, and physical education, serving as training and educational tools for professionals and patients alike (Wattanasoontorn et al., 2013). In education, Serious Games are widely employed from preschool to higher education levels and have been extensively studied in scientific literature (Michael & Chen, 2005). Another category explores the use of Serious Games in the business sector, focusing on skill acquisition relevant

to business environments. Examples include understanding conceptual frameworks like the 3P model and the triple bottom line, grasping the importance of attitude and intention in entrepreneurship, and acquiring business knowledge through engaging mechanics (Gatti, Ulrich, & Seele, 2019; Rodrigues et al., 2016).

2.2. Common needs in the company

Companies as a whole face common challenges such as talent retention, employee training, and onboarding (Alshehhi et al., 2021). Employee retention is a significant challenge for corporations in the modern business environment. This challenge has been extensively studied in academic literature, where multiple factors influencing employee retention have been identified, and various strategies have been proposed to address this issue (Boushey, 2012). Another relevant challenge is keeping employees consistently trained for the company to be successful and sustainable. This need has been emphasised in numerous academic studies, highlighting the importance of continuous training for skill development, innovation, and employee retention (Sung, 2014).

The employee onboarding process poses a significant challenge for companies, as it is crucial to ensure effective and efficient integration of new employees into the organisation. Scientific literature has addressed this issue in depth, highlighting both the challenges and strategies for successful onboarding (Becker & Bish, 2021; Chillakuri, 2020).

2.3. Gamification

Gamification, integrating game elements into non-game contexts like education, aims to enhance engagement and motivation in learning activities (Deterding et al., 2011). It employs game mechanics such as points and rewards to boost student participation and learning (Karagiorgas & Niemann, 2017). This approach leverages game dynamics to improve student interaction with educational material, and is particularly noted in engineering education for introducing new teaching methods (Romero Rodríguez, 2023; Braghirolli et al., 2016; Dib & Adamo-Villani, 2014).

The integration of game elements, according to Lee and Hammer (2011), can significantly enhance participant engagement and participation. On the other hand, Deci and Ryan's (1985) self-determination theory suggests that the inclusion of such elements fosters intrinsic motivation for learning. These theories have been reinforced by studies at different levels demonstrating their effectiveness (Xu, Buhalis & Weber, 2017; Hamari et al., 2014). However, critics in scientific literature also question gamification for relying on extrinsic rewards (Bogost, 2015).

Common gamification elements include points, badges, and leaderboards (Zichermann & Cunningham, 2011). Effective gamification design in education or

business requires balancing game elements with educational or business objectives. Gamification has evolved from simple reward systems to complex learning strategies, gaining popularity in the 2010s and becoming a significant tool in education across various disciplines (Utoyo, 2018).

2.4. Gamification in the business

Gamification in the corporate and business world has gained significant importance in recent years, transforming the way companies approach training, employee engagement, change management (Mahmud et al., 2021), customer engagement, knowledge, and loyalty (Xi & Hamari, 2020; Behl et al., 2020). By integrating game elements, it enhances employee well-being, fosters job satisfaction, and boosts engagement (Friedrich et al., 2020; Shahrestani et al., 2017; Hammedi et al., 2021), while promoting agility in the workplace (Nivedhitha, 2023).

In business operations, gamification is increasingly utilised to attract and retain customers and improve internal organisational processes such as training (Fetzer et al., 2017; Larson, 2020). It facilitates innovative learning methods, enhances knowledge retention, and engages customers in co-creating products and experiences (Xu et al., 2017).

By enhancing brand engagement and loyalty, gamification fosters employee commitment and retention, aligning work tasks with personal values (Oxarart & Houghton, 2021). Integrating game elements into training programs not only increases their effectiveness, but also sparks creativity and makes learning more appealing (Xi & Hamari, 2020; Ikhide, Timur & Ogunmokun, 2023).

Moreover, gamification positively impacts talent retention by infusing playful elements into selection, training, and onboarding processes (Georgiou, Gouras & Nikolaou, 2019). It enhances knowledge and skill retention, particularly appealing to digital-native employees and driving overall engagement (Nivedhitha, 2023).

