Serious games as an efficient strategy for science communication in the Covid-19 pandemic

Los *serious games* como estrategia eficiente para la comunicación científica en la pandemia de la Covid-19

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RESUMEN
Introducción: Las necesidades comunicativas derivadas de la pandemia de la Covid-19 han favorecido el desarrollo de iniciativas dedicadas a canalizar la información a la ciudadanía a través de diversidad

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de acciones. Los *serious games* generados a través de *game jams* son un ejemplo destacado. **Metodología:** El objetivo principal de esta investigación es evaluar las posibilidades de producción eficiente de *serious games* en el ámbito de la comunicación científica sobre la Covid-19, y en el contexto de producción establecido por las *game jams*. Desde una perspectiva cualitativa, se realiza una búsqueda selectiva de este tipo de eventos en el contexto de la pandemia de la Covid-19, e identifica aquellas producciones cuyo objetivo sea informar con rigor científico sobre aspectos relacionados con la Covid-19, con un modelo de comunicación lúdica. **Resultados:** Se analiza el modelo de producción y seguidamente la estrategia lúdica de las tres tipologías de videojuegos que ofrece la muestra: basados en la reacción, recreación y estrategia. Como último elemento de análisis, la jugabilidad aporta una triple visión donde destaca especialmente la usabilidad de los juegos. **Discusión y Conclusiones:** Por una parte, se evidencian las necesidades de planificación e inversión que requieren los *serious games* para garantizar su efectividad como productos comunicativos en el ámbito científico. Igualmente, se observa que la alta inversión y producción no influyen obligatoriamente en la receptividad de los públicos. Por último, se concluye que la adecuada orientación de públicos y objetivos, logran generar una adecuada estrategia comunicativa eficaz en el ámbito de la ciencia.

ABSTRACT

Introduction: The communicative needs derived from the Covid-19 pandemic have encouraged the development of initiatives dedicated to channeling information to citizens through a diversity of actions. Serious games generated through game jams are an outstanding example. **Methodology:** The main objective of this research is to evaluate the possibilities of efficient production of serious games in the field of scientific communication on Covid-19 and in the context of production established by game jams. From a qualitative perspective, a selective search of this type of events in the context of the Covid-19 pandemic is carried out and identifies those productions whose objective is to inform with scientific rigor on aspects related to Covid-19, with a ludic communication model. **Results:** The production model is analyzed, followed by the ludic strategy of the three types of video games offered in the sample: reaction-based, recreation and strategy. As a last element of analysis, the playability provides a triple vision where the usability of the games stands out especially. **Discussion and Conclusions:** On the one hand, the planning and investment necessities that serious games require to guarantee their effectiveness as communicative products in the scientific field are evident. Likewise, it is observed that the high investment and production do not necessarily influence the receptivity of the public. Finally, it is concluded that the appropriate targeting of audiences and objectives can generate an adequate and effective communication strategy in the field of science.

CONTENIDO

CONTENT

Translation by **Paula González** (Universidad Católica Andrés Bello, Venezuela)

1. Introduction

The history of video games has been marked since their origins by their ability to adapt and evolve. In the current digital ecosystem, the video game industry has managed to position itself prominently. In 2020, a year marked by the social and economic effects of the first waves of the Covid-19 pandemic, according to the Spanish Video Game Association (AEVI, 2021), the video game industry in Spain increased its turnover by 18% compared to the previous year and, for the first time, online sales exceeded physical sales. The number of players also increased, standing at 15.8 million in 2020, as well as the average weekly hours dedicated to this activity (7.5 hours), although this continues to be lower than that of neighboring countries, such as Germany, France, or Italy (AEVI, 2021).

Beyond the big figures, it is in the context of the pandemic when, although the dichotomous debates about the benefit or not of their use remain latent, the focus shifts to responsible use and consumption, as well as the possibilities of a wide, complex, and connected playful universe, leaving aside the "antisocial" stigma of their consumption to become a "reinvented form of social media" (IDG Consulting, 2020, p. 5).

Since society had to assume the vital changes derived from adapting to the pandemic environment, initiatives have multiplied to transmit information in the best possible way (Costa-Sánchez and López-García, 2020; Garrett, 2020), and to build a new narrative discourse for scientific communication actions. Defining a scientific communication free of complexities and aimed at offering truthful, real, and simple information became a necessity that the Spanish Association of Scientific Communication (2020) reflected in the publication of a decalogue in which the main recommendations to follow when reporting on the Covid-19 pandemic were noted. According to De Sola (2021), the media was asked for a public service action, which guaranteed the publication of "true and rigorous information, avoiding the use of sensational images and language, publicizing the available scientific evidence, and using clear language accessible to the general public" (p. 2).

It is in this framework that initiatives arise for the use of video games as vehicular tools for scientific communication (Kippes, 2020). Their possibilities, apart from the merely playful, are what have induced their application in learning contexts for years (Álvarez, 2010), with a diversity of formats still under exploration. Contreras et al. (2011) pointed out how the appearance of new resources on the internet had facilitated the transformation of the concept of learning, generating new paradigms and especially highlighting one of them: "having fun while learning" (p. 254). This communicative option, through a playful environment, but focused on transmitting clear and precise information, has made it possible to create video games aimed at disseminating effective control and security measures in the face of the pandemic, with a characterization typical of serious games.

1.1. Beyond entertainment: serious games

In 1969, Abt referred to the term serious games as one that defines games (referring to board games, cards, etc.) with an "explicit and carefully planned educational purpose and that are not intended to be played solely for fun " (Abt, 1987, p. 9).

In recent decades, the growth of the industry dedicated to the development of these types of products and their application in educommunicative processes in different areas of knowledge has increased interest and literature around the term. However, the definitions provided do not differ in essence from Abt's proposal, agreeing that the key to these products is their educational purpose, which differentiates them from those that have a purely recreational purpose (Zyda, 2005; Michael and Chen, 2006; Susi et al., 2007) and in that they respond to a previous educational program (Sorensen and Meyer, 2007), an end that, on the other hand, is present in their conception, design, and development.

Traditionally, the concept of serious games has been linked to education, and in terms of the type of products, to those especially related to the concept of simulation, insofar as methodologically they favor situated, in context, and active learning (Gros, 2002), and learning based on contextualized cases (Moreno-Ger et al., 2014) that have a clear relationship with the real practice object of the educational activity (Addy et al., 2018; Hallinger et al., 2020). In short, they allow learning by doing, through the subject's experience with the simulated environment, in which they can carry out complex actions without their mistakes causing real damage, and they allow them to learn from mistakes, how to avoid them, and their consequences. And this not only applied to sectors that entail a high risk derived from the professional practice itself, but also for the work of the so-called soft skills, such as leadership, conflict management, diplomacy, and emotional intelligence (Almeida and Buzady, 2022) or awareness of social issues (Paredes-Otero, 2018).

Although the "serious" purpose marks the imprint and the need for careful planning in the design of serious games (Gorbanev et al., 2018), their development must use strategies aimed at promoting playful communication through careful gameplay, understood as "the set of properties that describe the player's experience with a given game system, whose main objective is to amuse and entertain satisfactorily and credibly" (González et al., 2008, p. 5) and that, to adequately attend to its serious purpose, in serious games, it must also aim for the "balance between the learning objectives and the fun of the experience" (Morales and San Cornelio, 2016, p. 3), adapting the proposed challenge to the progression of skills of the player and promoting the implicit learning of the player (Sierra-Martínez et al., 2022).

