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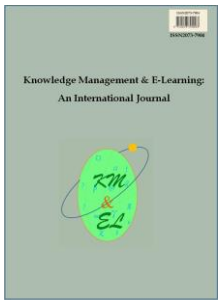

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Critical digital literacy for Catalan high school students: Co-design of an educational module around an indie video game

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Abstract: According to annual reports by Edelman (2025) and DataReportal (Kemp, 2025), Western societies are experiencing an upswing in both polarization and digital media consumption – a trend particularly pronounced in Spain. This paper outlines a co-design process involving 139 students and 20 video game experts to develop guidelines for an educational module on critical digital literacy. It offers insights into Catalan students' preferences for educational content (short, creative, visual content) and expert recommendations on essential approaches for teaching critical digital literacy (discursive and iterative lessons). The findings show that students are eager to engage in this kind of participatory research. The study identifies four areas of student interest/weakness that can serve as entry points for teaching critical digital literacy (brainwashing tools, creativity, immigration, and what is real), together with four video games deemed suitable for educational use (*Brawl Stars*; *Papers, Please*; *The Stanley Parable*; *What Remains of Edith Finch*). Finally, the paper provides an exploratory, locally grounded yet ecologically valid perspective on how to start integrating indie games into high school curricula.

Keywords: Game-based learning; Engagement; Media literacy; Adolescence; Critical thinking

Biographical notes: Dídac Jiménez Torras is a grant recipient and doctoral candidate for the Open University of Catalonia (UOC). His research interests include media literacy, video games, critical thinking, and biases.

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1. Why is critical digital literacy a topic in need of addressing?

To begin, I define critical digital literacy as the ability to question and deconstruct assumptions, make contextually valid comparisons, and detect bias ("*critical*"), and to navigate, evaluate, and produce information safely through online tools and platforms ("*digital*"). For the educational module co-design presented in this study, I adopted the Digital Literacy model developed by the DQ Institute (2026), which breaks down the construct into actionable competencies.

But why is critical digital literacy relevant? Digital screen time has been increasing globally over the past decade, with the average user now spending 35 hours per month on TikTok and 27 hours per month on YouTube (Kemp, 2025). This increase is largely driven by the younger generations: according to the Reuters Institute's Digital News Report, 86% of users aged 18 to 24 now get their news from social media (Newman et al., 2024). At the same time, trust in traditional news sources like The Times, politicians, and public institutions has plummeted (Edelman, 2025).

These surges in consumption and distrust have not come with an increase in creative reflexivity. A study by the Pew Research Center involving 2,745 Americans found that just 25% of TikTok users are responsible for creating 98% of its content (Bestvater, 2024), meaning that most of the remaining users are lurkers who do not usually create content.

This distinction matters: compared to proactive users who seek out new products and engage selectively and critically, passive consumers are generally less inclined to reflect (Jiang & Ma, 2024). This lack of reflexivity can contribute to diminished trust in traditional sources and increased susceptibility to fringe theories (Pennycook, 2023).

As users engage with this content and turn to these theories as a way of disconnecting (Jouhki et al., 2022), their overall consumption often increases. This can undermine their ability to cope with anxiety and stress, driving them to social media and casual games as escapism gateways (Thorell et al., 2024). Over time, this reliance fosters greater dependency on digital platforms while impairing users' ability to decode their own and others' emotional cues (Piccerillo & Digennaro, 2024).

These effects have been particularly pronounced among the younger generations (Alpha and Z). The rise in social media use, especially after the release of the iPhone and the emergence of selfie culture and Instagram, has coincided with elevated rates of depression, anxiety, and suicide among young people. Over the past 15 years, these mental health indicators have more than doubled (Rausch et al., 2024).

With social demands preventing them from escaping this vicious cycle, digital media consumption is likely hindering their academic achievement. The 2022 PISA exams – administered to 15-year-olds five years after TikTok's global release in 2017 – revealed the lowest scores on record, especially in Mathematics (ability to systematize) and Reading (ability to understand messages) (OECD, 2023).