2.5. Game-Based Learning in the business education

The educational sector has increasingly explored games as effective learning tools, leading to innovative applications in both education and business contexts (Karagiorgas & Niemann, 2017). Game-Based Learning (GBL) employs games to enhance learning, fostering engagement, motivation, and participation in educational processes (Plass et al., 2015).

In business, GBL draws from theories like constructivism and experiential learning, emphasising experiential interaction for effective learning (Papadakis & Stavrakis, 2020; Slade et al., 2019; Starcic, 2008). By leveraging the psychology of learning and motivation, GBL improves knowledge retention and application through the captivating nature of games (Tavares, 2022).

GBL is valued in business settings for enhancing skills and competencies, offering a transformative learning experience in higher education and corporate training (Nahar, 2023). Business-oriented games integrate narratives, challenges, and rewards to boost learning and motivation (Belland, 2012).

In corporate training, GBL targets skills like leadership, teamwork, and decision-making (Lean et al., 2023; Van Peppen et al., 2022; Aubert et al., 2022), widely adopted across industries for professional development (Antón-Rodriguez et al., 2020; Robberts & Van Ryneveld, 2022).

GBL shares principles with gamification, aiming to enhance learning experiences but differing in approach; while gamification makes non-playful tasks playful, GBL uses games for educational purposes (Krath et al., 2021). Serious Games, purposefully created or existing, extend beyond entertainment to serve educational functions within this framework.

2.6. Serious Game in the business world

Serious Games, unlike traditional entertainment-focused games, aim for specific outcomes in education, health, business training, or social awareness (Hookham & Nesbitt, 2019). They use gameplay to address educational interests and simulate solutions, particularly evident in environmental and water-use contexts (Khoury et al., 2023). Initially used in military and medical fields, Serious Games have expanded to corporate training, offering effective learning and knowledge retention tools (Zhu & Wu, 2023; Larson, 2020). With applications across age groups and work contexts, they serve as versatile learning and development tools in the corporate world, holding significant potential for the future (Gurbuz & Celik, 2022).

This type of games in the business world emphasises the importance of experience and active interaction in learning (Parakh, 2022). The design of Serious Games for the business environment is based on principles such as content relevance, interactivity, immediate feedback, and adaptability to different learning styles. Corporate Serious Games integrate elements such as narratives, competencies, challenges, and rewards to enhance learning and motivation (Larson, 2020; Feng et al., 2023).

The use of Serious Games with an earnest purpose fosters innovation and creativity, providing a safe environment to experiment and explore new ideas (Zinke et al., 2018; Agogué et al., 2015). This reduces aversion to risk, leading to more effective learning, as mistakes in corporate environments do not translate into economic losses for the company. Serious Games are used in business training to improve skills such as leadership, teamwork, and decision-making (Lean et al., 2023).

Various research studies have demonstrated the effectiveness of Serious Games in improving engagement and knowledge retention in the corporate setting (Chittaro, 2023; Pistono et al., 2021). In entrepreneurial environments, Serious Games are a valuable tool as they can create uncertain and even currently unknown environments, such as those that occur outside of the school (Neck & Greene, 2011).

Serious Games in companies can help improve security, as they are an effective method to train workers on security risks and how to identify them (Nousias et al., 2019; Park & Kim, 2013; Neville et al., 2013).

These tools have been a valuable educational and training instrument for a long time, evolving into two main formats: analogical and digital. Analogical Serious Games, including board and card games, were the precursors in this field, used to facilitate interactive and engaging learning and skill development. These games are characterised by their tangible nature and physical interaction between players, fostering collaboration and direct communication (Müller et al., 2015).

Digital Serious Games, leveraging software and technologies like virtual reality and AI, have surged in popularity (Ma, 2021). These games, including those using virtual reality, offer immersive training environments, especially for human-robot collaboration (Matsas & Vosniakos, 2017). Analog or digital, Serious Games aim to educate, train, and motivate users effectively (Gazis & Katsiri, 2023).

Given the growing interest in using Serious Games in the business environment, this article analyses scientific publications to delve into trends, challenges, and best practices for implementing Serious Games in companies.

3. Methodology

Descriptive bibliometric analysis is employed to conduct a comprehensive review of the literature, identify existing knowledge gaps, extract novel ideas for research, and strategically position its intended contributions within the field of study (Mukherjee et al., 2022; Donthu, et al., 2021).

