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The Characteristics of Educational Video Games Developed in Spain

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Abstract

This study comprehensively analyses and examines videogames developed in Spain for educational purposes to determine its contribution (or not) to education. The methodology consisted of content analysis. A specific evaluation framework was created and validated for this purpose, to systematically assess the technical, pedagogical, recreational and functional characteristics of video games created for educational purposes. The resulting assessment guide is made up of 202 items, organised into ten areas of analysis: identification of the video game, supplementary materials, recreational-pedagogical information, technical characteristics, instructional design, didactic application, analysis of the fictional world, rules system, usability and interactivity, and an overall rating. This guide was reviewed and validated by experts in video games and education and can be used by researchers, teachers, and developers wishing to design, assess or improve similar resources. The results showed that, from its beginning, the videogame sector has been characterised by a lack of adaptable, customisable, accessible, and immersive games. Similarly, many Spanish educational video games have linear and behaviour-based designs, with little progression of difficulty and limited feedback. They often lack teaching guides or support materials for teachers, and accessibility and customisation remain underdeveloped features. This study identifies and proposes strategies for developing video games which are thoroughly entertaining and educational.

Keywords

education; computer game; educational game; system design; evaluation

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As características dos jogos educativos desenvolvidos na Espanha

Resumo

Este estudo analisa e examina exaustivamente os videogames com objetivos pedagógicos desenvolvidos na Espanha, a fim de determinar sua contribuição (ou não) para a educação. A metodologia consistiu na análise de conteúdo. Para isso, foi criado e validado um quadro de avaliação específico para avaliar sistematicamente as características técnicas, pedagógicas, lúdicas e funcionais dos videogames criados para fins educacionais. A guia de avaliação resultante é composta por 202 itens, organizados em dez áreas de análise: identificação do videogame, materiais complementares, informações lúdico-pedagógicas, características técnicas, design instrucional, aplicação didática, análise do mundo ficcional, sistema de regras, usabilidade e interatividade, e uma classificação geral. Esta guia foi revisada e validada por especialistas em videogames e educação e pode ser usada por pesquisadores, professores e desenvolvedores que desejam projetar, avaliar ou melhorar recursos semelhantes. Os resultados mostraram que, desde o seu início, o setor dos videogames tem sido caracterizado por uma falta de jogos adaptáveis, personalizáveis, acessíveis e imersivos. Da mesma forma, muitos videogames educativos espanhóis têm designs lineares e comportamentais, com pouca progressão de dificuldade e feedback limitado. Muitas vezes, carecem de guias didáticas ou materiais de apoio para professores, e a acessibilidade e a personalização continuam a ser elementos subdesenvolvidos. Este estudo identifica e propõe estratégias para o desenvolvimento de videogames que sejam integralmente divertidos e educativos.

Palavras-chave

educação; jogo de computador; jogo educativo; concepção de sistemas; avaliação

Las características de los videojuegos educativos desarrollados en España

Resumen

Este estudio analiza y examina exhaustivamente los videojuegos con fines pedagógicos desarrollados en España con el fin de determinar su contribución (o no) a la educación. La metodología consistió en un análisis de contenido. Para ello, se creó y validó un marco de evaluación específico para evaluar sistemáticamente las características técnicas, pedagógicas, lúdicas y funcionales de los videojuegos creados con fines educativos. La guía de evaluación resultante se compone de 202 ítems, organizados en diez áreas de análisis: identificación del videojuego, materiales complementarios, información lúdico-pedagógica, características técnicas, diseño instruccional, aplicación didáctica, análisis del mundo ficticio, sistema de reglas, usabilidad e interactividad, y una valoración global. Esta guía ha sido revisada y validada por expertos en videojuegos y educación, y puede ser utilizada por investigadores, docentes y desarrolladores que deseen diseñar, evaluar o mejorar recursos similares. Los resultados mostraron que, desde sus inicios, el sector de los videojuegos se ha caracterizado por la falta de juegos adaptables, personalizables, accesibles e inmersivos. Del mismo modo, muchos videojuegos educativos españoles tienen diseños lineales y conductuales, con poca progresión de dificultad y retroalimentación limitada. A menudo carecen de guías didácticas o materiales de apoyo para los profesores, y la accesibilidad y la personalización siguen siendo elementos poco desarrollados. Este estudio identifica y propone estrategias para desarrollar videojuegos que sean íntegramente divertidos y educativos.