In short, excessive social media use is rising, leading to dependency, depressive disorders, and less critical thinking. In light of these worrisome trends, this study proposes

the co-design of an educational module to develop adolescents' critical digital literacy. The overriding aim is to equip them with the tools to recognize the dark patterns that platforms employ to cage them.

2. Study design and literature review

I chose to co-design the educational model with students because I believed they were best positioned to pinpoint their own perceived digital consumption limitations. Moreover, involving them in the process was intended to make them more appreciative of the content, should they later have the chance to take the educational module. The benefits of participating in this collaborative creation process for student motivation and well-being (Suliman et al., 2025) were also a deciding factor when designing the study and were measured at the conclusion of the project.

Another reason for choosing co-design was to highlight the value of citizen science processes, particularly in the local context of Barcelona, where the study took place. The city has been spearheading participatory governance for some time, as seen in initiatives such as its citizen-consensus-based town budgets (Peña-López, 2017).

The educational module was built around commercial off-the-shelf games (COTS), both due to my expertise in this domain and because COTS titles can prompt students to examine the multimodal threats of digital environments in a controlled, simulated space from a distance (Gee, 2006). It was also believed that exposure to indie games could broaden students' perspectives beyond conventional platforms and games as a service.

COTS were also chosen because of the proven effectiveness of gamification. Think of *Khan Academy*, *Scratch*, *Duolingo*, and *Minecraft* (see the meta-analysis by Visible Learning) and their more serious game counterparts (Roozenbeek & van der Linden, 2019). Although the use of commercial games in education is a fairly new research avenue (Mahmoodi-Shahrebabaki, 2019), COTS have already been successfully applied to language learning (Rajendran, 2024; Schlasberg, 2021). This is closely related to critical digital literacy, as the "*critical*" part involves understanding and analyzing media, many of which are language rich. Video games, specifically, are multimodal.

Another reason games were chosen is their continued popularity among younger generations – 70% of Gen Alpha and 69% of Gen Z play video games (Newzoo, 2023). In the effort to foster critical digital literacy and autonomy, I also see some games as an intermediate point between what I categorize as passive "*faster*" digital media (social media, movies, series, etc.) and active "*slower*" physical media (reading, debating, crafting, doing sports, etc.). Games require interaction, they must be played, and their motivational appeal often lies in the challenges they present (Oberer & Erkollar, 2024).

In this sense, the motivational and attentional benefits of games are well-established (Granic et al., 2014; Kiili et al., 2023; Palaus et al., 2017), though they do carry some risk of addiction (or usage disorder). That said, these risks are considered less severe than those associated with social media (Bäcklund et al., 2022; Gao et al., 2022).

It is not that games are inherently "*good*" or "*bad*" – they come in many forms. Rather, certain games excel in particular contexts while falling short in others (Meriläinen & Ruotsalainen, 2023). No single game cultivates critical digital literacy in the same way or to the same extent. Škripcová (2022) wrote as follows:

> *"In Dishonored, where the player can decide whether to turn off the propaganda broadcast on global radio or replace it with another broadcast, which will influence the further development of the game. [...] In Detroit: Become Human [...] the player can use the newspapers to gather information about the development of the rebellion, how it was handled, and thus be able to analyze social opinion, which will allow him to better assess the situation and adjust his future decisions in this storyline accordingly. [...] the game Doki Doki Literature Club! [...] refers the player to game files that they must navigate, which serve as a form of narrative construction outside of the gameplay itself, as the game rewrites or erases them according to the player's choices in the story. It thus forces the player to seek out information that they would not otherwise find."*

Given the above, the present research took an exploratory approach that welcomed the use of games for both their intrinsic and extrinsic strengths – whether through messages and gameplay that directly challenge learners' critical digital literacy, or through opportunities to examine the games from a distance to inform students' digital competencies.