Continuing with the aim of shedding light on the term "Serious Game" as well as analysing both its benefits and challenges in the business world, we conducted a bibliometric analysis. This analysis used the Web of Science database to explore the concept of Serious Game within the business context. The search was conducted in November 2023. Our initial search using the terms 'Serious Game' or 'Serious Games', yielded 10,956 results in the Web of Science Core Collection, of which 5,592 were articles. We decided to focus our analysis on articles in the research area of Business Economics within the Web of Science, resulting in 450 articles that we proceeded to examine.

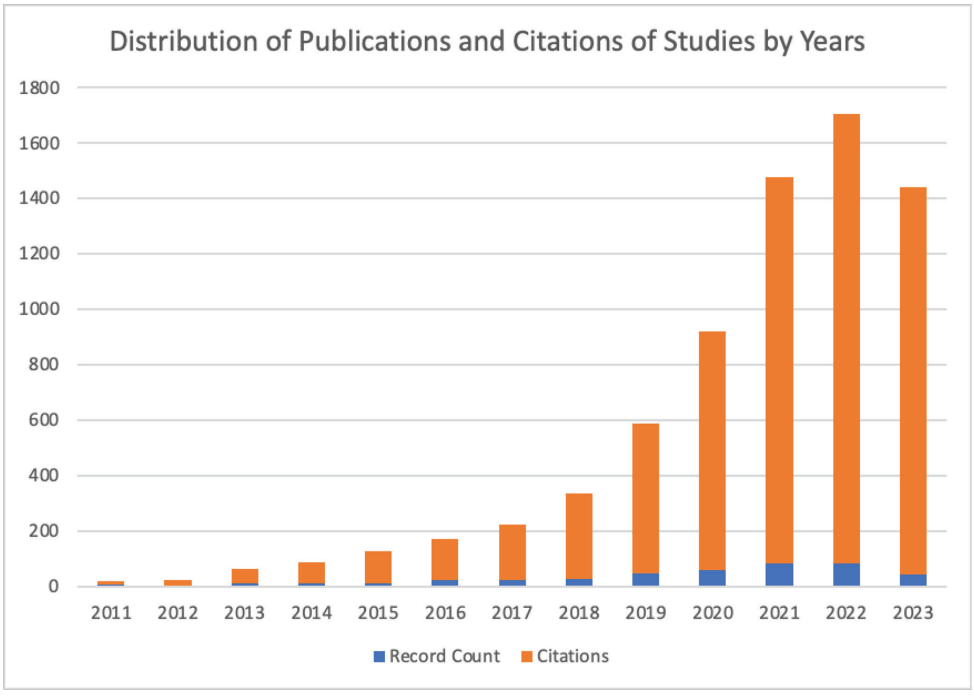
4. Results

During the analysis of publications related to the term "Serious Game", a clear upward trend is identified in both the annual publication volume and the number of citations associated with these articles, as reflected in Figure 1. Between 2011 and 2016, the annual publication count did not exceed 15 articles. However, 2016 emerged as a turning point, showing substantial growth that culminated in 2019

with the publication of 47 articles. In subsequent years, this upward trend persisted, reaching a notable total of 82 articles in 2021 and 85 publications in 2022. This marked increase in scientific production reflects a growing interest and relevance in research related to Serious Games, demonstrating an evolutionary dynamic in the attention and engagement of the scientific community in this specific field. Publications serve as an indicator of productivity, while citations evaluate the impact and influence of academic work (Donthu, et al., 2021). These articles have accumulated a total of 6,740 citations, with 2022 standing out with the highest number of citations, totalling 1,620, closely followed by 2023, which recorded 1,397 citations.

In Table 1, we can observe data regarding the institutional affiliations of authors with the highest number of articles. The information is categorised by the number of articles, the percentage in relation to a total of 450, the citation count, the average citations per article, and the country of origin of the institutions. Concerning the distribution of affiliations, there is a variety of institutional affiliations: with INRAE (France) standing out with 16 articles published in the field of Serious Games, followed by WAGENINGEN UNIVERSITY RESEARCH (Netherlands) with 12 articles. These institutions lead in terms of the number of records, indicating interest in research on games for teaching and learning. Regarding the percentage of total

Figure 1. Distribution of publications and citations of studies by years



Source: Own elaboration.