Caserman et al. (2020), based on the DIN SPEC 91380 specification, raise the need to maintain a balance between the serious aspects and the playful aspects, placing as central elements of the "serious" part of the game: the existence of a characterization objective, a methodology appropriate to the stated objective, and quality assessment; and, regarding gaming: preferential attention to elements related to entertainment and the quality of the means used.

1.2. Serious games as a tool for scientific communication of Covid-19

Responsible Research and Innovation (RRI) shows as a necessity the analysis of initiatives that create playful and open communication products accessible to all audiences, and that promote citizen participation and scientific education as key objectives indicated by the Horizon 2020 and Horizon Europe Programs (Forsberg et al., 2020). As a strategy for scientific communication, serious games are an effective tool to condition or direct the user toward certain positive social behaviors (Martínez-Cano et al., 2019, p. 1475), also usable in the field of public health (Maiolini et al., 2012).

The proposals for the creation of video games as tools for the communication of information around Covid-19 cover different models, among which can be found: a) newsgames, as specific developments to combat disinformation (Gómez-García and Carrillo-Vera, 2020), "empower the player as a citizen" (Herrero-Curiel and Planells, p.21), and develop critical thinking and media literacy (Grace and Farley, 2016), although their production during the pandemic has been relatively scarce (Navarro-Sierra and Quevedo-Redondo, 2020); b) creations dedicated to training and raising awareness in the health sector (Suppan et al., 2020), or c) the video games aimed at informing in a certain precise way about the prevention and containment measures that society must know at all times and that are predetermined by scientific research.

1.3. Production of serious games in a global context

Despite the increase in the consumption of serious games on mobile devices, as Kara (2021) points out, the number of studies on the use of this type of product in science education is even lower than those that analyze its use on other platforms, especially compared to those created for the computer or the internet. Likewise, and specifically, as far as playful action is concerned, research has focused on the adventure genre, although sports, simulation, role-playing, and puzzle games also occupy a prominent position, compared to games of racing, strategy, or platforms.

The production of serious games suffered a slight decrease in 2020 in terms of studies dedicated to their development, going from 29% in 2019 to 22% in 2020 (DEV, 2021). The Spanish Video Game Database, DeVuego, only records 4 video games classified as "serious" to date, although it defines "educational" ones as "video games whose objective is not only to entertain but also to educate or help learn about some subject or topic" (DeVuego, 2022). In this category, there are 88 published titles and 1 in development. Only one video game related to the Covid-19 pandemic appears in this list, *Covid Game*[2], developed in 2020 by Omnium Lab Studio, an educational mobile game, developed with Unity, with a free license.

Other serious games about Covid-19 have had the altruistic participation of Spanish studios, such as *Flatten Island*[3] (2020), developed by Videogames without Borders, to raise funds for the fight against the Covid-19 pandemic. Other similar productions in the international arena stand out for emerging linked to research centers, such as the newsgames *Factitious 2020*[4] (2020), produced by The AU Game Lab and The JoLT program, and *GoViral!*[5] (2020), developed with the support of the World Health Organization and the collaboration of The Social Decision-Making Lab (Cambridge University), DROG, Gusmanson, and the UK Cabinet Office.

According to the Spanish Association of Video Game and Entertainment Software Producers and Developers (DEV, 2018), the estimated time to make a computer video game in Spain is from 9 to 24 months, times that can be reduced to 3 to 9 months for simpler or "casual" projects and from 6 to 12 months to develop a video game for a portable console. Regarding mobile and smartphone games, the estimated time would range from 3 to 8 months (p. 55), even less for simple content in which reaching users in the shortest possible time is a priority (Gómez-García, et al., 2019). On the other hand, mobile devices (smartphones [20%] and tablets [10%]) are at the head of the most used devices for the consumption of video games in 2020, only surpassed by consoles (25%), especially in the age ranges between 11 and 24 years old (AEVI, 2021).

Regarding the characterization of video game production, according to the DEV (2021), the Spanish business fabric is mostly made up of micro (70%) and small (25%) companies, where only 18.5% of jobs are occupied by women and with a marked concentration of studies, jobs, and turnover in the Community of Madrid, the Valencian Community, Andalusia, and, especially, in Catalonia, where 27.3% of studies, 46% of employment, and 51% of turnover in 2020 are concentrated.

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[2] https://omniumlab.com/portfolio/covid-game/

[3] https://flattenisland.org/

[4] http://factitious-pandemic.augamestudio.com/#/

[5] https://www.goviralgame.com/en

Regarding the use of engines, Unity is positioned as the most used game engine in development in the last decade, used in 64.8% of Spanish games produced in 2020 (DeVuego, 2022).

Taking into account these estimates, the trends in consumption and the maturity of the business fabric dedicated to the production of video games, with 78% of companies that in 2020 did not exceed 10 years (DEV, 2021), the production of video games for mobile platforms ventures as a less risky option in terms of resource forecasting.

1.4. Game jams as a context for the production of serious games

Since the first Indie Game Jam was held in 2002, these events have multiplied, sometimes within the framework of The Global Game Jam[6] http://globalgamejam.org/ (GGJ), others as independent activities, linked to specific themes and organizations. The game jam movement is fundamentally a virtual or face-to-face encounter, in which a group of developers decides to develop video games with the premise that the activity is carried out in a short period. It adopts the forms and possibilities of the *hackathon* (Cabrera et al., 2021), but its orientation, instead of software, is the creation of video games. The GGJ is the most important video game creation event in the world. Since its launch in 2008, the results of each edition are shown on its website, which offers the progression of participants and results. In 2020, 9,601 games were generated with 934 locations in 118 countries, with specific editions also related to the development of serious games, such as the one organized in January 2022 by the Canarian Association of Video Game Developers under the slogan "Change the world through games" (2021).

Game jams are premised on the short space of time in which their development can be carried out (Kultima, 2015; Massa and Alfredo, 2017), which usually results in the quality of the products made and may influence the developers' profiles to require certain professionalism, which allows them to have optimal knowledge of the tool to be used.

These development contexts are revealed as privileged ecosystems for the study of video game production. They encourage developers to acquire skills that increase efficiency in production processes, especially resource management, both time perception and management, as well as co-creation (Kultima, 2021).

Whether in person or online, the organization of the event defines the basic rules of development, which includes: timing, engine to use, theme or central themes. The temporary formats vary from the classic, between 24 and 72 hours, to the so-called slow game jams, which can last days, even weeks.

On certain occasions, besides the traditional actors in the industry, especially in the field of serious games, there is room for other expert roles in the field of science and research (Kultima, 2021). In this way, game jams include indications made by institutions or organizations specialized in the chosen subject, to generate video games with a purpose that goes beyond entertainment, to help solve specific problems and real-world situations (Ramzan and Reid, 2016); and with scientific quality, as is the case of various game jams that emerged around the Covid-19 pandemic (Matthews and Thomas, 2022).

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[6] http://globalgamejam.org

2. Objectives

The main objective of this research is to evaluate the possibilities of efficient production of serious games in the field of scientific communication on Covid-19 and in the context of production established by game jams, responding to the following specific objectives:

SO1. Characterize serious games from the point of view of the resources used for their production.

SO2. Identify the playful strategies implemented through their mechanics, dynamics, and aesthetics.

SO3. Assess the efficiency of serious games as products for playful communication based on gameplay analysis.

3. Methodology

Starting from the hypothesis that the development of serious games for the scientific communication of aspects related to Covid-19 must combine a careful informative and educational strategy, with a playful strategy that favors adequate playability, this research has evaluated the possibilities to develop both in a production context limited in time and resources, production conditions that are recreated in game jams.