Palabras clave

educación; juego de ordenador; juego educativo; diseño de sistemas; evaluación

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Introduction

The *Revista Colombiana de Educación* has always been characterised by its focus on the most current issues in the educational landscape, which are of great interest both to the academic community and to professionals working daily in schools and in community-based institutions. These issues require reflections to enable the interpretation, understanding and informed decision-making regarding developments within the educational context. For this reason, to mark the publication of the 100th issue of this journal, our research is shared regarding the role of video games in education, and particularly in the educational analysis of video games. Without a doubt, this resource has become an ever-present element in the lives of students at different educational levels, both in strictly school-based contexts and within non-school contexts in recent years, including those of the family.

Similarly, the international and Spanish context has experienced an important increase in publications focused on the study, design and analysis of video games —see for example, dossiers numbers 84 and 85 published in the *Revista Colombiana de Educación* (Rodríguez-Rodríguez *et al.*, 2022a, 2022b), which include, among others, the work by Marín-Suelves *et al.* (2022) on research trends in the use of video games in education. Other key works include López-Gómez *et al.* (2023), Revuelta and Pedrera (2019), and Fernández-Vara (2019). Likewise, some works that are related to the topic are of great interest, such as Merchán et al. (2023) on play, technology and archaeology in museums, as well as the need to consider, from the design stage of resources, the needs of pupils with special educational needs (Gómez Prada, 2010).

This bibliographical overview shows the importance of research into the analysis of video games from an educational perspective, as well as the need for appropriate instruments for their design and analysis. Information and communication technologies (ICT) are an essential part of our daily lives. Children and adolescents have found in them an extraordinary means of learning and satisfying their curiosity, as well as for socialising and communicating (Machargo *et al.*, 2003). Within this framework, video games are consolidating their position as one of the digital resources most used by children and adolescents, and represent a medium with educational potential as they become integrated into their daily lives.

In Spain, by age group, 84 % of children between 6-10 years old play video games, a percentage that rises to 91 % in the 11-14 age group (AEVI, 2024). Therefore, increasing access to video games at an early age highlights the importance of approaching them not only as a form of entertainment, but also of investigating them from an educational point of view. In fact, several studies have

shown that their proper use can promote learning and children's development. According to Charsky (2010), incorporating new technological tools into formal education allows knowledge to be acquired in a deferred manner, since face-to face attention is shared with other psycho-educational alternatives. New game technologies that involve children in digitally improved analogue behaviours can be beneficial for the development of typically developing children: interactivity has the potential to encourage and guide developmentally appropriate child behaviour (Torres *et al.*, 2021). At the same time, Marsh *et al*. (2016) cited Edwards (2013) to indicate that traditional games and convergent games (those that use digital media) are interrelated and that it is no longer appropriate to consider traditional games as being of superior quality, since convergent games can also lead to imaginative play. In line with these ideas, empirical research shows that interaction with the digital environment can influence cognitive development. For example, a study undertaken with 191 children aged 7-10 years showed that high-level digital users performed better than lower-level digital users in cognitive ability for language, reasoning and memory (Di Giacomo *et al.*, 2017). Learning success will also depend on teacher contact with pedagogical ideas related with best practices regarding this technology, so teachers must be trained in this regard.

However, the educational potential of video games is not only limited to their cognitive impact and role in teaching. It is also necessary to consider, among other issues, social and cultural factors that may influence the learning experience, such as gender stereotypes or representation within the game.

In addition to inclusion and representation, it is essential to analyse how the design and difficulty of video games influence students' motivation and learning. A study conducted by Nebel (2017) highlighted that video games aim to increase both the quantity and quality of knowledge. Difficult games may not be particularly beneficial within an educational context, as the sense of satisfaction of progressing through the game can be especially important for pedagogical purposes.

For this research, a review of empirical studies about video games in education was carried out. The results show that one of the focal points —which lies at the core of this project— should be the evaluation of video games from a pedagogical perspective (Rodríguez-Rodríguez, 2019), as many of the studies carried out previously to assess this type of resources were primarily focused on technical aspects.

Therefore, our study focuses on the pedagogical aspects of video games, with the analysis of video games developed in Spain as a prime objective, and particularly those intended for education. To meet our goal, a video game evaluation tool was designed, validated and applied to describe the technical,

pedagogical, recreational and functional characteristics of video games developed for educational purposes.