However, as multiple scholars have noted, selecting appropriate games for the classroom comes with a range of difficulties (Becker & Gopin, 2016; Faure-Carvallo et al., 2022; Watson & Yang, 2016; Xie et al., 2021). Key issues include:

- Literality: Games use figures of speech and non-realistic graphic styles.
- Time: Lesson time is limited.
- Knowledge: Teachers and students may not know how to play or analyze games.
- Material: Devices are needed to play games.
- Price: COTS frequently cost money.
- Bureaucracy: Using video games to teach is unconventional, so they may face institutional resistance.
- Support: Resources to introduce games are not readily available.

I also want to be upfront about the fact that games are not "*magical*", and teachers may lack the time and know-how to find and implement quality video games in the classroom (Tirén, 2021). This is a relatively new approach to a relatively new problem, making it all the more essential. If high school teachers were to implement COTS on their own, they would risk choosing games (or other recreational activities) with counterproductive effects (Osman et al., 2020). For example, interventions with excessive exposure to in-game competition or lack of monitoring can backfire (Zhang & Hasim, 2023). Likewise, due to publication bias, "*negative*" spillover effects of this kind are underrepresented in the literature.

To address these limitations, I incorporated expert input throughout the process. Given the complexity of critical digital literacy, I believe it is essential to carefully consider not only which games are selected but also how to implement them to avoid the unintended consequences discussed above (Bray & Hosein, 2023).

Ultimately, the co-design process involved 139 students in their third year of Spanish compulsory secondary education (which translates to Educación Secundaria Obligatoria, or ESO) – typically 14-15 years old and roughly equivalent to 9th grade in the

United States education system – and 20 university-level experts, defined here as active game developers and/or scholars.

With a focus on the specific context of high school classrooms, my primary exploratory objectives were to:

- Identify students' self-perceived interests and weaknesses when engaging with online content.
- Identify COTS that could be used to teach a narrowed form of critical digital literacy focused on those interests and weaknesses.

This paper presents preliminary participatory research that is heavily targeted to (and customized for) a specific group, so the results are not meant to be generalizable. Although the choice of age group was incidental, it fits the social media at-risk population.

3. Method

This is an exploratory study, meaning that the analysis did not strictly adhere to preregistered protocols. This flexibility was intentional, allowing emergent patterns in the data to influence the analysis. In this section, I describe the instruments and methods used during the data collection phase of the study.

It is important to note, again, that this study does not aim to be generalizable, as it employed intentional non-probabilistic sampling. This approach was chosen due to the researchers' proximity to the participating schools and the study's time constraints. In total, the sample included 139 students from Pedralbes public high school, 12 experts from Tecnocampus-UPF (a specialized Catalan tech unit), and eight experts from Enti-UB (a specialized Catalan games unit). The sole inclusion criterion was willingness to participate; no invited students or experts were excluded.

Table 1 below summarizes the instruments used. I encourage readers to consult the source files on OSF.

Table 1
Summary of the instruments used, dates, and samples

Instrument	Date	Sample
Experts		
Game selection survey	13/02 to 05/03	20/20 [100%] (gender not collected)
1-on-1 interviews	15/03 to 05/05	6/20 [30%] (16.7% female)
Students		
Module design – session 1	27/02	139/139 [100%] (46.8% female)
Module design – session 2	04/04 & 05/04	139/139 [100%] (41% female)
Module design – session 3	25/04 & 26/04	138/139 [99.2%] (42.7% female)
MyDigiSkills	14/02 to 27/02	10/139 [7.2%] (gender not collected)
5 Literacy concepts survey	29/02	81/139 [58.3%] (gender not collected)
Review survey	13/05 to 15/05	101/139 [72.7%] (gender not collected)

3.1. Methods and instruments used with students

Regarding the 139 students, I conducted three 30-minute sessions during school hours (with permission to interrupt their regular lessons). The students were divided into six classrooms, averaging 23 students each (aged 14-15, 46.8% female). The consecutive sessions followed a fairly structured presentation and script, and incorporated three types of questions: (1) multiple choice (via hand raising); (2) open spoken debate; and (3) written anonymous questions.

