

Article

Evaluating Video Games as Tools for Education on Fake News and Misinformation

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Abstract: Despite access to reliable information being essential for equal opportunities in our society, current school curricula only include some notions about media literacy in a limited context. Thus, it is necessary to create scenarios for reflection on and a well-founded analysis of misinformation. Video games may be an effective approach to foster these skills and can seamlessly integrate learning content into their design, enabling achieving multiple learning outcomes and building competencies that can transfer to real-life situations. We analyzed 24 video games about media literacy by studying their content, design, and characteristics that may affect their implementation in learning settings. Even though not all learning outcomes considered were equally addressed, the results show that media literacy video games currently on the market could be used as effective tools to achieve critical learning goals and may allow users to understand, practice, and implement skills to fight misinformation, regardless of their complexity in terms of game mechanics. However, we detected that certain characteristics of video games may affect their implementation in learning environments, such as their availability, estimated playing time, approach, or whether they include real or fictional worlds, variables that should be further considered by both developers and educators.

Keywords: fake news; media literacy; video games; media literacy skills



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1. Introduction

Access to credible information is crucial for achieving equal opportunities in our society. The proliferation of fake news in media and on social media has been the subject of concern in recent years [1,2]. Such news represents false information presented as truth, disseminated through the media, particularly online, with the intention to deceive and manipulate the public opinion [3,4]. Sunstein [5] states that the proliferation of information on social media has impacted our ability to access a wide range of political perspectives and argues that some political actors take advantage of this dynamic to influence our behaviors. As the volume of information available online continues to grow, and with our ease of access to information through the Internet [6], our ability to distinguish between truthful and false information becomes increasingly important [7,8].

The origin of fake news can be traced back to antiquity, with the Romans already disseminating false information to manipulate the population [9]. Today, its impact is even more drastic. Fake news has become a political tool used to win elections, influence public opinion, and generate disinformation [10,11]. Moreover, the impact of such news on society can be highly negative when dealing with health, politics, or security issues. According to Bin Naeem and Bhatti [12], the spread of fake news about COVID-19 has led to a decline in the adoption of preventive measures and has increased confusion and fear among the population, possibly resulting in a greater spread of the virus and an increase in cases. Similarly, fake news may influence political decision-making [8,13], with significant implications for social stability [14]. Addressing these issues requires promoting media

literacy and critical thinking among the population [15,16] to help identify fake news or other types of misinformation [17].

Teachers have traditionally instructed students on journalism concepts, news-writing, and the differences between news genres [18]. School curriculums typically include some notions about news, but within a limited context, and most documented classroom interventions are the consequence of a personal commitment by teachers [1]. However, it is insufficient to seek formulas for incorporating media literacy into a curriculum already laden with academic knowledge; it is necessary to create new spaces for reflection on and well-founded analyses of misinformation [16]. This is paramount in the current landscape characterized by a lack of scenarios that promote reflection and initiatives that address the need for media literacy [19]. Given the need to cultivate the youth's journalistic literacy skills in our age of misinformation [20], without spaces for reflection [21] and with current initiatives not fully addressing these needs [22,23], it is necessary to re-think the strategies for delivering media literacy skills. Using video games can be a powerful approach to fostering these [24], as specific learning content (such as fake news, digital privacy, personal media habits, and practical media skills) may be seamlessly incorporated into game design to achieve multiple learning outcomes and the cultivation of competencies transferable to real life [25].

However, Glas et al. [26] point out that despite there being many games aimed at teaching about fake news or privacy, among others, it is not clear how they actually serve as educational tools for media literacy, which competencies or content they focus on, and how these are delivered through game design. Most studies are limited to the scope of one game and its effects or centered around one particular aspect of media literacy. Moreover, there is a lack of studies focusing on the practical aspects of game implementation in educational settings.

The purpose of this research is to contribute to filling this research gap by conducting a quantitative analysis of a pool of media literacy video games while adopting a broad and multifaceted understanding of media literacy. This will (1) provide an overview of which media literacy competencies and learning outcomes are covered by existing media literacy video games in relation to a curriculum of reference, (2) generate insights into the strategies used to promote these competencies through game design, and (3) understand how certain characteristics of these video games may influence their implementation as pedagogical tools in educational settings such as schools. Additionally, we provide a set of detailed practical examples of how content and design in video games may contribute to delivering learning experiences. For this study, we utilize the definition of "media literacy games" as games whose purpose extends beyond entertainment, focusing on media literacy, and which, through their design, are explicitly oriented towards one or more of the key themes, skills, or competencies associated with media literacy, thus connecting with a broader field of research centered on the use of digital or tabletop games for education or behavioral change [27].

This work is part of the initial phase of the YO-MEDIA project (Youngsters' Media Literacy in Times of Crisis) funded by the Calouste Gulbenkian Foundation (269094), designed to examine how games may be used to enhance media literacy among young people. This research seeks to shed light on the effectiveness and potential of media literacy video games as educational tools, addressing a critical need in our information-driven society. It is a vital component of the YO-MEDIA project.

2. Theoretical Framework

2.1. Media Literacy

Media literacy focuses on understanding news through the combination of journalism, citizenship, and technological concepts [28] and helps individuals become adept readers and producers [29]. Despite media literacy historically being understood as the ability to read, watch, listen, and comprehend media, the evolution of the traditional media landscape linked to new digital technologies has brought about a change [26]. Today, the

concept of media literacy cannot be confined to an instrumental or functional literacy driven by the mere retrieval of information, but also needs to be construed as the capacity for the critical understanding of and active participation in the media [30]. As Buckingham [30] highlights, media literacy is much more than simply “accessing” these media or utilizing them as tools for learning. Instead, it entails cultivating a broader critical understanding that delves into the attributes of these media while also considering their social, economic, and cultural implications.

We understand media literacy from the perspective of “game literacy”, as the manner in which players develop and apply different skills; not only as cognitive competencies that build informal learning skills by enabling players to think, converse, and read [31], but as competencies through which players also acquire critical thinking abilities, make decisions, and take action within a dynamically evolving environment [32] and have abundant opportunities to carry out informal learning activities, and, in some cases, achieve formal learning [33]. Ultimately, the capacity to engage with a game often encompasses more than mere familiarity with its rules, objectives, and interface; it also involves the aptitude to partake in social and communicational practices [34], regardless of whether the game is played on a computer, mobile device, or console.