The research is qualitative since even though it combines quantitative and qualitative strategies to obtain, analyze, and present (Valles, 2007), it aims to describe and explain the studied phenomenon (Sierra Bravo, 2007) and identify the conditions in which it occurs. (Danke, 1986). It begins with the prior documentary study that has made it possible to identify the initial production requirements, based on which we designed the selective search for video games developed in the specific context of the production of game jams held during the Covid-19 pandemic between March 2020 and March 2022, which can be classified as serious games, and whose objective is to train or inform with scientific rigor on aspects related to Covid-19.

The analysis of the selected video games is proposed from three perspectives that allow evaluating the viability to carry out serious games, efficiently, for the effective scientific communication of Covid-19:

In the first place, considering the video games in the sample as interactive products, an attempt has been made to identify the basic resources used. Some, such as the time and content to be discussed, are defined in the event's participation rules, but in this analysis special attention is paid to the composition of the work teams, the success rate in the development of the projects, defined by the percentage relationship between the number of projects delivered and the number of games successfully completed, according to the specifications of the events, as well as the tools used.

Second, the MDA (Mechanics, Dynamics, and Aesthetics) approach developed by Hunicke et al. (2004) was used to, from the systemic conception of the videogame, identify: 1) the mechanics, understood as the particular components of the game; 2) the dynamics or behaviors in the execution time of the system, to classify the types of gameplay and the required skills (Martín, 2015); and 3) emotional or aesthetic responses as an expression of the player's experience when interacting with the system (Hunicke et al., 2004; Sánchez, 2018), to identify the essential features of the implemented playful strategies.

Thirdly, the aspects that can affect the playability of the project were evaluated, such as graphic quality, the level of simulation of artificial intelligence (AI), progression of difficulty in game time, and usability, based on the analysis of the ease of use of the controls, the existence of saving options, the existence of help and tutorials, and the evaluation of the feedback system (Martín, 2015).

3.1. Sample selection

Initially, production contexts that meet the study criteria have been selectively sought, selecting those game jams, held between March 2020 and March 2022, whose central theme was the Covid-19 pandemic and in which the developers have participation and/or specialized scientific advice on the subject.

Only 3 events have been identified (Table 1) that meet these established criteria, in which 67 prototypes have been developed.

Table 1. *Game jams dedicated to the Covid-19 pandemic between March 2020 and March 2022*

Name	Organizers	Date	Number of games produced
Fight Covid Jam	Peninsula Corporate Innovation GameBCN, Health professionals from the Hospital Universitari de Bellvitge, Socialpoint, DKV.	From 16/04/2020 to 19/04/2020	15
Flattening it Together - Covid-19 Game Jam	The Fedex Institute of Technology - Memphis Game Developers.	From 30/05/2020 to 02/06/2020	3
Jamming the curve	LAbX, Georgia Tech, Seattle Indies, INDCOR, Northeastern University´s Game Studio and Pre-mack Roces PC, *gamers*, public health experts, and scientists.	Froml 15/09/2020 to 03/10/2020	49

Source: own elaboration from the websites of the game jams.

The games produced in the context of *Flattening it Together - Covid-19 Game Jam* were discarded for the sample because the produced prototypes respond to the theme, but not to the purpose of the object of study. As for *Jamming the curve*, although they met the scientific criteria that supported the development of serious games on the subject of the research, these are carried out in a broader time context or slow jams.

The games that were produced in the context of the *Fight Covid Jam*, held between April 16th and 18th, 2020, with a registration of 86 participants, made up of 21 teams, and to "contribute to raising awareness of the use of preventive measures to stop the spread of COVID-19" (GameBCN, 2020), specifying that:

> The theme of the games (what will be gamified) will be related to the preventive measures that must be adopted to prevent the spread of the virus. The gamification of the measures to prevent the spread of Covid-19 must have scientific and communicative rigor, with a very respectful tone. (Península, 2020)

The titles of the 15 games produced were as follows: *NIOT – Now is Our Time, Covid-19_Frenzy, Covid-19: Historias Compartidas, Covid19quest, Covidpoly, Don't Touch, eVIDence, Flatten the*

curve, The Cleaner, Preveni2, Quarantine Challenge, QuarantineLife, CovidQuiz, Santatze, and *Unidos contra Covid19.*

Although the organization fell on the consulting firm Peninsula Corporate Innovation[7] and the non-profit video game studio incubation program, GameBCN[8], it also had the participation of health professionals from the Hospital Universitari de Bellvitge, from the specialized company in the development of mobile games and apps, Socialpoint, and the insurance company DKV.

The information was collected through first-person observation and experimentation, the previous download in .apk format from the game jam website (GameBCN, 2020) and installment on an Android mobile device, and was complemented by viewing of the gameplays generated by the participants for the event and the information published on the official website of the game jam (GameBCN, 2020). Each video game in the sample was played on at least two occasions by two members of the research team, and subsequently, the results of the observation process were shared, based on the self-made instrument designed for the study (Gertrudis -Casado et al., 2022a). In those cases in which the assessments of the two researchers were different or extreme, a discussion process was opened that included the judgment of a third researcher.

As a result of this process, the assessments made by the researchers on the elements under analysis were obtained and are available for consultation in Gertrudis et al. (2022b).

4. Results

4.1. The production model

The characteristics of the production model are, to a large extent, marked by the specifications of the context. For this reason, the purpose, the minimum structure, the (mobile) platform, as well as the target audience to which the games are directed have been defined in the game jam rules, placing the focus on the age range from 14 to 55 years old.

Regarding the minimum structure established in the regulations, all games must contain a didactic introduction about Covid-19, gamify the use of the mask, and gamify at least one more measure to prevent the spread of the virus. The specifications were published on Discord, the chosen channel for communications, on April 16th at 9 a.m. and the teams had 4 days, until midnight on April 19th, 2020, to deliver the projects.

Of the 21 participating teams, 15 would finally deliver their projects, although in 33.33% of the analyzed games (N=5) functionality problems have been detected that prevent, in some cases, completing the game. This must be taken into account since it makes it impossible, when interpreting the results, to evaluate certain aspects. In these cases, the information obtained from the experimentation in the first person has been completed, with the analysis of the gameplays generated by the developers themselves.

The teams that delivered their projects had between 1 and 7 members. 40% of the video games delivered were developed by teams made up of 5 or more components and only one individual proposal was submitted. The success rate among teams with up to 4 members was 75% (N=6), while among those with 5 or more members, the success rate was 33.33% (N=2). Regarding the gender composition of the

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[7] https://peninsula.co

[8] https://gamebcn.co/

development teams, female participation only reached 16.92% of the total number of participants, and 53.3% of the groups (N=8) were made up of only men.

One of the requirements of the game jam was that the participants had to "have everything necessary (hardware and software) to participate in the development of a video game" from their homes (GameBCN, 2020) and it was recommended to have "basic knowledge" to not harm the rest of the group components. Analyzing the composition of the teams, it is observed that, in terms of professional profile, the members of at least 6 groups have been identified as students linked to training centers collaborating with the event (Centre de la Imatge i la Tecnología Multimèdia CITM (Universitat Politècnica de Catalunya; the Escuela de Nuevas Tecnologías Interactivas attached to the Universidad de Barcelona (ENTI-UB), and the Escuela Sant Marc de Sarrià), 5 groups linked to independent video game developers, and 4 groups in which the link could not be determined.