It should be emphasised that in recent years, from a social and political point of view, the Spanish educational context has been characterised by the development of certain measures that favour the implementation of video games in the classroom. To contextualise and define the scope of the study, this project is based on the Autonomous Community of Galicia, bearing in mind that in the past few years, this geographical area has also been promoting initiatives to facilitate the use and incorporation of video games in the classroom.

There are still few studies specifically dedicated to analysing local video games which present proposals for specific improvements from the perspective of educational professionals. However, the idea of "thinking globally and acting locally" is nothing new, as social ecology has supported it for years. Transferred to the video game arena, specifically educational games and serious games, some of these global issues include contents and challenges which do not engage students, inaccessible games, lack of adaptation to teachers' needs, etc.

The results and conclusions obtained in this study aim to identify some characteristics and peculiarities of video games developed in Spain and can be considered relevant in the case of possible pedagogical uses of these media or for improving future developments (whether carried out by production companies, such as NGOs, professors) regardless of where they are based.

Research Methodology

Content analysis was selected as the methodological approach to examine educational video games from a pedagogical perspective (Bardin, 2004). The study combined descriptive and inferential analyses to evaluate the formal, interactive and pedagogical characteristics of the games, including their educational messages, values, target audiences and suitability for educational contexts. Comparisons were also conducted across the video games included in the sample.

Design and Planning of the Empirical Research Process

To carry out the empirical research, the work was structured around the following general stages:

1. Drafting and Proposal of the Guide

To interpret and draw conclusions about the characteristics of educational video games developed in Galicia, an evaluation tool was designed to serve as a guide

when analysing the games in the sample and meeting the objectives of our research.

This initial guide consisted of eight areas of analysis subdivided into more specific units of research, through which the most closely correlated analytical aspects were grouped together. In each one of these units, a series of items with different categories of analysis were added. For every case, the option that most closely matched the specific aspect was selected, always including a justification of each decision.

The initial analysis tool, consisting of a total of 274 items, is fundamentally qualitative. To facilitate its use and subsequent comparison and visualisation of the results (graphs, diagrams, etc.), some of its items include a simple assessment scale or other quantitative elements.

2. Validation of the Evaluation Guide

To ensure the credibility and validity of the evaluation guide, five criteria were considered: its internal coherence and organisation into dimensions, units and items; its conceptual representativeness in relation to the existing literature; its analytical and content representativeness; the authors' experience in the development of digital educational resources; and an external review aimed at obtaining a critical assessment of the initial design. This review was conducted by university lecturers specialised in video games and education, as well as professionals from the sector, who provided suggestions for improvement.

3. Selection of the Video Game Sample

Over 700 enquiries were made to software companies, town councils, publishing houses, museums, libraries and other entities to compile the sample of video games. In the end, a total of 182 video games were identified, the first of which was developed in 1995. From the total number, 64 were submitted as educational games by their creators However, access was only gained to 43 of them. Out of these 43, 25 met the criteria to form part of the study sample. The remaining 18 were not considered video games based on the tool developed by González-Tardón (2014) that differentiates programs that are video games from those that are not.

Once the sample had been compiled, the next step was to obtain the necessary computer equipment to meet the specific technological requirements for each of the games. In many cases, due to the age of the game, it was necessary to use obsolete hardware and operating systems. During the tests carried out, five games reported a series of errors that prevented their analysis. Finally, the sample

consisted of 20 video games. Additional information about the 20 video games included in the sample is provided in Appendix A.

4. Finalisation of the Evaluation Guide

Taking the suggestions into account, the final guide deals with the following ten areas, which correspond to the main areas of analysis of the characteristics of video games:

1. Identification of the video game
2. Materials that complement the video game
3. Pedagogical-recreational information
4. Technical characteristics
5. Analysis of instructional design
6. Analysis of didactic application
7. Analysis of the fictional world
8. Analysis of the rules system
9. Analysis of usability and interactivity
10. Global evaluation of the video game under analysis

In this article the focus is on areas 2, 3, 5, 6 and 9, as these are the most directly related to the pedagogical aspects of the design and use of video games.