2.2. Games and Media Literacy

In the growing field of gaming research, scholars have been addressing literacy practices and learning during gameplay in a range of games and game genres [31,35,36]. Gee [35] discussed the literacy possibilities offered by games, the kind of experiential learning they provide, and how players can engage with topics and concepts not easily accessible through conventional learning approaches.

Games can potentially serve as an effective tool for improving media literacy and the ability to distinguish between true and false information [37]. They have been shown to enhance people’s ability to process and comprehend information and help develop critical thinking skills [38]. They also provide a safe environment for experimentation, serving as an effective tool for media literacy [39,40]. Video games have not only proven to be useful in acquiring these skills, but in general, they are tools that increase motivation [41], including for self-learning [42], thanks to game mechanics that can affect engagement [43]. They attract the player with the narrative, influencing their interest and fulfillment, key factors towards increasing commitment and satisfaction [44].

Some video games have been shown to help improve performance in critical thinking tests, like Minecraft, which requires players to think creatively and strategically to solve construction problems [45], or Portal 2, a puzzle video game in which players must find solutions to riddles [46]. Other benefits include improvements in problem-solving and decision-making [47]. Moreover, some have been specifically designed to foster media literacy and help distinguish between genuine and fake news, such as Bad News or Factitious—Pandemic Edition [48]. But their main advantage lies in their ability to demonstrate how things work in a practical manner by engaging users in a vivid experience [24]. However, it should not be surprising that their effectiveness relies on the inherent possibilities of each game [38].

Games are also media, and this becomes more pertinent when considering their extensive utilization by the youth [46]. This implies that the analysis of games requires new and distinctive methods that cannot simply be transferred from other media, though this is equally the case when we compare television and books, for example. While some elements are shared across media, others are distinctive to a specific medium [30].

2.3. Media Literacy Frameworks for Education

To enhance media literacy, it is necessary to tackle the underlying problems and promote a culture of fact-checking and critical thinking. Some authors have suggested that school education could include programs about responsible social media use and the importance of verifying information before sharing it [49]. Tools and technologies such

as FactCheck.org [50] could be used to verify the authenticity of news, and pedagogical strategies could be implemented, like media analysis, evaluation of information quality, and understanding of media rhetoric and biases [51].

Other authors have proposed their own theoretical frameworks for media literacy in educational programs [16,52–54], and there have also been institutional efforts toward this end, such as the Digital Citizenship Education Handbook by the Council of Europe [55], written from a theoretical perspective. These initiatives and proposals are of a general nature and do not tackle media literacy in education from a practical and implementable point of view. The lack of clearly defined learning objectives hinders, to a certain extent, their implementation in formal educational settings, which are typically curriculum-driven and need to use learning objectives as evaluation measures.

The European Association for Viewers Interests (EAVI) [56] produced the report *Get Your Facts Straight!: Toolkit for Educators and Training Providers*, which includes a goal-oriented methodology and curriculum that breaks down media literacy education on misinformation and fake news into three main learning areas, each corresponding to a module that includes several learning outcomes, as shown in Table 1. Despite not being specifically designed to be implemented through video games, for this study, we will use its objective-driven educational methodology on media literacy as a reference to evaluate which learning outcomes the analyzed sample of video games contribute to delivering.

Table 1. Structure of *Get Your Facts Straight!: Toolkit for Educators and Training Providers*.

Module	Learning Outcomes
Module 1 What is disinformation	1.0 I can explain the difference between information and disinformation. 1.1 I can identify the types of misleading news.
Module 2 How social media make money and why disinformation and propaganda are vastly present on social media	2.1 I understand the consequences of believing and sharing false information for the society and for myself. 2.2 I understand the reasons why disinformation is published with the intention to mislead me. 2.3 I know there are some political or commercial interests that try to affect my behavior online. 2.4 I have a general idea about how algorithms affect what we see online.
Module 3 How to recognize and react to disinformation	3.1 I understand what are some examples of credible sources of information. 3.2 I know how to check information and I know the changes in the media landscape. 3.3 I know how to defend myself from threats and risks on social media. 3.4 I know what I can do to be a positive and responsible social media user.

3. Materials and Methods

This work applies the deductive method to provide, after an exploratory phase, a quantitative–descriptive view of the existing video games about media literacy in order to understand their usefulness for teaching purposes and their ease of implementation in learning environments. Figure 1 illustrates a summary of the methodology followed during the present study.

We selected a sample of video games after reviewing the JournalismGames.org database from the Interactive Media Department of the School of Communication at the University of Miami and after carrying out searches on the STEAM platform and on Google with the keywords “fake news”, “media literacy”, and “media”. We discarded any video game that did not focus on addressing media literacy, the use of fake news, or tangentially fought misinformation. We prioritized video games that provided a deep and meaningful approach that would be of use for teaching purposes, offering an immersive and educational experience.