Table 1. Affiliations with the highest productivity rate

Affiliations	Record Count	% of 450	Citation number	Average per item	Country
INRAE	16	3,56	129	8,06	France
WAGENINGEN UNIVERSITY RESEARCH	12	2,67	380	31,67	Netherlands
INSTITUT AGRO	11	2,44	87	7,91	France
BREDA UNIVERSITY OF APPLIED SCIENCES	10	2,22	246	24,6	Netherlands
UNIVERSITE DE MONTPELLIER	10	2,22	87	8,7	France
CIRAD	8	1,78	88	11	France
UNIVERSITY OF THE SUNSHINE COAST	8	1,78	175	21,88	Australia
GRIFFITH UNIV	7	1,56	127	18,14	Australia
POLYTECHNIC UNIVERSITY OF MILAN	7	1,56	89	12,71	Italy
SWISS FEDERAL INSTITUTES OF TECHNOLOGY DOMAIN	7	1,56	97	13,86	Switzerland

Source: Own elaboration.

publications per affiliation, the percentage in relation to the total of 450 records provides insight into the relative contribution of each institution to the Web of Science dataset. INRAE and WAGENINGEN UNIVERSITY RESEARCH represent 3.56% and 2.67%, respectively, suggesting that these institutions have a significant presence in the analysis conducted on the Web of Science sample.

The citation count and average per article offer a measure of the impact of publications associated with each institution. Wageningen University Research (380 citations) and Breda University of Applied Sciences (246 citations) lead in terms of total citations, with impressive averages of 31.67 and 24.6 per article, respectively. Following closely is the University of the Sunshine Coast in Australia with 21.88 citations per article.

When examining publications by the country of affiliation, a diverse geographical distribution is observed, with institutions from France, the Netherlands, and Australia. French institutions (INRAE, INSTITUT AGRO, CIRAD) have a prominent presence, while Wageningen University Research leads in the Netherlands, and the University of the Sunshine Coast and Griffith University stand out in Australia.

Analysing citation data, the year with the highest number of citations is 2022, particularly notable for Wageningen University Research and Breda University of Applied Sciences. This could indicate a peak of interest or relevance in that year for research associated with these institutions.

The most prolific authors on the subject are summarised in Table 2. The analysis includes the number of articles published on Serious Games in business, the

Table 2. Authors with the highest productivity rate

Authors	Record Count	% of 450	Citation Count	Total Publication	Total Citation	H Index
Mayer I	9	2	262	47	780	15
Dumont B	6	1,333	56	123	3727	37
Russell-bennett R	6	1,333	159	135	2575	28
Allal-cherif O	5	1,111	87	13	187	9
Medema W	5	1,111	150	16	539	10
Mulcahy R	5	1,111	142	49	924	18
Oliveira M	5	1,111	41	20	61	4
Ryschawy J	5	1,111	45	44	1250	19
Adamowski J	4	0,889	126	196	6341	41
Aubert A H	4	0,889	64	21	626	12

Source: own elaboration.

percentage in relation to a total of 450, the citations received on Serious Game articles, the total number of author publications in other fields, cumulative citations, and the H-index.

Mayer leads with 9 papers on Serious Games, followed by Dumont and Russell-Bennett, each with 6 records. Authors Allal-Cherif, Medema, Mulcahy, Oliveira, and Ryschawy each have 5 articles. Additionally, other authors such as Adamowski and Aubert, have 4 papers each. When analysing the percentages in relation to the total of 450 records, it is observed that no individual author represents a significantly high proportion. This suggests an equitable distribution of contributions among various authors.

The total number of citations for each author reflects the impact of their research in the academic community. In this regard, Mayer has 262 citations, making him both the most prolific and cited author. Russell-Bennett stands out with 159 citations in the field of Serious Game. Regarding the H-index, which is based on the total number of publications and citations, measuring the author's productivity and impact, Adamowski has the highest H-index at 41, indicating that he has 41 articles that have been cited at least 41 times each. In terms of the total publications, Adamowski leads with 196 publications in total, followed by Russell-Bennett with 135.