The analytical tool generated in this phase of the research was designed to be applied by the authors of this article. However, it can be used by anyone interested in the analysis of video games and by professionals involved in their design and development. It should be noted that the guide is made up of a total of 202 items. It is available in Galician via this link: https://drive.google.com/file/d/1s2xVEEkqvArdNPL1L5_MhB5YQowi1C3L/view?usp=sharing

5. Application of the Guide to the Sample Compiled

Following the suggestions regarding content analysis, the video games were then evaluated.

Results and Discussion

Firstly, the findings from each of the dimensions evaluated in the study were analysed and the main conclusions derived from them were then presented.

When describing the results, the process undertaken was based on the analysis of each of the most specific units of enquiry and their items. It should be

considered that the individual analysis of each item or indicator was not always possible due to the complexity of the subject matter, since in some cases it was considered appropriate to group together several items to provide a more precise and comprehensive explanation.

Materials that Complement the Video Game

This section specifies the materials (if any) that complement the video games.

A written synopsis was included in 40 % of the video games in the sample, either on the packaging or the websites. These texts often use colloquial language to describe the main character and encourage the user to start the game. Only 10 % of the games include a didactic guide for teachers, 15 % include general pedagogical information, and 10 % provide specific educational guidelines for the use of these resources in environments for which they were designed.

It is worth noting that previous studies have also highlighted the need to develop and provide appropriate guides for the didactic use of video games. For example, a group of experts in video games and education who participated in a study on the use of video games in teaching, conducted by the GfK agency (2011) for aDeSe (now AEVI: Spanish association of video games), also emphasized the need to develop such didactic guidelines.

Another significant fact is that 35 % of video games include short tutorials. Furthermore, 35 % also feature technical specifications that are mostly included in the CD packaging.

This collection of data highlights the scarcity of materials that complement video games or provide information about their characteristics, whether to play them or to use them as teaching resources. This supports the point that Gaydos (2013) raised about the limitations faced by teachers in developing educational tools based on digital games and other technologies. Such limitations arise from the need for guides or other complementary materials that provide guidance for the use of video games as resources to improve teaching and learning processes. These findings reinforce the idea that the pedagogical potential of video games is often limited not by the games themselves, but by the lack of supporting educational frameworks that enable their effective integration into teaching practice.

Pedagogical-Recreational Information

In this section the information shown in the resources or the information that accompanies the video games was assessed.

It should be noted that none of the games use the classification system or Pan European Game Information (PEGI) code. Furthermore, only one shows the Apple classification system, a requirement from the multinational company when the game is available in one of its virtual stores. Likewise, in previous studies, such as the one carried out by Guerra and Revuelta (2015), it was deemed necessary to include this label (PEGI), as it is considered of vital importance for teachers who want to use video games for didactic purposes, because it helps them select a game based on its educational purpose.

In most games (75 %) it is not specified whether the game is inspired or based on another medium. Therefore, the conclusion reached was that the ideas behind the games were original.

In 85 % of the cases, the main purposes for which video games were developed are presented using infinitive verbs that indicate fun such as to entertain, amuse and play, as well as verbs associated with learning, being discover, learn and encourage the most used.

In terms of classification, only seven of the twenty digital games mention the genre or subgenre to which they belong.

As for the main target groups, 35 % of the video games were intended for use in schools, 5 % at home, and another 5 % in both environments. For the remaining 55 % no information was provided on this matter. That is why, in most cases, it was necessary to resort to external sources to determine who the games were intended for.

The results presented in our study are consistent with those of other research projects that highlight educational centres as the main recipients of video games and educational classrooms as contexts in which various innovation processes can be developed with video games (Del Moral & Fernández-García, 2015).

None of the video games indicate whether they were designed to be used by people with special needs or disabilities. Undoubtedly, this is one of the most notable shortcomings present in the video games analysed in our study and it has already been highlighted as an urgent need in other types of research projects (Sampedro & McMullin, 2015). This absence highlights a critical shortcoming in terms of inclusive design and suggests that accessibility continues to be treated as a secondary feature rather than a fundamental component of educational video game development.

There are also no video games that specify the previous knowledge that users should have to get the most out of them.

Most video games do not describe their objectives, rules and challenges. In fact, only eight games provide this information. In other words, in most of the

sample, there is no explanation of what needs to be done in the game to successfully complete it, nor are general instructions included on how to play it.