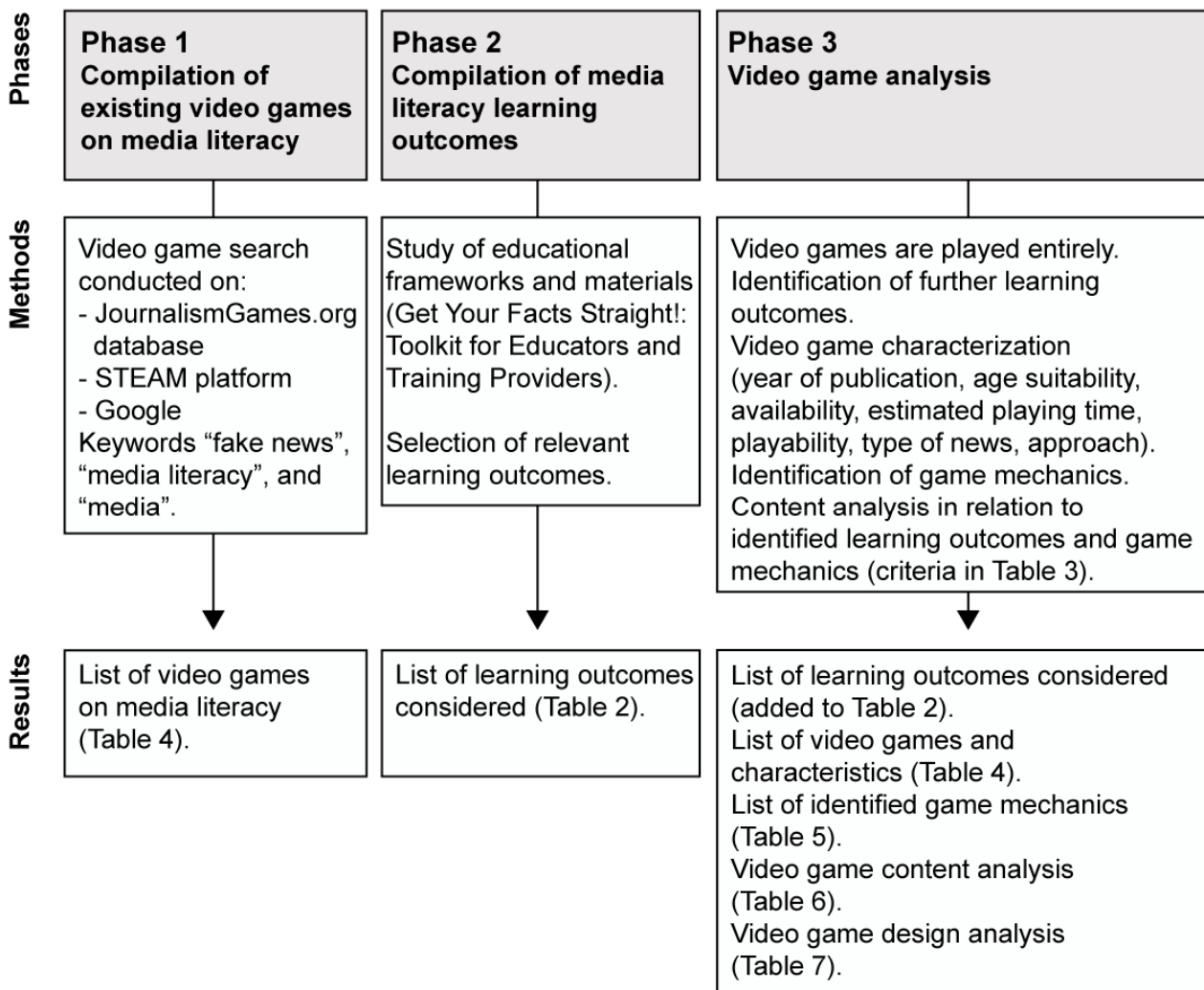


Figure 1. Summary of the methodology.

To understand the practicalities of how video games may be incorporated into learning environments, we analyzed the main characteristics of the selected sample regarding their playability, the type of news they depict (real vs. fictional worlds), their approach (constructivist/behaviorist), availability (whether they were free or had a fee, and their availability on the STEAM platform), age suitability, and estimated playing time. We also studied the games’ content in relation to the curriculum set out in Get Your Facts Straight!: Toolkit for Educators and Training Providers [43], specifically in reference to the 8 learning outcomes suggested in Modules 2 and 3 of the curriculum (see Table 1), by playing each game entirely. We did not consider the learning outcomes included in Module 1, as these are focused on more theoretical content that cannot be delivered through video games alone, while Modules 2 and 3 revolve around the student and clearly describe educational objectives that may be delivered by video games in a measurable way. While playing and studying the games, we identified an additional possible learning outcome in the pool of video games (9. “Know how to create fake news”). The complete list of learning outcomes considered for the analysis is shown in Table 2. Last, we compiled a list of the game mechanics present in the sample.

Video game complexity and usefulness for media literacy teaching purposes were evaluated by scoring the content (learning outcomes considered) and design (game mechanics identified) on a scale from 0 to 3, following the criteria set out in Table 3.

Table 2. List of learning outcomes considered.

No.	Learning Outcomes Considered
1	Understand the consequences of believing and sharing false information for society and the individual.
2	Understand the reasons why disinformation is published with the intention to mislead.
3	Know that some political or commercial interests try to affect online behavior.
4	Have a general idea about how algorithms affect what we see online.
5	Understand what some examples of credible sources of information are.
6	Know how to check information and know the changes in the media landscape.
7	Know how to defend oneself from threats and risks on social media.
8	Know how to be a positive and responsible player on social media.
9	Know how to create fake news.

Table 3. Evaluation criteria for learning outcomes and game mechanics.

No.	Content: Learning Outcomes	Design: Game Mechanics
0	Non-consideration of learning outcome	Not present
1	Learning outcome addressed indirectly	Low impact on the game
2	Learning outcome addressed metaphorically	Relative impact on the game
3	Learning outcome addressed explicitly	High impact on the game

4. Results

4.1. Media Literacy Video Games and Characteristics

We identified 24 video games on media literacy and conducted a comprehensive evaluation of their general features. Table 4 summarizes the main characteristics of each video game, including its name, year of publication, age suitability, availability, estimated playing time, whether it is re-playable, the inclusion of real news in the content, and the learning approach.

We identified six re-playable games within the analyzed sample. Most video games ($n = 14$) used real news, while the rest focused on fictional worlds. We also analyzed the games' type of approach to determine whether the video games provided the player with the necessary tools to build their own procedures to solve a problematic situation, through a constructivist approach, or whether the games proposed activities with content that had to be learned by the player, promoted by appropriate stimuli at each moment, in a behaviorist approach. We found that the majority of the games ($n = 18$) presented a behaviorist approach. A large number of the games studied were intended for audiences above 12 years old ($n = 11$), while 12 were intended for audiences over 14 ($n = 6$) and 16 years old ($n = 6$). Only one of the games was aimed at players above 18 (G21). Most video games were free of charge ($n = 17$), but all the games found on the STEAM platform had a fee ($n = 7$). The majority of the games reported an estimated playing time of 30+ min or below ($n = 15$), while two games had estimated playing times of 45+ min, and seven games had estimated playing times of 60+ min.

Table 4. Media literacy video games and characteristics.