Regarding the tools used, it has been determined that 80% of the games are made with Unity. The three teams that opted for other solutions, such as their own tools (2) and Unreal Engine (1), correspond to teams linked to or whose members are part of independent video game developers.

The characteristics of the production model are a reflection of the production model in Spain, especially regarding gender distribution and the preferential use of the Unity engine (DeVuego, 2022). As for the composition of the groups, it also recreates the composition of the business fabric characterized mainly by the existence of small studios.

4.2. The playful strategy

The MDA analysis model (Hunicke et al., 2004) has been applied and the analyzed video games have been grouped according to the type of predominant gameplay (Martín, 2015). As a result, the existence of 2 outstanding categories has been identified, characterized by reaction and recreation gameplays, and a third category of games in which, even presenting elements of the previous ones, it is considered that strategy predominates.

4.2.1. Reaction-based video games

In those video games in which reaction-based gameplay predominates (N=8), especially with levels and arcade features, the increasing difficulty is identified over time and the player requires reflexes and skill in the use of the controls. These are simple video games, with an estimated time to complete the game of fewer than 10 minutes, in which the player must perform a limited number of actions, mainly selecting the correct option based on a proposed case or situation. In most of these games there is a time variable (N=5), generally in "countdown" mode, which marks the time the player has to reach the minimum number of correct answers to overcome the proposed challenge (*Covid-19 Frenzy, eVIDence, Preveni2, CovidQuiz,* and *Unidos contra CoVid19*).

Figure 1. *Time in reaction video games.*
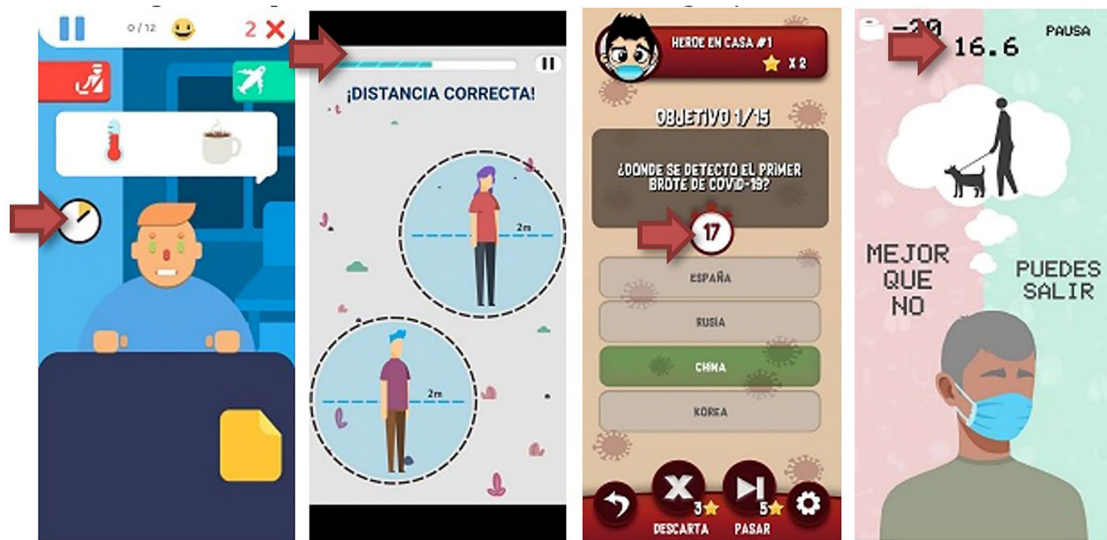
Source: *Evidence, Preveni2, CovidQuiz,* and *Unidos contra CoVid19* screenshots (GameBCN, 2020).

In other games (N=2) time adopts a different functionality. In *NIOT – Now is our time*, time is related to an increase in difficulty since it implies a greater number of characters to pay attention to, that is, over time the difficulty to control the situation increases, being in this case, "drag and drop" the main mechanic, both to maintain the social distance of the characters, and to place the necessary protection and hygiene measures on them. In *The Cleaner*, a platform game defined by the developers as an endless runner type, the objective is to survive as long as possible, avoid the obstacles that arise, and control the level of infection caused by the virus. In both cases, these are games in which the estimated time to complete will depend on the skill and reflexes of the player.

From the point of view of aesthetics, the mechanics and dynamics generated during the execution of the system, especially derived from the pressure exerted by time in decision-making and actions, mainly evoke experiences aimed at a personal challenge and the self-discovery of knowledge and skills.

Regarding the execution of the projects, a reasonable success rate is identified in its production, since only 1 of these games presents operating errors (12.50%) and regarding the necessary resources, it is verified that 7 of the 8 projects in this category (85.71%) are developed by teams made up of a maximum of 4 components, with the success rate, in this case, being 85.71% (N=6).

4.2.2. Recreation-based video games

This category mainly includes social simulation games (N=5), in which situations related to reality during the first month of the state of alarm and the period of confinement are recreated. In these games, the objective is survival and avoiding the spread of the virus, and as far as the player's actions are concerned, they are based on the proper management of resources, and for this, the player will have to interact with the environment and make appropriate decisions. The spaces in which the action takes place in these games are: the home, supermarket, hospital, and outside, understood as transit areas to carry out actions that are strictly necessary in the context of the pandemic *(Covid-19: Historias Compartidas, Flatten the curve, Quarantine Challenge, Quarantine Life, Santatze)*.

From a mechanics point of view, the player's actions are simple and repetitive. You can move around the space, you must interact with the elements that exist, and the main action is to manage the resources properly. The conditions of victory reside precisely in being able to maintain the balance between the different needs (hygienic, social, and nutritional) during confinement, and for this, time once again acquires a prominent role. In this case, time is represented as real-time in worlds and, although accelerated compared to game time, it is a fundamental variable, since defeat conditions are associated with any of the associated variables reaching 0. The main objective is resisting the time of confinement, complying with safety and hygiene regulations, what social isolation implies, and the consequent impact on social relationships and people's moods. Do not succumb to routine, expressed in the cyclical and repetitive nature of actions. The relationship between the variables is more complex and that transfers greater responsibility to the player, some decisions can positively affect one variable and subtract another. The case in which this relationship is more evident is in *Covid-19: Historias Compartidas*, in which talking to a neighbor can increase the level of happiness but implies a risky situation (social distancing and hygiene).

As for the aesthetics, they are playful experiences that, besides evoking the challenge, encourage the player's narrative immersion in the story. The player becomes part of the problem and the solution and, although the functionality of the collaborative game is not implemented as such in the sample, the playful story does not only promote self-discovery (individual priorities), but also the understanding of the game as a social framework (social implications of individual decisions).

4.2.3. Strategy-based video games

Two games are classified in this category, *CovidQuest* and *Covidpoly*, in which, despite having elements of action and recreation, it is considered that the defining feature of their dynamics lies in strategy. This classification is made taking into account that both cases present operating problems or require the implementation of certain functionalities, for which attention has been paid to the gameplays and descriptions of the developers, teams made up of more than 5 members, to complete the analysis, in particular of *CovidQuest*, where a role-playing game is proposed, in which the character is a citizen who must interact with the environment, complying with hygiene and personal protection regulations.

Covidpoly is a puzzle game with 6 levels of difficulty in which, unlike all previous proposals, time is not decisive, as the player's actions are based on reflection and not reaction. It is not a recreation game, since how the challenge is transferred to the player does not have parallelism with the reality to which the information alludes. The challenge is to complete the actions in the correct order and to do so, it is necessary to properly use the cards and the dice to move around the board. The estimated time to complete the game will depend on the player's strategy.