In Table 3 below, highly cited articles are analysed, highlighting their relevance and recognition in the field of "Serious Games". These studies cover various topics such as business education (Neck & Greene, 2011), climate policies (Dubois et al., 2019), safety management in construction (Park & Kim, 2013), gamification in tourism (Xu, Buhalis & Weber, 2017), virtual reality for human-robot collaboration (Albert et al., 2014), and the effectiveness of technological tools in health and safety

Table 3. Most cited papers

Authors	Article Title	Source Title	Publication Year	Times Cited, WoS Core
Neck, Heidi M.; Greene, Patricia G.	Entrepreneurship Education: Known Worlds and New Frontiers	JOURNAL OF SMALL BUSINESS MANAGEMENT	2011	570
Dubois, Ghislain; Sovacool, Benjamin; Aall, Carlo et al.	It starts at home? Climate policies targeting household consumption and behavioral decisions are key to low-carbon futures	ENERGY RESEARCH & SOCIAL SCIENCE	2019	224
Park, Chan-Sik; Kim, Hyeon-Jin	A framework for construction safety management and visualization system	AUTOMATION IN CONSTRUCTION	2013	205
Xu, Feifei; Buhalis, Dimitrios; Weber, Jessika	Serious Games and the gamification of tourism	TOURISM MANAGEMENT	2017	202
Albert, Alex; Hallowell, Matthew R.; Kleiner, Brian; Chen, Ao; Golparvar-Fard, Mani	Enhancing Construction Hazard Recognition with High-Fidelity Augmented Virtuality	JOURNAL OF CONSTRUCTION ENGINEERING AND MANAGEMENT	2014	138
Xi, Nannan; Hamari, Juho	Does gamification affect brand engagement and equity? A study in online brand communities	JOURNAL OF BUSINESS RESEARCH	2020	127
Matsas, Elias; Vosniakos, George-Christopher	Design of a virtual reality training system for human-robot collaboration in manufacturing tasks	INTERNATIONAL JOURNAL OF INTERACTIVE DESIGN AND MANUFACTURING - IJIDEM	2017	103
Baptista, Goncalo; Oliveira, Tiago	Gamification and Serious Games: A literature meta-analysis and integrative model	COMPUTERS IN HUMAN BEHAVIOR	2019	94
Gao, Yifan; Gonzalez, Vicente A.; Yiu, Tak Wing	The effectiveness of traditional tools and computer-aided technologies for health and safety training in the construction sector: A systematic review	COMPUTERS & EDUCATION	2019	90
Lin, Jian-Wei; Tsai, Chia-Wen; Hsu, Chu-Ching	A comparison of computer-based and game-based formative assessments: a long-term experiment	INTERACTIVE LEARNING ENVIRONMENTS	2023	86

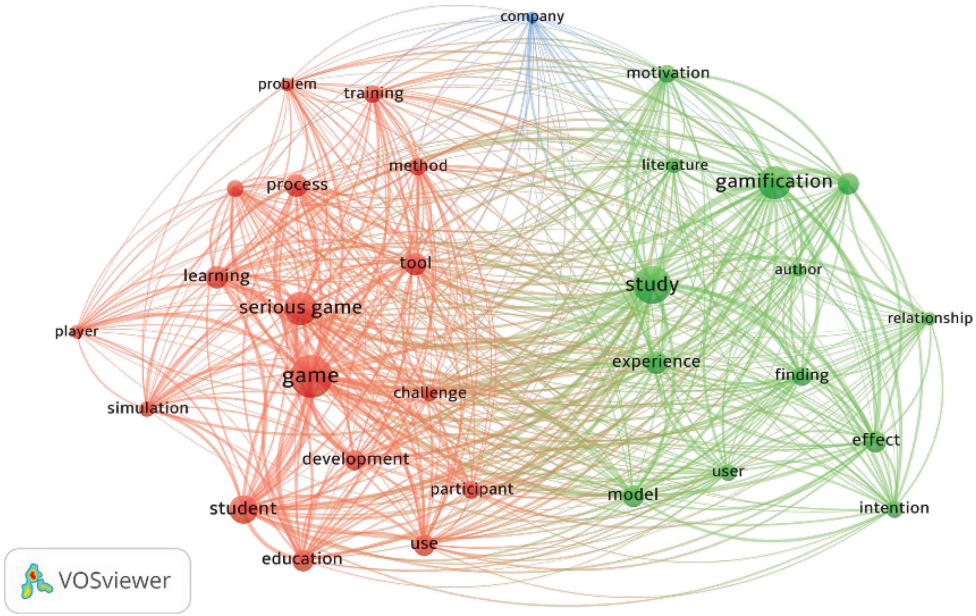
Source: own elaboration.

training in construction (Gao et al., 2019). This collection of publications represents a substantial compilation of knowledge in the "Serious Games" field, highlighting their importance and impact in the academic community.