Only three games mention the basic skills they aim to develop. Only four list the specific educational objectives that can be achieved. Similarly, only two of the sample games specify the educational content they include. None of the video games mention their relationship with the Official Curriculum of Galicia and Spain or with any legislation governing the educational system. The need to analyse and make explicit the relationship between video games and the existing curriculum appears as a key factor in guiding the contextualisation of video games and their significance in the classroom (García-Pernía *et al.*, 2011).

Instructional Design

This section aims to assess the suitability of the objectives and pedagogical content that motivated the development of the video games in relation to their target group, genre, theme, etc. The pedagogical principles that sustain the game and the characteristics of the challenges that compose them were also analysed.

Regarding the suitability of the educational objectives, our evidence suggests that in more than half of the sample (75 % of the cases) the educational objectives are entirely appropriate. Furthermore, no examples in which the educational objectives were not adapted in some way were found. Nevertheless, the educational purposes of video games are considered too ambitious, as the descriptions that accompany some of these resources can generate high expectations that are difficult to achieve or attain fully, given the scarce number of challenges that they contain and considering their characteristics.

Regarding the suitability, structure and origin of the contents, the sample deals with topics of a different nature, predominantly those related to cultural or transversal areas, such as health education, healthy eating, risk prevention and tolerance. They do not cover curricular subjects of a specific educational level, in contrast to the games validated, for example, in the studies by Holmes (2012) about sciences; by Magnussen *et al.* (2014) on physics; or by Annetta *et al.* (2009) on biology. In other words, they are not games that correspond to a specific subject in the school curriculum.

As for the structure and representation of content, 80 % of video games does not organise their content into hierarchical series of challenges, puzzles, mini-games or levels. In general, the contents of the games are presented in an explanatory way, by means of texts with conceptual information that are displayed on the screen. However, taking the challenges does not test the comprehension of the content. For this reason, it was determined that, in general, the educational contents are not correctly integrated into the game structures.

Multiculturalism is not reflected in 95 % of the games, as only one of them featured characters from different cultures. Furthermore, in terms of promoting values, in general there are no political, racial, sexual, cultural or religious prejudices, or aggressive or violent connotations, although in some instances this may be perceived otherwise. For example, there are cases where it is necessary to fight and eliminate characters to progress. There is also a game in the sample in which a character is hit with a mallet every time the player does not answer the question correctly before the time runs out.

In some of the video games the promotion of healthy habits is neglected. For example, in one video game there are characters smoking, while in another, an alcoholic drink must be consumed to overcome a certain situation.

Most of the video games from the sample contain no factual or conceptual errors. However, errors or outdated information have been detected in some of them, such as cases where incorrect answers are in fact marked as correct.

Overall, 75 % of video games have scenarios, elements or objects that largely integrate content considered relevant to the achievement of educational objectives.

For the most part, the predominant impact areas in video games are conceptual and procedural. However, the process required to overcome many of the game's challenges mainly relates to mouse and keyboard skills. Therefore, it is not about using strategies and techniques to overcome challenges, such as relating concepts, analysing information, demonstrating knowledge, building, managing, etc. In short, to encourage the application of what has been learnt and to promote meaningful learning, there are aspects that should be prioritised in the design and use of video games, such as the inclusion of challenges that encourage the application and transfer of acquired knowledge to solve new situations or problems, the creation of solutions or products within the game itself, informed decision-making, and greater integration between educational content and game mechanics.

Regarding the characteristics and pedagogical suitability of the challenges, most videogames test agility (such as quickly clicking on objects, moving them, etc.) and identification skills (such as recognising objects to catch or avoid). The subsequent most common tasks are about answering challenges that are generally presented as a question with three possible choices, one of which is correct.

In 80 % of the games, the challenges do not incorporate different levels of difficulty. Furthermore, in 100 % of the sample, the challenges are predefined in the game and repeated every time a game is played. In general, classic formats of digital activities considered easy to program are used, such as selection tasks, memory games, drag activities, puzzles, questions and answer tasks, etc.

The videogames do not present different challenges associated with the same content in order to facilitate memorisation and understanding. The skills or knowledge learned in one challenge or level of difficulty are not applied in another level whilst learning new skills or knowledge.

In addition, challenges are not presented in a gradual, progressive manner, with appropriate incremental steps and smooth transitions. Difficulty levels remain uniform throughout the video games and do not fully test one's ability, thus the possibility of overcoming the tasks is almost guaranteed.