Despite not having all the functionalities implemented, it is considered that the estimated duration in both cases will be greater than 10 minutes.
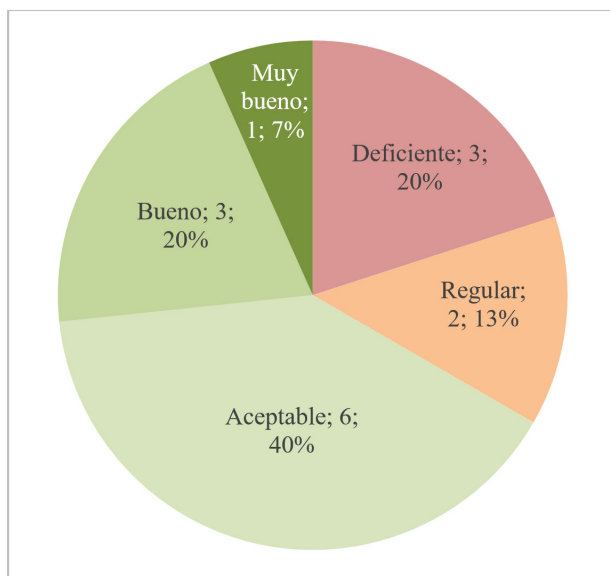
4.3. Gameplay

4.3.1. Graphic quality

40% of the games (N=6) have "acceptable" graphic quality, that is, the graphic resources used allow them to fulfill their communicative purpose without the quality of the graphic elements hindering or enhancing the fulfillment of the purpose of the game. This value predominates because it is the highest, as can be seen in the chart in Figure 2. 20% (N=3) of the games obtain a "good" value, which means

that they use graphic elements that contribute satisfactorily to fulfill the purpose of the game, although they are considered improvable in future iterations. It also highlights that only the winning game of the game jam (Figure 3) obtains the value of "very good" in its graphic quality. This uses two-dimensional figures with prominent colors that allow different elements to be differentiated effectively and without too much cognitive effort. The combination of the simplicity of the graphic elements, the correct visual composition, and the correct choice of the range of colors used, allows this game to obtain the best rating in terms of graphics.

On the other hand, among the games analyzed, there are 2 (13%) classified as "regular" graphic quality and 3 (20%) classified as "poor". This is a very high percentage for those games whose graphic quality interrupts, hinders, or does not allow the achievement of the purpose of the game.

Figure 2. *Graphic quality (N=15).* **Figure 3.** *Winning game*

Source: own elaboration.

Source: *Preveni2* screenshots (GameBCN, 2020).

### 4.3.2. Realism and progression of difficulty in game time

The analysis value that reflects the AI simulation level shows that all games are classified as "simple and repetitive". None of the games incorporates AI technology that adds unpredictability to game dynamics based on the actions performed by the player through interaction. The complete sample analyzed lacks functionality that allows the adaptation of the progress (times or ease of use) to personalize the gaming experience and adapt to the abilities of each player. This means that all the challenges that arise in the games that are part of the object of study are always the same, simple and repetitive mechanics that make it difficult, on the other hand, for the level of replayability to be high in most cases.

In the same way, the progression of the difficulty in the time of the game is a determining factor in the contribution to the fulfillment of the foreseen communicative objectives. For the analysis of this variable, 3 of the games are excluded from the analysis due to functionality problems. This variable describes the intensity and the direction (increase or decrease) in which the difficulty of the tasks

evolves as the player's residence time increases. 47% (N=7) of the games have an ascending progression (Figure 4), which is considered appropriate since it contributes to maintaining or increasing the player's motivation to continue.

Instead, 3 (20%) of the games are found to have a decreasing difficulty progression and 2 (13%) exponentially decreasing (Figure 4). In the first case, the gaming experience is considerably affected due to the decrease in interest to continue playing, since the actions are increasingly easier for the user. In the second case, demotivation or disillusionment is generated as time passes. In these games, there is an exponential leap in difficulty from the first to the second level, leading the player to a state of frustration that can prevent the communicative purpose from being fulfilled.

Figure 4. *Difficulty progression over game time.*
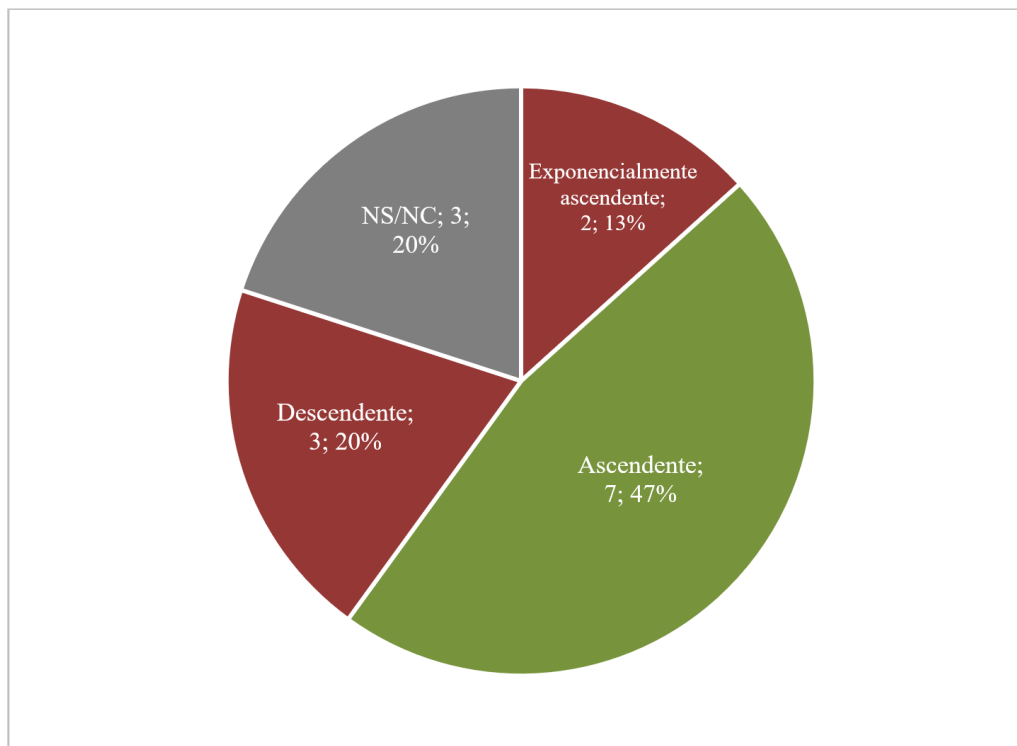
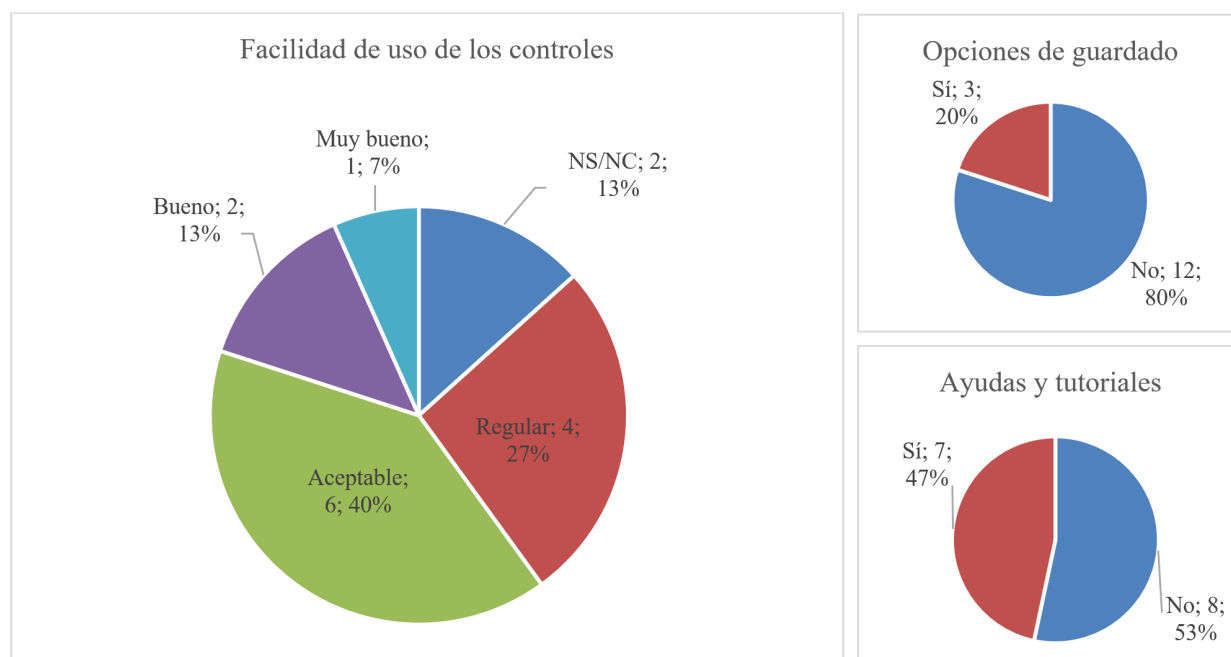**Source:** own elaboration.