To complete the analysis of the co-occurrence of keywords, the network of co-occurring keywords is presented through figures displaying said network. Using VOSviewer, with a minimum occurrence threshold of 50 for each term, we identified a total of 52 terms. After applying a relevance score of 60%, we narrowed it down to 31 terms, resulting in three clusters. These clusters comprised 465 links in total, with a combined link strength of 46.507. The field is presented by three clusters of connected topics in Figure 2: Cluster 1: Learning and Development through Serious Games (Red), Cluster 2: Engagement and Motivation in Gamified Experiences (Green), and Cluster 3: Organisational Impact of Serious Games (Blue).

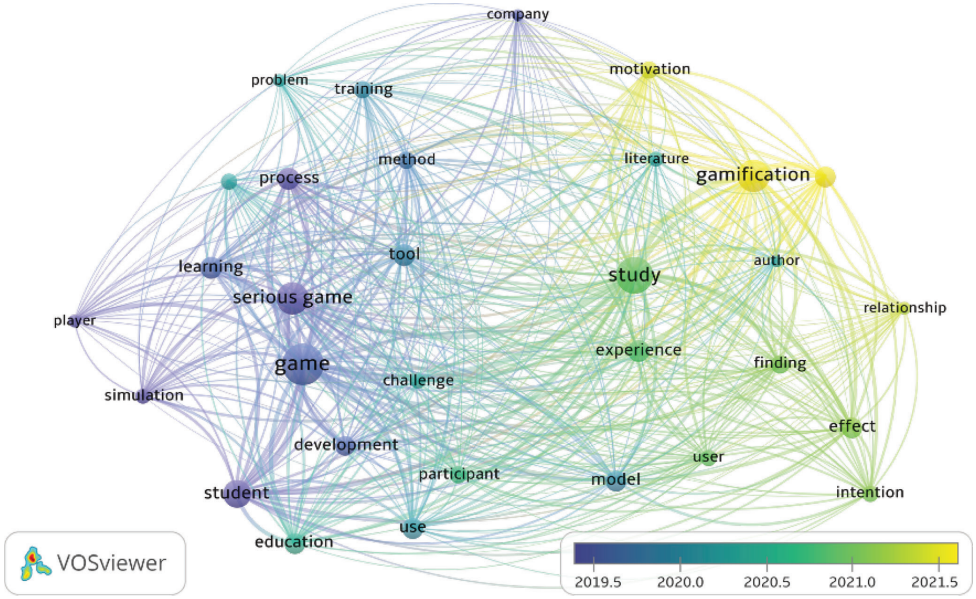
We have also used Figure 3 for overlay visualisation, which shows the temporal distribution of keyword in each cluster (Caputo et al., 2021). In this figure, the keywords are coloured according to a score depending on the average year of occurrence of a keyword. Colours range from blue (oldest year) to green and yellow (most recent years). The field of studies on Serious Games in business has evolved from a previous focus on topics such as Serious Games and learning (oldest keywords), to more specific topics such as motivation and gamification.

Figure 2. Network diagram of the co-occurrence of keywords



Source: own elaboration.

Figure 3. Overlay diagram of the co-occurrence of keywords



Source: own elaboration.

5. Discussion

The most cited article is "Entrepreneurship Education: Known Worlds and New Frontiers". In it, the latest concepts for teaching entrepreneurship are analysed. Serious Games are proposed as a tool to provide students with a different environment to actively practise entrepreneurship. This can be achieved through activities such as a treasure hunt on social media to simulate the creation of businesses and organisational culture, or participating in video games to understand entrepreneurial thinking. This approach, combined with a fun component, is designed to produce serious and impactful results in the field of business education. As a result, Serious Games allow students to play in a virtual environment that mirrors reality (Neck & Greene, 2011).