No.	Video Game	Year	Age	Availability	Playing Time (min)	Characteristics
G1	The Republica Times	2012	12+		15+	+ °
G2	Interland	2017	12+		30+	- °
G3	Bad News	2017	12+		30+	+ °
G4	Fake It to Make It	2017	16+		30+	* ^ -
G5	Go Viral!	2018	12+		30+	+ °
G6	Fakey	2018	12+		15+	+ °
G7	Post Facto	2018	12+		15+	+ °
G8	Cranky Uncle	2020	12+		15+	+ °
G9	Harmony Square	2020	12+		20+	+ °
G10	Choose your own fake news	2020	12+		20+	+ °
G11	Adventures of Literatus	2020	14+		30+	- °
G12	Stop the troll	-	14+		20+	+ °
G13	BBC iReporter	2020	14+		30+	^ -
G14	Cat Park	2022	14+		60+	^ -
G15	EU vs. Disinfo Quiz	2022	14+		15+	+ °
G16	NewsFeed Defenders	2023	16+		60+	+ °
G17	Julia: A Science Journey	2023	12+		20+	+ °
G18	Political Animals	2016	16+	ab	60+	* - ^
G19	Headliner	2017	14+	ab	45+	- °
G20	No Place for the Dissident	2020	16+	ab	60+	* - °
G21	Floor 13: Deep State	2020	18+	ab	60+	* - °
G22	Influence Inc.	2022	16+	ab	60+	* - ^
G23	Power & Revolution 2022 Edition	2022	16+	ab	60+	* + ^
G24	Forge of Destiny	2023	12+	ab	45+	+ °

a Has a fee, b Available on STEAM, * Re-playable, + Uses real news, - Uses fictional news, ^ Constructivist approach, ° Behaviorist approach.

4.2. Identification of Game Mechanics

After playing each video game entirely, we compiled a list of the six game mechanics identified in the analyzed pool (Table 5).

Table 5. Identified game mechanics.

No.	Game Mechanics
1	Allows players to investigate the news and find out which are real and which are fake.
2	Allows players to create news and includes consequences for the player if they spread fake news.
3	Challenges the player to spread fake news created by others.
4	Shows the player different news items (real and fake) and asks them to select the real ones.
5	Allows players to create fake news and spread them within the game.
6	Quizzes the player by challenging their knowledge of political or current topics.

4.3. Most Complete Video Games for Media Literacy

Table 6 displays the list of video games analyzed and the scores assigned for each of the learning outcomes (see Table 2) according to the scale presented in Table 3, as well as the total number of learning outcomes within each game and the total score for the whole amount of learning outcomes in each video game (total game score). It also shows in how many video games each learning outcome is included (outcome presence) as well as the total score of each learning outcome in the whole pool of video games (total score per outcome). We also included the number of times each learning outcome was assigned each scale value in the pool of games studied.

Table 6. Video games and learning outcomes.

Game/Mechanic	1	2	3	4	5	6	7	8	9	No. of Outcomes	Total Game Score
G22	3	3	3	3	2	3	3	3	3	9	26
G4	2	3	3	3	3	3	2	3	2	9	24
G14	2	2	2	3	3	3	3	3	3	9	24
G3	2	2	2	3	3	2	3	3	3	9	23
G13	3	3	3	1	3	3	1	3	2	9	22
G5	2	2	1	3	3	2	3	2	3	9	21
G16	1	1	1	3	3	3	3	3	3	9	21
G21	3	3	3	2	1	2	2	3	2	9	21
G19	2	3	1	1	1	3	3	3	3	9	20
G24	2	2	2	3	3	2	2	2	2	9	20
G20	3	3	2	1	1	1	2	3	2	9	18
G23	3	3	2	1	1	2	1	2	1	9	16
G9	1	1	1	3	2	1	2	1	3	9	15
G11	1	1	1	1	2	2	2	1	2	9	13
G10	3	3	2		1	1	1	2	1	8	14
G18	2	2	2	2		2	2		1	7	13
G8				1	3	3		2	3	5	12
G7				3		3	2	3		4	11
G6	1						3	3	2	4	9
G17					2		2	2	2	4	8
G15				3	3				2	3	8
G2	1				3		3			3	7
G1			1		1	1				3	3
G12					3	3				2	6
Outcome presence	18	16	17	18	21	20	20	19	20		
Total score per outcome	37	37	32	40	47	45	45	47	45		
Max. score (3)	6	8	4	10	11	9	8	11	8		
Med. score (2)	7	5	7	2	4	7	9	6	9		
Min. score (1)	5	3	6	6	6	4	3	2	3		

As shown in Table 6, more than half of the video games analyzed ($n = 13$) include the nine learning outcomes (see Table 2). When also considering the total score assigned to each video game according to the learning outcomes present, we can determine which

items among these have the best total score and should, therefore, be suitable for a more complete and robust educational experience. Up to 11 video games include all the learning outcomes in quite a direct manner in general (total game score of 18 or above): these are the most comprehensive games identified in the sample. Moreover, G22 approaches the maximum total score with 26 points, making it the most robust game analyzed in terms of media literacy learning outcomes by explicitly meeting and addressing nearly all the outcomes except for one, which is addressed metaphorically. This video game would thus constitute the most complete media literacy educational tool available in the pool of games analyzed.

4.4. Most Common and Robust Learning Outcomes

According to Table 6, the outcome with the greatest presence in the video game pool is number 5 (“Understand what some examples of credible sources of information are”), which is included in 21 of the games analyzed. On the other hand, the least represented is outcome 2 (“Understand the reasons why disinformation is published with the intention to mislead”), present in 16 games.

The total score per outcome indicates which learning outcomes are generally better incorporated into the sample of video games analyzed. There are two outcomes with a score of 47 (maximum score is 72), which is the highest score achieved: outcomes 5 and 8 (“Understand what some examples of credible sources of information are” and “Know how to be a positive and responsible player on social media”, respectively); these are the learning outcomes most explicitly addressed in the sample. This analysis also shows that outcome 9 (“Know how to create fake news”) is present in a large number of the games ($n = 20$) and with a relatively high score (45 points), justifying its inclusion in the list of outcomes considered. The learning outcome with the lowest total score is number 3 (“Know that some political or commercial interests try to affect online behavior”) with 32 points, also on the list of outcomes that appear in fewer games ($n = 17$).

Most outcomes are more often addressed explicitly than indirectly, except for number 3 (“Know that some political or commercial interests try to affect online behavior”). Five of the outcomes are predominantly addressed directly in the pool: the number of times an outcome is explicitly addressed surpasses the occasions when it is addressed metaphorically and greatly exceeds indirect treatment (learning outcomes 2, 4, 5, 6, and 8). Outcomes 8 (“Know how to be a positive and responsible player on social media”), 4 (“Have a general idea about how algorithms affect what we see online”), and 5 (“Understand what some examples of credible sources of information are”) stand out, as their explicit treatment surpasses both metaphorical and indirect approaches combined.