4.3.3. Usability

Regarding the ease of use of the controls, most of them are easy to use. The highest percentage, with 40% (N=6), are games that require an acceptable amount of time to become familiar with the controls (Figure 5). Only one of them, the winning game, requires virtually no time to get to grips with since it only uses two actions: tap and drag. Take advantage of these two very widespread controls in the use of smartphones, thus facilitating their use. Furthermore, it adequately applies the pressing surface, becoming, in some cases, the entire screen, which does not give rise to confusion in any case.

On the other hand, 27% (N=4) have a fairly high degree of difficulty in using the controls. In most cases, the "regular" rating is set due to bugs in the functionality (as in the game *NIOT - Now is Our Time*), which fails to determine the drag surface of the object to put the masks on the characters and makes it very difficult to achieve the objectives – or simply because of the complexity of the controls.

In *QuarantineLife* and *Satatze* usability is not valued due to functionality errors.

Figure 5. *Ease of use of controls, saving options, and help and tutorials.*
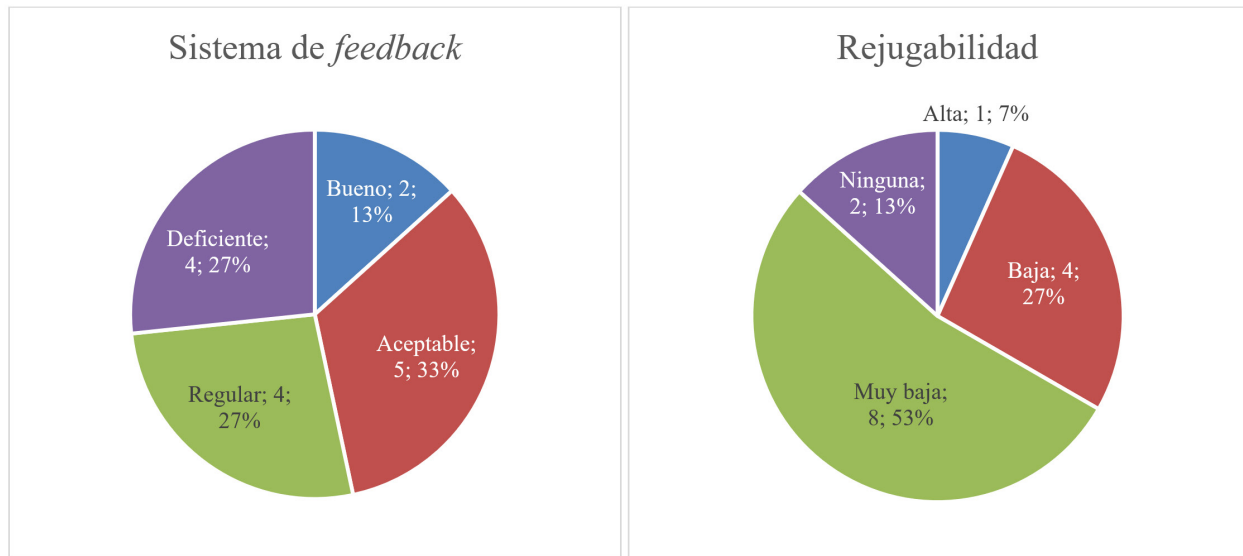

Source: own elaboration.

Another relevant functionality that influences gameplay is the save options, available in only 20% (N=3) of the analyzed games. The *QuizCovid* game save option stands out. In this game, you have to answer 5 questions without failing, and the next level requires answering 10 questions without failing. Each level increases the number of questions that must be answered consecutively. The save option reduces frustration and increases educational gameplay as you have to memorize the correct answer to continue beating levels. This functionality is essential to maintain the player's motivation.

In the video game *NIOT - Now is Our Time*, where to perform the next minigame you must have overcome the previous one, the save option makes it easier to resume the challenge in the future. Since the difficulty of the game is very high from the second level onwards, repetition is presumed essential to overcome it. Therefore, the save functionality plays an indispensable role.

Something also fundamental to facilitate the fulfillment of the educational objectives of the video game are the help texts and the tutorials. 47% (N=7) of the cases analyzed do have help functionalities to facilitate learning how to use the game or tutorials, compared to 53% (N=8) that do not (Figure 5). The most used mode is the text instructions at the beginning of the game that do not necessarily have illustrations or graphics that reduce the cognitive effort to understand it.

On the other hand, the feedback system is the functionality that directly links knowledge with player interaction (Figure 6). No game was found with the value "very good", but 13% (N=2) and 33% (N=5) have good or acceptable feedback systems, respectively, which means that they have a functionality that allows the user to receive adequate information while interacting so that the objectives of the game are achieved. Similarly, the remaining games, 27% (N=4), have poor or regular values (Figure 6), because the feedback system is non-existent or does not provide relevant information for achieving the objectives, or it can be improved.

Figure 6. Results of the feedback system variables and replayability of the analyzed games

Source: own elaboration.

5. Discussion and Conclusions

The analysis of these video games must be duly contextualized at the time of their production, just one month after the state of alarm was decreed in Spain due to the Covid-19 pandemic (March 14th, 2020), on the verge of health collapse and without a planned vaccination horizon in the short and medium-term.

Regarding the characterization of serious games from the point of view of the resources used for their production, it is observed that the success rate is higher among smaller teams and in simpler projects. Furthermore, aside from the fact that basic knowledge is required in these events to participate in the creation of scientific video games, it is concluded that the development of this type of product requires a certain degree of professionalization. This coincides with the statement by Masa and Alfredo (2017) that links professionalism with the quality and success rate of the products.