In "It starts at home? Climate policies targeting household consumption and behavioural decisions are key to low-carbon futures", the fundamental role of households in global greenhouse gas emissions is analysed. The Serious Game is used to have participants imagine a scenario in which they were required to reduce their carbon footprint by 50% by 2030. Participants must make decisions about food consumption, mobility, housing, and other consumables. After the Serious Game simulation, the achieved reduction is presented, aiding public education and highlighting the consequences of decision-making and its impact on emissions (Dubois et al., 2019).

The article "A framework for construction safety management and visualisation system", with 205 citations, addresses the improvement of safety management practices in construction. A novel Safety Management and Visualization System (SMVS) through augmented reality and games is proposed. The goal is to increase workers' risk recognition capacity and improve real-time communication between site managers and workers. An expert safety assessment and a case study are conducted. The article emphasises the practical applicability of the Game Studio environment in the safety management process (Park & Kim, 2013).

Researchers Xu, Buhalis, and Weber, in 2017, analyse "Serious Games and the gamification of tourism" published in TOURISM MANAGEMENT. The article examines the application of gamification in the tourism sector and how it presents an opportunity to achieve higher levels of satisfaction and brand loyalty through precise interactions. It is a relevant article as it conceptualises gamification in tourism and highlights best practices for successfully implementing it as a tourism marketing tool. Tourists can enjoy the advantages of gamification, experiencing the fun derived from the game (hedonistic value) and receiving practical benefits such as tourist information and rewards like free tickets and discount coupons. For tourism companies, gamification offers a more dynamic relationship with customers, resulting in a positive perception of the brand and increased loyalty (Xu, Buhalis, and Weber, 2017).

In the research "Enhancing Construction Hazard Recognition with High-Fidelity Augmented Virtuality," Albert et al., in 2014, present an augmented virtual reality training platform, known as SAVES, with an effective learning system. The platform is designed to enhance hazard recognition skills among construction workers. Field experiments with workers from various projects demonstrated a substantial improvement in hazard recognition and communication after the game. The study underscores the potential advantages of integrating serious game concepts and augmented virtual environments into occupational health and safety training. The implementation of Serious Games could lead to a reduction in construction-related injuries (Albert et al., 2014).

The study "Does gamification affect brand engagement and equity? A study in online brand communities" by Xi & Hamari in 2020 explores the connections between gamification, brand engagement, and brand value within gamified online brand communities. The results revealed that gamification features related to achievements and social interaction showed positive associations with all three facets of brand engagement: emotional, cognitive, and social. Immersion in gamification was only positively associated with social brand engagement. Additionally, brand engagement shows a positive correlation with brand value. These results suggest that gamification can positively influence brand engagement, thereby contributing to increasing its value (Xi & Hamari, 2020).

The research "Design of a virtual reality training system for human-robot collaboration in manufacturing tasks" by Matsas & Vosniakos in 2017 presents a serious game that realistically simulates collaboration between industrial robots and humans in basic manufacturing tasks. This article focuses on a virtual reality training

system designed for the assembly of aerospace composite material pieces. The game includes the analysis of system configuration, user tracking, and navigation, emphasising interaction techniques that facilitate virtual collaboration between humans and robots. Safety considerations are addressed with an emergency system, and the study explores improved user behaviours during robot collaboration. Highlighting the results, 76% of players reported feeling like they were participating in a fun game during the experiment, and 90% believed that training tasks requiring human-robot collaboration could be more engaging through interactive "Serious Games" (Matsas & Vosniakos, 2017).

In "Gamification and Serious Games: A literature meta-analysis and integrative model" Baptista and Oliveira (2019) conduct a meta-analysis to synthesise the literature on gamification and Serious Games. In the study, predictors of gamification usage intention are examined, and attitude, enjoyment, and utility are identified as the most significant factors. Furthermore, intention, enjoyment, and utility emerge as key predictors of brand attitude toward gamification (Baptista & Oliveira, 2019).