The sessions were organized as follows.

- Session 1 focused on students' self-perceived digital limitations and concerns.
- Session 2 narrowed down game options and explored what the structure of the educational module should look like.
- Session 3 involved benchmarking the two student-chosen games by simulating a typical classroom lesson using them.

During this phase, I was accompanied by a fellow researcher who logged all the answers and made observational notes on extraneous events using a rubric. Teachers were present but instructed to remain silent. They also responded anonymously to several written questions.

In addition to the sessions, the students were invited to complete three surveys. Participation was optional, so there was some sample loss. Here is a breakdown of the surveys:

- Survey to assess digital skills via the MyDigiSkills instrument (10 answers, 92.8% loss) – Discarded
- Microsoft Forms survey on five critical digital literacy concepts, assessing both competency and perceived usefulness (81 answers, 41.7% loss)
- Microsoft Forms survey reviewing the citizen science process and collaboratively deciding on final module details (100 answers, 28.1% loss).

I involved the students from the outset to ensure that they felt ownership over their learning process – beginning by asking about their motivations, and then collaboratively pinpointing the games they were most inclined to play, and what exactly they would learn from them. Based on this structure, the students provided the experts and me with the necessary input to assess and propose the module's structure, along with the specific games they ultimately validated in the last session.

3.2. Methods and instruments used with experts

Regarding the 20 experts, I conducted one survey and a series of six interviews. The survey, created using Microsoft Forms, consisted of two main sections. The first asked experts to select, from a prefiltered list of 17 COTS, those they believed could be useful in teaching critical thinking skills. The second section invited them to suggest additional COTS they considered potentially useful for supporting high school students' critical digital literacy.

Given the impracticality of discussing hundreds of games within the scope of expert participation, I curated a filtered list prior to soliciting feedback. Below, I provide the

rationale behind each of the filters, with the aim of demonstrating how the selection process was guided by the overarching construct of critical digital literacy.

This filtering process has been used in previous educational game studies (Demir et al., 2020). However, unlike those studies, the present research involved validation of the list by 20 independent experts (akin to the Delphi method). The following criteria were used to create the initial game list, prior to preregistration.

- Single-player, narrative-driven, indie games with a Spanish translation (filtered using SteamDB): As countercultural artefacts, the games needed to be slow-paced. To that end, I leaned into offline plot-focused video games that included a Spanish translation, since students at this grade level are still learning English.
- Games that are not difficult, relaxing, violent, action-heavy or sexual (filtered via SteamDB): To appeal to students of all levels and sensibilities, games were filtered to exclude those that might exceed age appropriateness or be either too slow or too intense.
- Games with more than 500 reviews and a user score above 80% (filtered via SteamDB): This arbitrary threshold served to ensure a degree of popular acclaim and community recognition. If a game had been too obscure or lacked community tutorials, it might have been difficult to guide teachers and students.
- Games with an average playtime under 15 hours (filtered using HowLongToBeat): Another arbitrary threshold intended to avoid any major discrimination based on time availability. Given that the module could end up being short and that some students may face parental restrictions on playtime, shorter games were prioritized.
- Games recognized by at least one educational game database (i.e. included in the Family Gaming Database, Games for Change directory, Foundation for Digital Games Culture list, or ArmMeWithGames catalogue): This criterion was intended to avoid cherry-picking and to support smoother implementation by relying on games already vetted for educational use (expecting that they would be both playable and suitable for critical analysis).