Concerning the identification of the playful strategies implemented through their mechanics, dynamics, and aesthetics, it is evident that for the communicative action to be effective it is necessary to plan a playful strategy that, as González et al. (2008) and Morales and San Cornelio (2016) point out, takes care of the balance between fun and the rigor of the reality that is intended to be transferred to the user. A reality that connects with the player through the adequate contextualization of the challenge, with a sufficient informative load and linked to the action, which, as Sierra-Martínez et al. (2022) point out, favors the implicit learning of the player, avoiding the rupture between information and interaction. This requires as Caserman et al. (2020) indicate, preferential attention to elements related to training, depending on the type of game and the player it is aimed at. In reaction-based games, time becomes a fundamental challenging element that tests the player's skills and stimulates a sense of challenge. In recreation games, mainly simulation games, the narrative immersion of the player in the story is encouraged, favored by the empathic connection of the player with the reality represented in the world of fiction. The interaction of the player with an environment that reproduces the conditions of the

reality that is intended to be communicated provides, as Gros (2002) points out, learning stimulated by the demands of the environment, where the subject becomes the protagonist of the experience, which favors the critical thinking and media literacy (Grace and Farley, 2016).

The complexity of ludic strategies in recreation and strategy games requires careful planning and greater resources, although this does not imply that they are more effective from the communicative point of view.

Regarding the assessment of the efficiency of serious games as products for playful communication based on the analysis of gameplay, it can be stated that graphic quality contributes to increasing the effectiveness of the video game, from the communicative point of view. It facilitates the fulfillment of the purpose for which the product has been conceived, as long as there is a correct balance between functionality and graphic quality. Most of the analyzed games that correctly implement a functionality, but do not have a high graphic quality, lack a high degree of playability. This statement coincides with that made by Caserman et al. (2020) concerning the importance of the factor of "attractive graphics" in serious games for them to be effective.

High importance is identified in finding a balance between the "serious" part and the "playful" part. For this, it is necessary to find a positive balance in the graphic quality, the progression of difficulty, and the ease of use of the video game, the relationship between the assessment of the feedback system and the gameplay being especially significant. This positive balance has been found in games that present simple, easily recognizable mechanics and a sufficiently stimulating challenge to encourage the continuation of the game.

Therefore, a necessary balance is proposed between rigor, precision, and realism, which is required by the purpose for which these products are developed, with generating a satisfactory gaming experience, from the point of view of the gameplay.

On the other hand, it is observed that, despite the reduction in production and distribution costs, the development of serious games for scientific communication implies a significant investment in resources, derived from the playful requirements and its purpose specifically linked to the reality that is intended to address. These costs are not always compensated due to the unequal reception of the audiences to which they are intended, derived from the imbalance between the purpose for which they are created and its reflection in the "serious" part of their development, and the attention paid to the playful aspects to promote a satisfying gaming experience.

Finally, although the production of serious games is not a priority line of business (DEV, 2021), this type of game is considered an effective communication strategy in the field of science and social awareness, as long as the products are well targeted to a suitable target audience and their design is focused on the player.

6. References

Abt, C. C. (1987). *Serious Games*. University Press of America.

Addy, T. M., Dube, D., Croft, C., Nardolilli, J. O., Paynter, O. C., Hutchings, M. L., Honsberger, M. J. y Reeves, P. M. (2018). Integrating a Serious Game Into Case-Based Learning. *Simulation & Gaming, 49*(4), 378-400. https://doi.org/10.1177/1046878118779416

Álvarez García, S. (2010). En busca del "Auleph". Aproximación a los entornos digitales para la gestión del aprendizaje. Revista ICONO 14. *Revista Científica de Comunicación y Tecnologías Emergentes, 8*(3), 303-327. https://doi.org/10.7195/ri14.v8i3.241

Asociación canaria de desarrolladores de videojuegos. (2021). *Global Game Jam Juegos Serios*. ACADEVI. https://bit.ly/3Q0q10k

Asociación Española de Comunicación Científica. (2020). *Consejos para informar sobre el nuevo coronavirus*. https://bit.ly/3Lu6xOm

Asociación Española de Empresas Productoras y Desarrolladoras de Videojuegos y Software de Entretenimiento. (2018). *Las 3D de la Financiación de Videojuegos: Detectar, destinar, devolver.*

Asociación Española de Empresas Productoras y Desarrolladoras de Videojuegos y Software de Entretenimiento. (2021). *Libro blanco del desarrollo español de videojuegos 2020*. https://bit.ly/3NYNZZ3

Asociación Española de Videojuegos. (2021). *Anuario AEVI 2020*. https://bit.ly/3xrDt6q

Almeida, F. y Buzady, Z. (2022). Development of soft skills competencies through the use of FLIGBY. *Technology, Pedagogy and Education*, 1-14. https://doi.org/10.1080/1475939X.2022.2058600

Cabrera, R., Calderón, C. y Carrión, A. (2021). Hacktech COVID-19: Caso de estudio de un hackathon virtual en Latinoamérica. *ACI Avances en Ciencias e Ingenierías, 13*(2), 14-14. https://doi.org/10.18272/aci.v13i4.2370

Caserman, P., Hoffmann, K., Müller, P., Schaub, M., Straßburg, K., Wiemeyer, J., Bruder, R. y Göbel, S. (2020). Quality Criteria for Serious Games: Serious Part, Game Part, and Balance. *JMIR serious games, 8*(3), e19037. https://doi.org/10.2196/19037

Contreras Espinosa, R., Eguia Gómez, J. L. y Solano Albajes, L. (2011). Videojuegos como un entorno de aprendizaje. El Caso de "Monturiol el joc". *Revista ICONO 14. Revista Científica De Comunicación y Tecnologías Emergentes, 9*(2), 249-261. https://doi.org/10.7195/ri14.v9i2.35

Costa-Sánchez, C. y López-García, X. (2020). Comunicación y crisis del coronavirus en España. Primeras lecciones. *Profesional de la Información, 29*(3). https://doi.org/10.3145/epi.2020.may.04

Dankhe, G. L. (1986). *Investigación y comunicación*. McGraw Hil.

DeVuego BD. (2022). *Base de Datos del Videojuego Español*. https://www.devuego.es

De Sola Pueyo, J. (2021). Science in the media: the scientific community's perception of the COVID-19 media coverage in Spain. *JCOM, 20*(02), A08. https://doi.org/10.22323/2.20020208

Forsberg, E. -M., Gerber, A. y Carson, S. G. (2020). *Including Responsible Research and Innovation (RRI) in the development and implementation of Horizon Europe*. https://bit.ly/3Eiq9Tr

GameBCN. (2020). *Fight Covid Jam*. https://fightcovid.gamebcn.co/

Garrett, L. (2020). COVID-19: the medium is the message. *The Lancet, 395*(10228), 942-943. https://doi.org/10.1016/S0140-6736(20)30600-0

Gertrudis-Casado, M. C., Gálvez-de-la-Cuesta, M. C., Romero-Luis, J. y Gertrudix, M. (2022a). *Modelo de análisis de serious games en el entorno de las game jam* (Version 1). Zenodo. https://doi.org/10.5281/zenodo.6462394

Gertrudis-Casado, M. C., Gálvez-de-la-Cuesta, M. C., Romero-Luis, J. y Gertrudix, M. (2022b). *Dataset del análisis de los juegos de Fight COVID Jam 2019* (Version 1) [Data set]. Zenodo. https://doi.org/10.5281/zenodo.6462470

Grace, L. D. y Farley, M. (2016). How game design thinking becomes engagement design. *Proceedings of the 20th International Academic Mindtrek Conference* (281-286). https://doi.org/10.1145/2994310.2994332