4.5. Learning Outcomes and Game Mechanics

Table 7 displays the list of video games analyzed and the scores assigned for each of the mechanics identified (see Table 5) according to the scale presented in Table 3, as well as the total amount of mechanics within a game and the total score for the whole number of mechanics in each video game (total game score). It also shows in how many video games each mechanic is included (mechanic presence) as well as the total score of each mechanic in the whole pool of video games (total score per mechanic). We also included the number of times each mechanic was assigned each scale value in the pool of games studied.

As shown in Table 7, we found that six video games in the analyzed sample include the six mechanics identified (see Table 5). These games (G19, G20, G21, G22, G23, G24) also present the nine learning outcomes set out in Table 2 (see Table 6). It should be noted that, although a game may include all the mechanics detected, this does not guarantee that it will meet all the learning outcomes. For instance, G3 addresses the nine outcomes with only one mechanic (mechanic 1: “Allows players to investigate the news and find out which are real and which are fake”). Additionally, G4, G5, and G9 address the nine outcomes with only two mechanics (mechanic 2: “Allows players to create news and includes consequences for the player if they spread fake news” and mechanic 4: “Shows the player different news

items (real and fake) and asks them to select the real ones”). The opposite is also true; there are games with a high variety of mechanics ($n = 5$) and, therefore, presumably have more complexity, but they address fewer than half of the objectives (such as G6).

Table 7. Video games and mechanics.

Game/Mechanic	1	2	3	4	5	6	No. of Mechanics	Total Game Score
G22	3	3	3	3	3	3	6	18
G21	3	2	2	3	3	2	6	15
G19	3	3	2	3	3	2	6	16
G24	3	3	2	3	3	2	6	16
G20	2	3	2	3	3	2	6	15
G23	2	3	2	2	3	2	6	14
G13	3	3	3	3	3		5	15
G16	3	3	3	3	3		5	15
G6	3		3	3	3	3	5	15
G8	1	2	1	1		3	5	8
G17	3		1	1	1	1	5	7
G14	3	3		3	3		4	12
G10	3		3	1	1		4	8
G11	3		3		1		3	7
G7	3	1		3			3	7
G18	3	1				2	3	6
G15	3		1	1		3	3	8
G9		3		3			2	6
G4		3		3			2	6
G5		3		3			2	6
G12	3		3				2	6
G2	3			2			2	5
G3	3						1	3
G1		1					1	1
Mechanic presence	20	16	15	19	13	11		
Total score per mechanic	56	40	34	47	33	25		
Max. score (3)	17	11	7	13	10	4		
Med. score (2)	2	2	2	2	0	6		
Med. score (1)	1	2	3	4	3	1		

The most frequently used mechanics are 1 (“Allows players to investigate the news and find out which are real and which are fake”) and 4 (“Shows the player different news items (real and fake) and asks them to select the real ones”), which appear on 20 and 19 occasions, respectively. The least used mechanic is number 6 (“Quizzes the player by challenging their knowledge of political or current topics”), which appears in only 11 games. The most impactful mechanics in the pool of games are also 1 and 4, with total scores of 56 (maximum score is 72). The mechanic that seems to have a lower overall impact is also number 6, with a score of 25 points. In general, nearly all mechanics, when used, are employed with high impact in the video game in which they appear.

5. Discussion

In recent years, the number of games that address fake news and media literacy has grown, which aligns with the observations made by Adams et al. [1] and Shehata [2], who highlight a global concern. Game developers respond to these preoccupations by creating experiences that promote critical awareness. In the following subsections, we provide a comprehensive summary of the main characteristics of the video games focused on media literacy currently available on the market, including content (learning outcomes) and design (game mechanics), and discuss their suitability and usefulness for learning purposes. Last, we provide a series of examples of how learning outcomes are incorporated into video game content.

5.1. Characterization of Media Literacy Video Games

Certain game characteristics may influence the suitability and usefulness of video games for media literacy teaching and their ease of implementation in the classroom (see Table 4). For instance, despite re-playability being beneficial for educational purposes [57], we found that only six out of the twenty-four video games analyzed were re-playable. This variable is also closely linked to the estimated playing time, as most games with a longer duration (45 min or more) were also re-playable.

The estimated playing time also affects the extent to which video games can be implemented as a tool in the classroom. Shorter games (30 min or less) may be played during a typical one-hour class, while longer video games could be suitable, for example, as homework. We found that most of the games in the sample, fifteen in total, had a low estimated playing time and could easily be used in a classroom environment, while two of them had a longer duration (45 min or more) that could still enable their use in this setting with certain constraints. These video games could be incorporated into the resources and materials of Modules 2 and 3 from *Get Your Facts Straight!: Toolkit for Educators and Training Providers* [56], which suggest other resources such as videos, mobile games, websites, or slides to help achieve specific learning outcomes with an estimated time for group work and discussion with students between 10 and 40 min. Games with playing times above 60 min ($n = 7$) would be difficult to use in typical school settings.

Target audiences determine whether a video game can be used as a teaching tool within the educational system or not. Nearly all the video games were suitable for audiences within school and high school ages ($n = 23$). Games aimed at players over 18 years old could only be used in countries where the schooling age is extended (for instance, some Nordic countries) or in educational settings other than schools and high schools, such as at university level. Only one of the video games analyzed (G21) fell into the latter category; it is a complex simulator that showcases a dystopian thriller with game mechanics that force players to challenge authority to achieve their objectives and in which they must control people's opinions and will.

Other variables related to game availability (pricing and platform) may influence accessibility and, therefore, affect or hinder their implementation in the classroom. Free items are more accessible and more likely to be implemented. They can also easily be used for homework, as there is no additional cost for the student or parents and guardians. We found that the majority of the video games analyzed ($n = 17$) were free of charge. While the integration of media literacy topics into platforms such as STEAM increases their reach and promotes public awareness of the problem of misinformation in society, all the games that were available on the STEAM platform ($n = 7$) required a fee. This may represent an obstacle for their implementation: first, due to a fee that may affect their incorporation into school settings but also prevent their usage at home for those who cannot afford it; and second, because STEAM is a platform that requires individual accounts and subscriptions, which would complicate its use in a collective setting such a classroom.