There are more than 30,000 COTS on Steam, from which a final list of 17 titles was selected. Initially, I had included five additional games that met at least three of the filtering criteria; however, these were later removed after failing expert validation. The experts' role was to assess the 17 shortlisted games, validate or reject them, and suggest alternatives they believed could support the teaching of critical digital literacy. This is the list of selected titles, along with their approximate playtime: (1) *Before Your Eyes* (1 hour), (2) *Alba: A Wildlife Adventure* (3 hours), (3) *What Remains of Edith Finch* (2 hours), (4) *Tangle Tower* (6 hours), (5) *Florence* (1 hour), (6) *My Child Lebensborn* (5 hours), (7) *Orwell: Keeping an Eye on You* (4 hours), (8) *The Lion's Song* (4 hours), (9) *A Normal Lost Phone* (2 hours), (10) *Tacoma* (2 hours), (11) *Gorogoa* (2 hours), (12) *The Stanley Parable* (2 hours), (13) *If Found…* (2 hours), (14) *Citizen Sleeper* (6 hours), (15) *Never Alone* (3 hours), (16) *The Red Strings Club* (4 hours), and (17) *Subsurface Circular* (2 hours).

Interviews were conducted with the six experts who, in the final survey question, expressed interest in further participation. They ranged from 29 to 75 minutes, and were recorded using Streamlabs OBS and transcribed with Whisper AI and YouTube's subtitle generator. The interviews followed a semi-structured script, addressing five aspects:

- Which of the games from the survey deserve extended classroom coverage for the purpose of teaching critical digital literacy?
- What format could a new media class adopt to include such a game?
- What critical digital literacy concepts should high school students be learning?
- What guidelines should be provided to students to help them analyze the COTS?
- As a professor yourself, what kinds of educational materials would you find helpful for teaching this module?

4. Results

Before presenting the results, it is important to note that the overall research design was openly preregistered on OSF (https://doi.org/10.17605/OSF.IO/WJNB8). The raw data are available across multiple platforms for transparency and data integrity – specifically on OSF and ResearchBox (https://researchbox.org/2387). I encourage readers to review the datasets and contact me with any concerns or observations regarding the statistical analyses or inferences.

4.1. Video games selected to teach critical digital literacy

As previously explained, the co-design process focused on identifying students' perceived interests and weaknesses related to critical digital literacy. These insights guided the selection and validation of COTS that could be used to address them, following a narrowing down via the initial expert survey.

Accordingly, it makes sense to start this section with the survey results. Table 2 presents a summary of the games that received the highest number of votes from the experts.

Table 2
Summary of the most-voted games from the expert survey (out of 17 COTS) ($N = 20$)

Game	Votes
Alba: A Wildlife Adventure	15 in favor, 0 against, 5 N/A
What Remains of Edith Finch	18 in favor, 1 against, 1 N/A
The Stanley Parable	17 in favor, 1 against, 2 N/A
Games suggested by experts, outside the list	*Papers, Please* (4 appearances) *This War of Mine* (4 appearances)

Several weeks after the survey, I conducted one-on-one interviews with each of the six experts who had expressed interest in further participation. In these interviews, we discussed how the filtered COTS could be used to teach critical digital literacy.

I examined the results exploratorily, reading through each interview transcript and annotating key themes. While this inductive approach has certain validity limitations – namely, that it was not preregistered or co-reviewed with a common pool of codes – it remains moderately reproducible. All interview recordings, transcripts, instruments, rubrics, surveys, presentations, and summary notes have been made openly available in the supplementary material on OSF and ResearchBox.

Several exploratory highlights emerged (i.e., themes that appeared in at least three interviews). For instance, *Alba: A Wildlife Adventure* was considered likely to be unpopular among students due to its childish art style and was therefore discarded. *This War of Mine*, despite some experts' enthusiasm towards using it, was also excluded due to its PEGI 18 rating (age restriction). In contrast, *Papers, Please* was endorsed by 5 out of 6 experts in the one-on-one interviews for its provocative gameplay and non-mainstream look.