Gao, Gonzalez, & Yiu in 2019 conduct the article "The effectiveness of traditional tools and computer-aided technologies for health and safety training in the construction sector: A systematic review". The study primarily evaluates the effectiveness of training using traditional tools and computer-aided technologies on individual's well-being. Effectiveness measures included knowledge acquisition, alteration of unsafe behaviour, and the reduction of injury rates. The results indicated that traditional tools showed effectiveness, supported by statistical evidence. However, the effectiveness of computer-aided technologies was also evident, but the study suggests analysing more cases to provide more robust evidence (Gao, Gonzalez, & Yiu, 2019).

The paper "A comparison of computer-based and game-based formative assessments: a long-term experiment" is one of the most relevant as, in 2023, it received the Highly Cited WOS rating. The study investigates the impact of two formative assessment tools, computer-based assessment (CBA) and game-based assessment (Kahoot!), on the perception of learning, behavioural intent, and learning performance in a university setting. It is established that the perception of fun systematically influenced behavioural intent in the class using Kahoot! There are no significant differences in scores obtained midway and at the end of the semester between the two classes employing different systems. Therefore, it can be concluded that by applying a more enjoyable approach, very similar grades can be obtained, and the learning experience is more enjoyable.

6. Conclusion

This article aims to draw conclusions about the effectiveness of Serious Games in business environments through a literature analysis. The analysis addresses both employee training and the impact on customers, exploring the presence and

application of Serious Games in different industrial sectors based on the reviewed documentation. As a result, we identify best practices and offer recommendations for the successful implementation of Serious Games in business environments.

After conducting the literature analysis, we observed that the use of Serious Games is highly beneficial in various disciplines, such as marketing (Xi & Hamari, 2020; Xu, Buhalis, and Weber, 2017), healthcare (Gao, Gonzalez, & Yiu, 2019), and science (Fox et al., 2020), providing a unique opportunity for proactive learning by offering students an immersive experience (Romero Rodríguez, 2023). The use of Serious Games in the education sector should particularly focus on engineering students, fostering motivation to apply new teaching methods (Braghirolli et al., 2016; Dib & Adamo-Villani, 2014).

Regarding the analysis of publications, we observed a significant increase in scientific production related to Serious Games, indicating growing interest and relevance in this research area. The most prolific year to date is 2022 with 85 published articles. The number of citations also follows an upward trend, with 2022 receiving 1,620 citations, followed by 2023 with 1,397 citations. The institution with the highest publications in the field is INRAE (France) with 16 articles on Serious Games, followed by Wageningen Univeristy Research (Netherlands) with 12 articles, 380 citations, and an average of 31.67 citations per article. Regarding authors with the highest number of publications, Mayer has recorded 9 papers on Serious Games (receiving 262 citations), followed by Dumont and Russell-Bennett, with 6 records each.

As best practices, we found that Serious Games are effective for simulating business creation, developing skills through a playful approach and yielding positive results in business education (Neck & Greene, 2011). Additionally, Serious Games can educate about the consequences of citizens' decisions and their impact on emissions. Through simulation, awareness can be raised about reducing the carbon footprint (Dubois et al., 2019). Serious Games also educate employees about workplace safety management (Gao, Gonzalez, & Yiu, 2019), particularly in the construction sector through augmented reality (Albert et al., 2014; Park & Kim, 2013). In the tourism sector, Serious Games are identified as a good practice for gamifying interaction with customers, promoting greater brand loyalty (Xi & Hamari, 2020). Tourists enjoy the fun, in addition to the practical benefits offered by the company's service (Xu, Buhalis, and Weber, 2017). Overall, the literature analysis provides positive evidence about users' gaming experience, even when simulating human-robot collaboration in manufacturing tasks (Matsas & Vosniakos, 2017).

This paper acknowledges limitations, including potential bias in article selection and a narrow focus on the benefits and challenges of Serious Games in enterprises, overlooking long-term sustainability. Future research could explore the impact of Serious Games on employee training and customer interaction, compare their effectiveness with other approaches, and assess their sustainability and applicability across sectors. Despite these limitations, the paper contributes to academic knowledge and offers practical insights. By identifying best practices and recommending successful implementation strategies, it enriches the field and enhances employee

training, customer impact, and consumer interaction across industries. Ultimately, this work promotes the effective use of Serious Games in business, benefiting society and advancing knowledge in this emerging field.

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