Within the analyzed sample, most free video games were suitable for younger audiences (over 12 years old) and had shorter estimated playing times (approx. 30 min on average). These games are designed to deliver quick play rounds and are more suitable

for broader audiences, which makes them great candidates for incorporation into the classroom. In contrast, paid video games seem to be aimed at older audiences (over 14 years old) and have longer playing times of more than 45 min, often exceeding 60 min in re-playable games. However, they may offer a more in-depth learning experience.

Another key characteristic is the learning approach within these games, which determines how these tools may be implemented and the role of teachers and students. Behaviorism focuses on repetition and constant practice, while constructivism encourages critical thinking, active participation, and problem-solving. In behaviorism, the student assumes a passive role, whereas in constructivism their participation is active. In this regard, constructivist approaches, like games and projects which involve student participation, are more suitable for learning purposes, as they allow the student to be an active element that generates knowledge while the teacher only plays the role of a guide. In the case of using video games in the classroom, the teacher's role would thus vary: in a behaviorist approach, the teacher would be an information transmitter, while in a constructivist approach, they would act as facilitators and guides of the learning process [58,59]. Within the sample, the majority of video games ($n = 18$) presented a behaviorist approach.

The effectiveness of video games is achieved by integrating accurate and credible information, persuasively conveyed [60] through the context and documentation provided [61]. However, the type of world a video game depicts may also affect its implementation in a learning setting. Games that include real news may contribute to a greater awareness of the world at a given time and promote critical and grounded discussions. In this regard, it is important to mention G23, which employs news about the war in Ukraine. Other games (G6 and G15) also feature real current issues, including general mentions of the war, while G17 specifically addressed the COVID-19 pandemic. However, the content of these games ages as reality and the knowledge of a given event change and evolve, which may render certain video games obsolete or unusable in the long term for teaching purposes. Most of the games analyzed used real news ($n = 14$) and, although these might be a desirable tool in current times, video games using fictional worlds ($n = 10$) may be more suitable for inclusion in a curriculum in the long run. The latter mainly focus on detecting fake news and combating misinformation, and they do not include current political issues so as not to distract from the learning goals with the tensions and divisions that merely talking about politics, war, and the like, can create.

5.2. Learning Outcomes and Game Mechanics

More than half of the video games analyzed ($n = 13$) included all the learning outcomes considered (see Tables 2 and 6) and up to 11 video games addressed all the learning outcomes in a metaphorical or explicit manner, which is more suitable for media literacy teaching purposes than the inclusion of learning outcomes in an indirect fashion. These constitute the most comprehensive media literacy video games within the sample. It is noteworthy to mention G22, the most robust game detected, which addresses nearly all the selected learning outcomes (8 out of 9) explicitly, making it the most complete media literacy educational asset in the sample. This game also has a constructivist approach and is re-playable, ideal characteristics for a video game to become a learning tool. Nevertheless, the fact that there are so many items that address all the learning outcomes provides teachers and educators with a wide array of options to choose from for media literacy education, and most of those are free of charge ($n = 8$), are not restricted to any platform ($n = 8$), or are short enough for use in the classroom ($n = 6$). Unfortunately, the most complete and robust game (G22) carries several constraints to its classroom implementation: it is a long game (more than 60 min of estimated playing time), it has a fee, and is only available on STEAM. These characteristics may hinder its use for educational purposes, but these disadvantages can certainly be overcome.

The outcome with the greatest presence in the video game pool is number 5 ("Understand what some examples of credible sources of information are"), present in 21 items. The least represented is outcome 2 ("Understand the reasons why disinformation is published

with the intention to mislead”), available in 16 games. Two learning outcomes stand out as the most explicitly addressed in general in the whole sample: outcomes 5 and 8 (“Understand what some examples of credible sources of information are” and “Know how to be a positive and responsible player on social media”, respectively). The least robustly treated topic within the video game sample seems to be outcome number 3 (“Know that some political or commercial interests try to affect online behavior”), which also appears in few games as compared to others ($n = 17$). Nevertheless, most learning outcomes are more often addressed explicitly than indirectly, except for number 3, which is more often addressed indirectly in the analyzed games. Learning outcomes 8 (“Know how to be a positive and responsible player on social media”), 4 (“Have a general idea about how algorithms affect what we see online”), and 5 (“Understand what some examples of credible sources of information are”) are the most explicitly addressed in general. However, it seems that not all learning outcomes are treated equally, and the crucial topic of the manipulation of information and why it exists (outcomes 2 and 3) seems to be more difficult to deliver through video games as a tool.

Regarding game design, during the analysis, we detected six different game mechanics (Table 5). The presence and impact of these mechanics were evaluated in each game (Table 7). We determined that a total amount of six games included all the mechanics. It is worth noting that the appearance of all the mechanics does not imply that the game will meet all the learning outcomes. Some games address all the learning topics with very few mechanics (G3, G4, G5, and G9), while other games with a high number of mechanics cover fewer than half of the outcomes (G6). The most frequent and impactful game mechanics detected were number 1 (“Allows players to investigate the news and find out which are real and which are fake”) and number 4 (“Shows the player different news items (real and fake) and asks them to select the real ones”). On the other hand, the most underused and least relevant mechanic was number 6 (“Quizzes the player by challenging their knowledge of political or current topics”). In general, nearly all the mechanics, when used, were employed with a high impact in the video game in which they appear. Nevertheless, it is paramount for educators to remember, when choosing a video game for media literacy teaching, that there does not seem to be a direct relationship between the complexity of the game design in terms of mechanics and their robustness as a teaching tool in terms of learning outcomes.

5.3. Examples of Learning Outcomes in Media Literacy Games

Longer re-playable games offer more prolonged experiences in time and, in general, include a more complex design in terms of game mechanics, which requires a greater commitment from the players [43]. They may stimulate immersion to raise awareness in the players, making them the protagonists of the actions and putting them in the shoes of the person who manipulates information. For example, in “No Place for the Dissident” (G20), the player must expand an ideology to dominate the world. The game mechanics allow the user to adopt ideological policies, manage a country, and compete with other players who also want to impose their ideologies. This way, some video games manage to put the users in the role of each involved party to help them understand the consequences of spreading misinformation (learning outcome 1). But this immersive strategy is not exclusive to very complex games in terms of design. For instance, in “Choose your own fake news” (G10), the player embarks on a journey where they choose their adventure by exploring news and data about job opportunities and vaccines and constantly challenges the player to learn to discern between truth and manipulation and develop the ability to make informed decisions in an environment plagued by deception.