Other noteworthy findings:

- 6 out of 6 experts recommended discursive classroom dynamics such as debates.
- 4 out of 6 suggested providing students with support materials – e.g., glossaries, cheat sheets (templates), examples, or tutorials – to make the module easier to work through.
- 3 out of 6 experts emphasized the value of introducing basic psychology concepts to help students analyze game mechanics.
- Another 3 out of 6 experts proposed including basic economic concepts to contextualize both the time and monetary investment associated with gaming.

The specific concepts raised by the experts included addiction, conditioning, rewards (including self-determination theory, or SDT), variable interval stimuli, violence, responsibility, resources, privilege, immigration, disinformation, war, consumption, time, retention, skepticism, short-term and long-term outcomes, AI, consumerism, immediacy, waiting, and game loops.

These are my curated highlights, as space constraints prevent a deeper dive into every detail discussed. For those interested, I recommend reviewing the source files. Below are a few translated excerpts from the interviews:

> *"Look, I'll give you three. [...] I think they're very much the key to everything [...] For me, they are: (1) objective, (2) resources, and (3) cost."*

> *"I, for instance, in the educational programs I have in progress, [...] would use Papers, Please; and it's for several reasons. For one, you're not going to have issues with the PEGI rating [...] And then [...] it doesn't have – or isn't associated with – the traditional hardcore gamer cultures."*

> *"Maybe some kind of 'cheat sheet'? Not just with controls, but with strategies or tactics [...] with some sort of 'retelling dossier' of memorable situations that have happened at another time."*

That concludes the input provided by the experts. On February 29, I held the first session with students, during which they also had the chance to recommend games. They were invited to make suggestions on two separate occasions. Across both instances, a total of 172 proposals were submitted. The unfiltered results were as follows:

First day: (15 people proposed) *Brawl Stars*, (14) *Fortnite*, (5) *GTA*, (2) *Call of Duty*, (1) *Valorant*, (1) *Cuphead*, (1) *Super Mario Odyssey*, (1) *Undertale*, (1) *Outer Wilds*, (1) *Elden Ring*, (1) *Roblox*, and (1) *Apex Legends*.

Last day: (42) *Brawl Stars*, (19) *Papers, Please*, (13) *Fortnite*, (13) *FIFA*, (7) *GTA*, (3) *Minecraft*, (2) *The Stanley Parable*, (2) *Raft*, (2) *60 Seconds*, (2) *Elden Ring*, (1) *Ghost Runner*, (1) *Hollow Knight*, (1) *Lisa the Painful*, (1) *Lisa de Joyful*, (1) *Portal 2*, (1) *Dishonored*, (1) *Cuphead*, (1) *The Witcher 3*, (1) *What Remains of Edith Finch*, (1) *God of*

War, (1) *A Way Out*, (1) *League of Legends*, (1) *Valorant*, (1) *The Coffin of Andy and Leyley*, (1) *Albion Online*, (1) *Destiny 2*, (1) *Cities Skylines*, (1) *Prison Architect*, (1) *The Sims*, (1) *Omori*, (1) *Sekiro: SDT*, (1) *Bloodborne*, (1) *Rust*, and (1) *Little Nightmares*.

None of the student-proposed games met the original filtering criteria: most are multiplayer, and those that are not are too difficult, too long, or rated PEGI 18. However, given their insistence during the sessions, I reconsidered whether the module could include one of their proposed COTS. After consulting with the experts, we decided that incorporating two contrasting games – one student-chosen and one expert-validated – could serve to highlight key differences between fast-paced, endless, mainstream games and slower, individual, indie titles.

I ultimately decided that the module would include the most voted student game, Brawl Stars, which is free, easy, short, and has no age restrictions. The students were then invited to vote for a second game to complement *Brawl Stars* (from among the three expert-validated titles, excluding *Alba: A Wildlife Adventure* and *This War of Mine*, which had been ruled out earlier). Each of these games was presented alongside seven illustrative concepts, all compatible with the European digital competency framework (DQ) (DQ Institute, 2026).

These concepts were meant to help students understand what kind of content they could expect in the games. To further support informed decision-making, students were briefed on the gameplay and shown the respective trailers.