When playing the game, feedback is generally received as correct and/or incorrect actions or answers. This feedback can be provided through success or error sounds, but also (in 55 % of the cases) in the form of positive scoring, i.e. adding points to the score. Only 10 % of video games deduct points for incorrect actions.

A very low percentage of the video games is seen to provide relevant clues to progress, whilst a similarly low percentage provide knowledge and encourage users to expand on the content, skills or values that are addressed in the game. In conversational games, this kind of help is offered through dialogues that the characters maintain whilst the user progresses through in the story.

As far as learning theories are concerned, the video games in the sample have a strong linear and behavioural character, using trial-and-error processes guided by means of positive reinforcement. There are no open-environment video games with open endings in the sample. Within the evolution in video game design and learning principles that Etxeberria (2008) shows from the contributions of Egenfeldt-Nielsen (2005) and Gros (2008), the video games analysed in this study are classified as first-generation games, characterised by a behavioural model, in which progress or the established resolution of problems according to guidelines with constant feedback prevails.

Although our study focuses on video games, the results bear parallels with the findings of Digón-Regueiro and Iglesias-Amorín (2022) on educational apps: both cases show closed designs, repetitive activities and trial-and-error learning, without progressive levels of difficulty or explanatory feedback, which reinforces a behaviourist and linear approach more oriented to memorisation than to meaningful learning. This convergence across different types of digital resources suggests a broader trend in the design of educational technology, where innovation in format is not always accompanied by innovation in pedagogical approach.

Didactic Application

In this section of the analysis, the aim is to determine whether the video games in the sample are appropriate for the environment for which they were developed, focusing mainly on the school setting. Furthermore, the study established whether the video games considered the figure of the mediator between the video game and the player (teacher, mother/father, etc.) and the student's learning model. The approach is based on the idea of understanding the video game as a device that must be analysed from educational and cultural perspectives (Massa, 2017). First, it should be pointed out that with respect to the estimated time to complete the games and considering the structure of the Spanish educational system (organised by subjects and timetables), 85 % of the cases analysed can be adapted to the current educational system. The primary reasons are the short duration and the fact that they include an option that allows the user to save their progress, leave the game and resume it later.

Regarding the model of the mediating figure between video games and players, only 10 % of the sample refers to this person, while the rest of the games ignore the role of the teacher, parents, guardians or tutors. One of the games includes a specific section for adults in which, albeit briefly, a series of recommendations for using the game at home is advised. In another game, the role of the teaching staff is suggested as an expert guide and energiser for the students. However, this is indicated on the website that hosts the game, i.e. the game does not allow the mediating figure to configure the game. In fact, none of the video games analysed can be configured by the mediator thus preventing intervention in their structures. In addition, the potential difficulties of their implementation, a key aspect in the design processes of these resources (Gómez-Gonzalvo *et al.*, 2018), are not mentioned in either the video games or in the complementary materials, nor do they explicitly request the opinion of the mediator on the use of these resources. It is important to note that, as Conde *et al*. (2023) indicate, video games can be an effective educational tool only when integrated into a structured pedagogical design and with the active participation of learning partners such as teachers and families. Their indiscriminate and unguided use can limit learning. This idea coincides with that put forward by Garbanzo-Rodríguez *et al*. (2017) and Fernández-Lanza (2022), who indicate that the use of video games as teaching tools must be planned and included within an educational strategy. All this reinforces the findings, which show that the games analysed rarely consider the teacher (or other mediator) and do not offer tools to adapt the experience to specific educational needs.

As for the players' learning model, none of the video games include challenges in which it is necessary to resort to alternative sources of information. Furthermore, they also do not suggest tasks to be carried out in a team, or allow

configurations or changes in the content, which means it is not possible to modify the challenges or activities to adapt the game to the player's needs; nor is the player's opinion on the use of the video game requested.

With reference to the involvement in organisational tasks, none of the video games include tasks that allow communicative interaction, for example between students at different educational levels or educational centres. Nor do they include functionalities that relate the teaching teams from different centres, or that connect the centre with the community or the family with the community.

Usability and Interactivity

This section analyses the ease of use of video games, their control and interface systems, and the suitability of their audio-visual aspects.

The technical functionality, graphic interfaces and audio-visual aspects of the games are considered intuitive and easy to use. It should also be noted that the implementation of these video games does not present difficulties, as those that require installation usually include a setup wizard.