To foster discernment skills in relation to media [51] so users can acquire tools to question the information they receive, identify biases, and make informed decisions, other games explore the motives behind disinformation with the intention to mislead (learning outcome 2). They may offer a deep understanding of why some political or commercial parties seek to influence our behavior (learning outcome 3) through information manipulation [5] and focus on showing how algorithms can affect what we see online (learning

outcome 4). For example, in “Fake It to Make It” (G4) the plot is focused on the field of advertising. Players seek strategies to influence people’s perceptions and behaviors to achieve their commercial objectives. The in-game experience immerses the player in a world where ethics and responsibility are questioned, providing deep insight into the power and consequences of manipulating real-life information and discussing how algorithms work.

To promote media literacy, it is crucial to encourage critical thinking and a culture of verification (learning outcomes 5 and 6). Games with quizzes and narratives that include real news emphasize this. Such an approach helps users identify fake news and other types of misinformation [17]. Video games that present methods to verify information and understand changes in the media landscape provide players with tools to discern between reliable input and misinformation. For example, in “BBC’s iReporter” (G13, Figure 2), the player is a reporter who must contrast their information sources under pressure to produce impactful news as quickly as possible. Players need to select predefined responses and interact with characters to resolve situations based on a narrative. These games highlight the importance of verifying information before sharing it, even when in a rush [49].

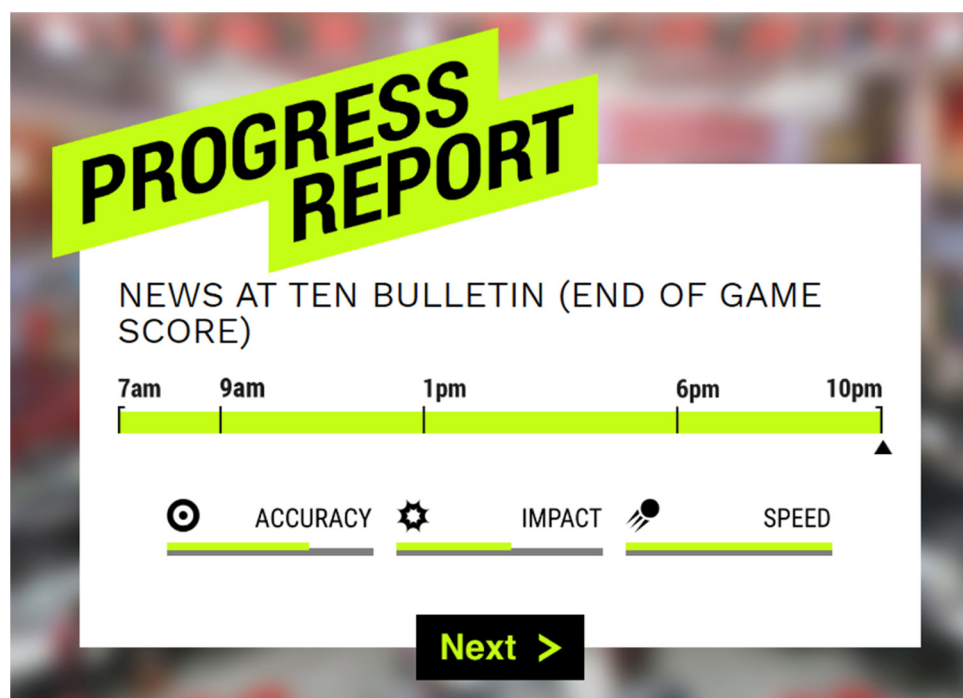


Figure 2. BBC’s iReporter (G13). Screen capture.

Regarding the defense against threats and risks on social media (learning outcomes 7 and 8), certain games provide relevant information on how fake news is constructed (learning outcome 9). In “Cat Park” (G14), with typical RPG mechanics, the player travels through a city where they will encounter an eclectic group of characters sharing a common goal: to bring down a cat park and spread it on social media. However, as the players create fake news, they will also learn counter-misinformation techniques and understand the benefits and limitations of different approaches. The goal is to solve the problems in the plot in a creative and strategic way that fosters creative solutions [46]. This experience provides a perfect blend of strategy and learning, allowing the player to explore the intricacies of information and misinformation.

In respect of video games that include current issues in the real world, it is worth highlighting “Power and Revolution 2022 Edition” (G23, Figure 3). It offers a simulation where players take on the role of political leaders and explore the Ukraine war, conspiracy theories, fake news, the interference of secret services, animal welfare, and global warming. Players can thus understand the complexities and implications of their actions in the media

and the social environment. The game management panel displays, through icons, how the country's economy functions, how waste recycling is carried out, the level of democracy, resources, education, and voting, as well as changes in political party and religion.



Figure 3. Power and Revolution 2022 Edition (G23). Screen capture.

Last, in “Influence Inc. 2022” (G22, Figure 4), the most robust game in terms of learning outcomes, the player takes on the role of the manager of a communication agency that resorts to all kinds of tactics to meet their goals. The user manipulates social media and news to promote celebrities and even influence elections and must think strategically about how to manage a digital influence agency using propaganda and advertising. Thus, while the users are amusing themselves with the video game, they are also carrying out actions within the game that produce valuable results for them [45]. This experience allows players to immerse themselves in a wide range of educational content, and although their malicious actions are carried out in a fictitious world, it provides a deep understanding of information control in the real world. By exploring the complexities of communication management, the player acquires critical awareness of how to handle and manipulate information, providing a valuable perspective for the world outside the game. The knowledge gained and the consequences observed in the game could be applied ethically in the classroom to ensure effective and contextualized learning.



Figure 4. Influence Inc. 2022 (G22). Screen capture.

6. Conclusions

In the present study, we analyzed 24 video games focused on media literacy by scrutinizing their content (learning outcomes according to the curriculum of reference), the way in which the content is delivered through their design (game mechanics), and the features that might impact their implementation within educational environments.