4.2. Overview of students' critical digital literacy interests and weaknesses

In the analysis of student responses, there was a near tie among the three games (see Table 3), with an absolute difference of just 8 votes out of 139. In contrast, the distribution of interest in the proposed concepts was far more polarized (see Table 4), with a 48-vote absolute difference between the most and least selected options.

Table 3
Summary of student responses in session 2: Game selection ($N = 139$)

Game	Votes
Papers, Please	49 votes (35.3%)
The Stanley Parable	43 votes (30.9%)
What Remains of Edith Finch	41 votes (29.5%)

Table 4
Summary of student responses in session 2: Least and most voted topics ($N = 139$)

Topic	Votes
T5 Bias	21 votes (15.1%)
T16 Sources	28 votes (20.1%)
T20 Creativity	66 votes (47.5%)
T3 What is real?	69 votes (49.6%)

As for the quasi-tie in game preferences, I suspect it may have stemmed from limited exposure: students did not get to test the games or watch more than three minutes of gameplay (recall that the sessions lasted 30 minutes).

That said, it could also be that the classrooms had a high degree of group homogeneity, as the four critical digital literacy topics from the DQ model – narrowed down for the third and final survey – showed no notable differences in preference. These topics (shown in Table 5) were ultimately incorporated into the educational module, tailoring the critical digital literacy construct to students' interests to boost their motivation to learn.

Table 5
Summary of review survey responses: Preferred topics for inclusion in the educational module ($N = 101$)

Topic	Votes
Creativity	52 votes (51.5%)
Brainwashing tools	49 votes (48.5%)
What is real?	46 votes (45.5%)
Immigration	46 votes (45.5%)

Along with the selected topics, the final COTS chosen by students and narrowed down with expert input were *Papers, Please* and *Brawl Stars*, both linked to critical digital literacy.

I should note that these choices were not made randomly. After filtering an initial list of 17 games, I informed the students in Session 1 that their interests and weaknesses regarding digital and educational experiences would be used to tailor a short educational module. And that is exactly what we did. I identified a critical digital literacy construct that reflected their input, then consulted the experts during our interviews to determine how best to tackle these specific areas.

For instance, in the qualitative group discussions with students in Session 1, two out of six groups expressed an interest in becoming economically independent, and another two mentioned concerns about addiction marketing. With respect to perceived weaknesses, three groups brought up compulsive shopping, and two noted how time seemed to go by faster when browsing social media.

As per my analysis/decision protocols, I focused on the themes most often repeated across the six student groups and made them central to the following session – progressing in an iterative scalar fashion until the final session, in which we decided on the final module structure.

The research evolved to include topics that originated from student input, many of which I had not predicted. For instance, although the initial idea was to use a single game, students' enthusiasm and variety of suggestions in Session 1 led me to ask in Session 2 whether they would prefer multiple games but less playtime. A clear majority – 97 out of 139 students (69.8%) – said yes. This is why Brawl Stars was ultimately included, despite not meeting the original filtering criteria. This incremental, student-informed approach was evident throughout Session 2 (see Table 6), where students were also asked how they would prefer the educational module to be structured.

Table 6 shows that students preferred a straightforward module with customized content. When later asked about format preferences, 48% chose PDF, 89% favored 10-20 minutes of reading, and 72% wanted short complimentary videos. They also expressed interest in having a selection of activities to choose from – without homework. Another

example of this interactive co-design approach emerged in Session 2: I proposed a gamified activity featuring different skill levels, thinking it might appeal to them. However, student opinions were mixed. Here are a few representative responses (only 7% elaborated on the prompt qualitatively):

> *"I truly like the current system, as the opportunity to see different difficulty levels gives you an opportunity to decide which one is the most appropriate for you."*
>
> *"I think it should be kept in mind that we're teenagers [...] knowing this, everyone would select the easiest question in order to work less. If it's the teachers who choose the difficulty level, I think there'd be people who wouldn't agree with the level assigned to them, and this would create inequalities and conflicts."*