One aspect identified in the analysis is the use of the masculine form in Spanish instead of gender-inclusive language. The adoption of language that avoids the generic masculine is recommended to promote gender equality, as also highlighted in previous studies (Díez Gutiérrez, 2009; Salas Guzmán, 2018). About the combination of audio-visual aspects, the results are largely positive and comply with the dimensions identified by Cabero (2001) in relation to technical and aesthetic aspects for the evaluation of audio-visual and computer media. This includes, for example, the adequacy of the sizes of the graphics, the correct mix of music and speech, and the synchronisation of image and sound, among other factors.

As far as accessibility is concerned, most video games do not allow any type of configuration. Furthermore, none of them allow the user to adjust the font size, activate or deactivate subtitles, configure peripherals, change colours, etc. Only five of the twenty video games give the user the option to deactivate the sounds or music.

Recent research on educational video games (Gulzar & Ansari, 2025; Martinez *et al.*, 2024) warns that the lack of customisation options, not very intuitive interfaces and limited feedback provided by video games themselves are an obstacle to effective learning. They also highlight that the absence of adaptive difficulty levels and accessibility settings restricts the participation of people with different abilities and experiences and makes it difficult to move towards a truly inclusive design. Our results strongly support these claims, showing that

accessibility and customisation remain largely underdeveloped, which reinforces the need to prioritise inclusive design principles in future developments.

In fact, accessibility in video games, whether developed in Spain or elsewhere, whether didactic or commercial, is a work in progress. According to Mangiron (2011), most successful commercial video games are barely accessible or not at all, which contributes to the exclusion of minorities.

The video games analysed are primarily addressed to the user as an individual, without considering other figures, such as teachers. In general, they do not offer options for modification or adaptation, and they mainly consist of a linear and guided software, with few options for exploration. This individualised and closed design contrasts with current pedagogical approaches that emphasise collaboration, adaptability and active learning, suggesting a misalignment between educational theory and the design of these digital resources.

One of the most highly valued aspects of video games are their graphics and designs, especially in the early conversational video games and adventure games developed between 2000 and 2006. The realistic recreations of the environments offered by some games are also positively valued, because they enable, among other aspects, the exploration of additional content, such as the landscape and story. However, the sample also includes poor graphic designs and inadequate interfaces that prevent the implementation of programmed actions as placing some elements on top of others.

Some of the video games avoid gender discrimination by portraying female and male characters in similar roles. However, there is generally a lack of characters representing different ideologies, social backgrounds, cultures, and identities. In addition, as previously indicated, the texts predominantly use the generic masculine, which is generally considered a sexist use of language. It should be noted that most of the video games analysed do not explain their educational aims. Likewise, most of the games do not state their educational objectives, nor do they establish a connection between the challenges and the content. Furthermore, they lack sufficient information to facilitate the study of their suitability, and, in fact, there are cases in which the year of publication is not indicated.

Most educational video games do not meet some of the characteristics or attributes that educational games should have in order to be considered effective learning tools. The video games analysed do not meet some of the characteristics contained in those considered as good video games by Malone (1981) and Gee (2004). In general, video games designed with educational intentions do not require collaboration to be completed, they do not offer multiple alternatives or learning routes, nor do they adapt to the player according to their ability.

The results of this research show the relationship between video games and education, as well as the importance of developing attractive and effective video games for teaching and learning processes. There is no doubt that well-designed video games are powerful digital resources. However, in order for the activity carried out with them to be successful, the weight must also fall on teachers as they must design and carry out the educational strategies or methodologies in which to integrate such media as a teaching resource.

Table 1 summarises the main findings of the study, providing an integrated overview of the key pedagogical, instructional, and functional characteristics identified in the video games analysed.

Table 1
Summary of Main Findings on Educational Video Games Developed in Spain

Dimension	Indicator	Percentage (%)
Complementary materials	Textual synopsis	40
	Didactic guide for teachers	10
	Pedagogical information	15
	Educational guidelines	10
	Tutorials	35
Pedagogical information	PEGI classification	0
	Specified target audience	45
	Stated educational objectives	20
	Specified educational content	10
	Alignment with the curriculum	0
Instructional design	Appropriate educational objectives	75
	Hierarchical content structure	20
	Presence of difficulty levels	20
	Adaptive difficulty	20
	Repetitive challenges	100
	Positive feedback (scoring)	55
	Penalties for errors	10
Accessibility and usability	Sound / music control available	25
	Accessibility options available (subtitles, font size, colours)	0
	Content / customisation options available	0
	Interface usability (qualitative)	High

Note: Percentages refer to the proportion of video games in the analysed sample (n = 20). "High" indicates a consistent qualitative trend identified during content analysis, referring to the general usability of interfaces, which are described as intuitive and easy to use. However, this does not imply accessibility, as most games lack inclusive design features or adaptation options for users with diverse needs.