Gómez-García, S. y Carrillo-Vera, J.-A. (2020). El discurso de los newsgames frente a las noticias falsas y la desinformación: cultura mediática y alfabetización digital. *Revista Prisma Social*, (30), 22-46. https://revistaprismasocial.es/article/view/3751

Gómez-García, S., Gil-Torres, A., Carrillo-Vera, J., y Navarro-Sierra, N. (2019). Creando a Donald Trump: Las apps en el discurso político sobre el presidente de Estados Unidos. *Comunicar*, 59, 49-59. https://doi.org/10.3916/C59-2019-05

González Sánchez, J. L., Padilla Zea, N. P., Gutiérrez, F. L. y Cabrera, M. J. (2008). De la usabilidad a la jugabilidad: Diseño de videojuegos centrado en el jugador. *Proceedings of INTERACCION*, (99-109). https://bit.ly/3xbfPcD

Gorbanev, I., Agudelo-Londoño, S., González, R. A., Cortes, A., Pomares, A., Delgadillo, V., Yepes, F. J. y Muñoz, Ó. (2018). A systematic review of serious games in medical education: quality of evidence and pedagogical strategy. *Medical education online, 23*(1), 1438718. https://doi.org/10.1080/10872981.2018.1438718

Gros, B. (2002). Constructivismo y diseños de entornos virtuales de aprendizaje. *Revista de Educación,* 328, 225-247.

Hallinger, P., Wang, R., Chatpinyakoop, C., Nguyen, V. T. y Nguyen, U. P. (2020). A bibliometric review of research on simulations and serious games used in educating for sustainability, 1997-2019. *Journal of Cleaner Production*, 256, 120358. https://doi.org/10.1016/j.jclepro.2020.120358

Herrero-Curiel, E. y Planells de la Maza, A. J. (2020). Nuevas narrativas periodísticas entre la información y la simulación lúdica: los docuwebs y los newsgames. *Palabra Clave, 23*(2), e2325. https://doi.org/10.5294/pacla.2020.23.2.5

Hunicke, R., LeBlanc, M. y Zubek, R. (2004). MDA: A formal approach to game design and game research. In: *Proceedings of the AAAI Workshop on Challenges in Game AI, 4*(1), 1722. https://bit.ly/3xjLmLc

IDG Consulting. (2020). *Análisis del impacto del Covid-19 y mejores prácticas de teletrabajo en el sector de los videojuegos*. AEVI. https://bit.ly/3EvkJVv

Kara, N. (2021). A systematic review of the use of serious games in science education. *Contemporary Educational Technology, 13*(2), ep295. https://doi.org/10.30935/cedtech/9608

Kippes, R. (2020). Jugar con la ciencia: estrategias para la apropiación social del conocimiento en el análisis de tres videojuegos de pandemia. En: Lovato, A., Américo, M. y Pires Nogueira, V. C. (Eds.), *Juegos, deporte, medios y tecnología* (78-93). Universidad Nacional del Rosario.

Kultima, A. (2015). *Defining Game Jam*. Proceedings of the 10th International Conference on the Foundations of Digital Games. https://bit.ly/37RXjxh

Kultima, A. (2021). *Game Jam Natives? The Rise of the Game Jam Era in Game Development Cultures*. Sixth Annual International Conference on Game Jams, Hackathons, and Game Creation Events, 22-28. https://doi.org/10.1145/3472688.3472691

Maiolini, C., De Paoli, S. y Teli, M. (2012). Digital games and the communication of health problems. A review of games against the concept of procedural rhetoric. *Game: The Italian Journal of Game Studies, 1*(1/2012), 63-75.

Martín Rodríguez, I. (2015). *Análisis narrativo del guion de videojuego*. Síntesis.

Martínez-Cano, F. J., Cifuentes-Albeza, R. y Nicolás, B. I. (2019). Videojuegos prosociales como espacio transicional lúdico para la paz: el caso de Reconstrucción. *Revista Latina de Comunicación Social*, 74, 1470-1487. http://dx.doi.org/10.4185/RLCS-2018-1394

Massa, S. M. y Alfredo, B. G. (Comp.) (2017). *Videojuegos en serio: creando serious games para aprender jugando*. Universidad del Plata.

Matthews, S. y Thomas, R. (2022). Virtual Game Jam: Collaborative Pathway to Serious Games for Health. *International Journal of Serious Games, 9*(1), 35-42. https://doi.org/10.17083/ijsg.v9i1.454

Michael, D. R. y Chen, S. (2006). *Serious game: games that educate, train, and inform*. Thomson Course Technology.

Morales Moras, J. M. y San Cornelio Esquerdo, G. (2016). La jugabilidad educativa en los serious games. *Artediez*, 10, 1-23. https://bit.ly/3zlosnY

Moreno-Ger, P., Martinez-Ortiz, I., Freire, M., Manero, B. y Fernandez-Manjon, B. (2014). Serious games: A journey from research to application. En: *IEEE Frontiers in Education Conference (FIE) Proceedings* (1-4). https://doi.org/10.1109/FIE.2014.7044052

Navarro-Sierra, N. y Quevedo-Redondo, R. (2020). Ludificación informativa en tiempos de pandemia: newsgames y la Covid-19. *ComHumanitas, 11*(3), 56-74. https://doi.org/10.31207/rch.v11i3.274

Paredes Otero, G. (2018). Los *serious games* como herramientas educo-informativas para el diseño de la conciencia social. En: Torres-Toukoumidis, A. y Romero-Rodríguez, L. M. (Eds.), *Gamificación en Iberoamérica: experiencias desde la comunicación y la educación,* (303-327). Universidad Politécnica Salesiana.

Península. (2020). *Fight Covid Jam: Los juegos contra el Covid-19*. https://peninsula.co/casos-de-uso/fight-covid-jam

Sánchez Coterón, L. (2018). Videojuegos y estética multimodal. *ASRI: Arte y sociedad. Revista de investigación*, (15), 113-125. https://bit.ly/37aUSWB

Ramzan, R. y Reid, A. (2016). *The importance of game jams in serious games*. 10th European Conference on Games Based Learning: ECGBL 2016, 538-546. Academic Conferences and Publishing International Ltd.(ACPI). https://bit.ly/3xgUtfb

Sierra Bravo, R. (2007). *Tesis doctorales y trabajos de investigación científica*. Thomson.

Sierra-Martínez, L. M., Chanchí-Golondrino, G. E. y Gómez-Álvarez, M. C. (2022). Directrices para el diseño y la construcción de videojuegos serios educativos. *Revista Colombiana de Educación, 1*(84). https://doi.org/10.17227/rce.num84-12759

Sorensen, B. H. y Meyer, B. (2007). *Serious games in language learning and teaching-a theoretical perspective*. Proceedings of the 2007 Digital Games research Association Conference (559-566).

Suppan M., Catho G., Robalo Nunes T., Sauvan V., Perez M., Graf C., Pittet D., Harbarth S., Abbas M. y Suppan, L. (2020). A Serious Game Designed to Promote Safe Behaviors Among Health Care Workers During the COVID-19 Pandemic: Development of "Escape COVID-19". *JMIR Serious Games, 8*(4), e24986. https://doi.org/10.2196/24986

Susi, T., Johannesson, M. y Backlun, P. (2007). *Serious Games – An Overview. Technical Report HS- IKI -TR-07-00*.

Valles, M. S. (2007). *Técnicas cualitativas de investigación social. Reflexión metodológica y práctica profesional*. Síntesis.

Zyda, M. (2005). From visual simulation to virtual reality to games. *IEEE Computer, 38*(9), 25-32. https://doi.org/10.1109/MC.2005.297

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