The growth in the number of games focused on fake news reflects the increasing importance of media literacy and the fight against misinformation in our current times. The content, mechanics, and dynamics of video games could offer a high degree of effectiveness in achieving critical learning outcomes for media literacy [27], allowing users to understand, practice, and implement these skills to combat misinformation. Likewise, these can foster sharper critical thinking and greater responsibility when consuming and sharing information, which is essential in an increasingly connected world. By integrating elements of news creation and distribution, video games offer a more immersive and challenging experience [45] than other tools, and players directly experience the consequences of their actions in a controlled environment [31,35]. Although in some cases the objectives within a video game may be considered negative, such as obtaining powers through violence (as in G21, G22, and G23 in the analyzed sample), the knowledge acquired can be applied ethically in the real world. Ultimately, the insights gained through video games can promote the development of critical thinking skills [26] and making ethical decisions in various contexts outside the game.

However, we found that some game characteristics may influence the suitability and usefulness of video games for media literacy teaching and their ease of implementation in the classroom. Estimated playing time should be considered when choosing a media literacy video game in a formal education setting, as re-playable games, though extremely beneficial for learning purposes, tend to be longer (60 min or more) and are, therefore, more difficult to incorporate into typical one-hour subject sessions or toolkits for educators, such as *Get Your Facts Straight!: Toolkit for Educators and Training Providers* [56]. Fortunately, most of the media literacy games found on the market today have estimated playing times that would fit these frameworks.

Target audiences also determine whether a video game can be used as a tool within the educational system or not, as only games aimed at players under 18 could typically be employed. It seems, though, that nearly all media literacy video games available on the market as of today (except for one item) are directed toward younger audiences and, therefore, are suitable for media literacy teaching purposes in schools.

Video game availability, particularly pricing and distribution platform, is a variable that educators should also evaluate before choosing a video game, as it greatly affects accessibility. While popular platforms such as STEAM increase the reach of video games and topics, these typically require a fee and individual subscriptions, which may hinder their implementation in collective settings such as educational environments. However, most media literacy video games are free and accessible.

The learning approach of a video game should be carefully considered before choosing it as a tool. Those based on behaviorism focus on repetition and constant practice, and the student plays a somewhat passive role. On the other hand, constructivist video games encourage critical thinking, active participation, and problem-solving. With the latter, educators should mainly act as guides. Even though the constructivist approach is more desirable for learning purposes, the majority of the video games on media literacy on the market incorporate a behaviorist approach.

Last, educators should ponder whether they prefer using a tool that employs real information, or video games depicting fictional worlds. Those that include real news may contribute to more awareness of the world at a given time and promote critical and grounded discussions, but they may rapidly become obsolete in our ever-changing world and constitute a distraction from learning objectives due to controversial issues being brought up. Most of the available video games on media literacy focus on real news.

Regarding crucial learning outcomes for media literacy, we discovered that more than half of the video games on the market were very complete and addressed all the learning objectives as set out in the curriculum of reference (*Get Your Facts Straight!: Toolkit for Educators and Trainers*); most of them did so in a metaphorical or explicit manner. These comprehensive tools were mostly free of charge, not restricted to a platform, and short enough to facilitate their implementation in the classroom, offering educators a broad range to choose from.

Most of the video games addressed the issue of credible sources of information (learning outcome 5). Other robust learning outcomes identified within the analyzed sample that tended to be addressed explicitly include knowing how to distinguish real and fake news (learning outcome 4) and knowing how to be a responsible player on social media (learning outcome 8). In contrast, the topics that seemed represented least and in a poorer manner were why disinformation is published with the intention to mislead (learning outcome 2) and the issue of political and commercial manipulation of information (learning outcome 3), which are crucial to navigating the Internet and social media nowadays. While not all considered learning outcomes were equally addressed, the findings demonstrate that certain media literacy video games currently available in the market could be harnessed as effective tools to attain critical learning objectives.

By playing the video games in their entirety, we were able to identify the most common game mechanics present in media literacy games. Most video games opt to focus on requesting the player to differentiate between true and false news (game mechanics 1 and 4), but those that better engage the player incorporate a variety of mechanics [25,41], including news creation and distribution on social media and facing the consequences of these actions (game mechanics 2, 3, and 5). This allows players to be involved in a more active way, encouraging decision-making and reflection on the impact of misinformation in society. Challenging the player about their knowledge about political or current topics was the least used method (game mechanic 6), which is somewhat positive, as focusing too much on controversial issues may distract students from the learning process. We also observed that the complexity of game design in terms of mechanics did not have a direct relationship with how comprehensive a video game was regarding the inclusion of media literacy learning outcomes. Thus, video games may empower users to grasp, exercise, and deploy skills to counter misinformation, regardless of the intricacies of gameplay mechanics.

As a practical example of the implementation of video games as an educational tool, educators may use the most robust game in terms of learning outcomes identified in this study (G22) to present students with a fictional scenario and situations involving the evaluation and verification of information, challenging them to discern between real and fake news. Through questions, decisions, and searches for reliable sources (outside the game), students can develop skills to identify and question misleading news in the real world.

After analyzing the main characteristics of media literacy video games, we can conclude that, despite the great effort of developers to incorporate this issue as a response to an increasing preoccupation, developing teams would benefit from a closer collaboration with educators to ensure that the video games produced can become effective and useful tools that can be smoothly integrated into formal education. Understanding how critical skills for media literacy are best addressed through video games and what mechanics best deliver these is a paramount area for future research, to ensure that video games can be effectively incorporated into curricula in this age of mis- and disinformation characterized by a lack of scenarios that promote critical thinking and initiatives that address media literacy. The development of research in the area of video games that employ fictional worlds and constructivist approaches is also of great importance for the determination of their educational potential as pedagogical tools, as the current media landscape is likely to be filled with new fictive worlds that have a great prospect for pedagogical purposes besides mere entertainment. It would also be crucial to develop more studies on video

games that focus on crises, such as wars and pandemics, very relevant issues that motivated some of the objectives of the YO-MEDIA project. However, research in this area faces certain limitations, such as the reduced amount of video games available on media literacy as compared to other topics and the lack of databases or repositories that compile such initiatives.

Finally, in the future, the use of other data analysis or processing techniques could be considered, once we have a larger dataset and a greater number of analyzed video games.

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