Conclusions

To conclude, the following points are worth highlighting: Games must have a didactic guide for teachers, including general pedagogical information and specific educational guidelines. They should have general instructions for playing

(describe their objectives, rules, and challenges). They should specify the educational content they include and their relation to any education system laws. They should correspond to a specific area of the school curriculum. The challenges they present should not be focused on manual skills (mouse and keyboard) but rather on relating concepts, analysing information and demonstrating knowledge, that is, applying learning. They should incorporate various levels of difficulty to test skills. The model must include the mediating figure between video games and gamers, the role of teachers as expert guides and student motivators. Students should be encouraged to use further alternative information sources, propose group projects and allow for content configurations to adapt the game to players' needs.

There is no doubt that well-designed videogames are powerful digital tools. However, for the educational use of video games to be successful, teachers must also step up to do their part, since they must design and carry out the educational strategies or methodologies where they can integrate these media as didactic resources.

This study contributes to a line of research on video games and education that has been progressively consolidated within the *Revista Colombiana de Educación*, particularly through issues 84 and 85 devoted to this topic (Rodríguez-Rodríguez *et al.*, 2022a, 2022b). Among the contributions included in these special issues is the work of Sierra-Martínez *et al.* (2022), which focuses on guidelines for the design of educational video games. Our study complements this line of research by providing evidence on the strengths, limitations, and challenges that still characterise the design of educational video games from a pedagogical perspective.

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Appendix A. Educational Video Games Included in the Sample

Video game	Educational topic	Main content	Target audience	Genre
El medallón de la fortuna	Cultural heritage education	Historical and cultural exploration through an adventure narrative	10+ years	Graphic adventure
O Segredo de Teba	Cultural heritage education	Discovery of Galician heritage, places and cultural elements	10+ years	Graphic adventure
Cunquín e o almorzo saudable	Health education	Healthy eating habits and nutrition	6–12 years	Educational mini-games
Lepi e o misterio do diario	Language and literacy education	Reading, comprehension and problem-solving activities	6–12 years	Educational adventure
O avó de Paulo	Social and cultural education	Intergenerational learning and social values	6–12 years	Educational adventure
O libro máxico de Moitollo	Language and literacy education	Reading, language and educational challenges	6–12 years	Educational adventure
Trivial.gz	General knowledge education	Quiz-based learning activities	10+ years	Quiz game
Xoga con Alfombriña	Early childhood education	Basic learning activities and educational games	3–6 years	Educational mini-games
O Preguntoiro	General knowledge education	Question-and-answer educational activities	10+ years	Quiz game
Imaxínate o Salnés	Local heritage education	Knowledge of the Salnés region and its cultural heritage	10+ years	Educational adventure
Los Sostenibles	Environmental education	Sustainability and environmentally responsible behaviour	6–12 years	Educational strategy game
CLMNTK, the game	Environmental education	Climate change, energy, pollution and water management	10–14 years	Strategic simulation
ZooLoco	Early childhood education	Basic learning activities and educational games	3–6 years	Educational mini-games
A Curuxa	Environmental education	Nature and environmental awareness	6–12 years	Educational adventure
Separa para reciclar	Environmental education	Recycling and waste management	6–12 years	Educational mini-games
Silín y Ruidón	Health education	Noise pollution and hearing awareness	6–12 years	Educational mini-games
TuTu	Health education	Healthy habits and well-being	6–12 years	Educational mini-games

Video game	Educational topic	Main content	Target audience	Genre
Sex Invaders	Sex education	Sexual health and affective-sexual education	12+ years	Educational arcade game
Nos vamos de viaje	Cultural heritage education	Mobility, travel and road safety awareness	6–12 years	Educational mini-games
Europa una aventura	Cultural heritage education	European citizenship, culture and institutions	10+ years	Educational adventure

Note. Own elaboration. Target age ranges are approximate and were established based on the information provided by the developers, the educational content addressed and the pedagogical characteristics of the video games analysed.