Table 6
Summary of session 2 classroom experience questions ($N = 139$)

Question	Votes
Q4 Skip the game introduction?	101 voted yes (72.7%)
Q5 Start the module by playing?	118 voted yes (84.9%)
Q6 Provide custom class notes?	114 voted yes (82%)
Q7 Offer a variety of activity formats?	128 voted yes (92.1%)

These answers led me to reconsider the proposal, and I ultimately decided to drop the levels. I see this as a strength of the open, iterative process used throughout this research. Although this mixed-method, exploratory study is not meant to produce generalizable findings, it does offer useful hints about a rather complex process.

For researchers leaning towards citizen science approaches for content design, it provides an overall idea of high school students' possible interests and struggles, especially in dense European cities such as Barcelona.

The final point I want to highlight is that during the last session – when we tested *Papers, Please* and *Brawl Stars* – students rated *Brawl Stars* (the game they had proposed) 19.7% higher than *Papers, Please* in terms of enjoyment, but only 3.1% higher in educational usefulness.

Considering that *Papers, Please* is a slow-paced, linear game rich in text and moral decision-making, the fact that 76.7% of students wanted to try it (despite it being outside their usual gaming preferences) suggests that its selection was not arbitrary. After all, as evidenced in the final review survey (see Table 7), students seemed to enjoy the process and expressed interest in trying the module they had helped to create. That said, in hindsight, this could have been an instance of rationalizing the process they had to take part in.

Table 7
Summary of review survey responses: Research process evaluation ($N = 101$)

Question	Votes
Q3.3 The module without games?	20 voted yes (19.8%)
Q4.1 Did you feel heard during the sessions?	7.63 out of 10
Q4.2 Want to create another module?	80 voted yes (79.2%)
Q4.3 Want to receive a copy of the research?	45 voted yes (44.6%)

Indeed, feedback from the after-Session 3 review survey (summarized in Table 7), which was sent to students digitally and received 101 responses (fewer than the full 139 due to the online format), seemed to indicate positive reception of the participatory methodology. I further explore this point in the following discussion and conclusions section.

5. Conclusion

5.1. Research highlights

The aim of this preliminary study was to identify students' interests and weaknesses in order to design a module that could teach critical digital literacy using materials that would genuinely motivate them. This paper has detailed the process of developing that module, while also validating findings from previous studies that used COTS for educational purposes (Becker & Gopin, 2016; Watson & Yang, 2016).

Whereas some studies offer game lists filtered through black-boxed criteria without involving experts or learning agents (Demir et al., 2020; Kronenberg, 2012), this study sought to address the needs of everyday classes. In doing so, it painted a picture of divergence: expert recommendations and students' initial preferences for game selection differed notably.

As shown, experts gravitated towards narrative-driven, reflective indie titles (*Papers, Please*, *What Remains of Edith Finch*, *The Stanley Parable*) that aligned with specific critical literacy concepts. By contrast, student suggestions initially skewed towards familiar, mainstream multiplayer games (*Brawl Stars*, *Fortnite*). This difference likely stemmed from the participants' distinct evaluation criteria: experts may have prioritized pedagogical suitability and thematic depth, whereas students leaned towards entertainment and whatever their peers were playing at the moment.

In this regard, I would argue that the participatory process used in this study prompted students to accept a middle ground. Despite limited initial familiarity, they ended up rating *Papers, Please* highly for its educational potential. This outcome highlights the value of co-design in bridging the gap between pedagogical goals and student engagement.

The game filtering process initially yielded 17 promising titles for fostering critical digital literacy, which experts then narrowed down to five final COTS – later reduced to three after the interviews – all sharing certain common attributes. Expert input favored games with strong narratives (*The Stanley Parable* frequently breaks the fourth wall), non-mainstream aesthetics (*Papers, Please* features an atypical, UI-driven pixel art style), and gameplay mechanics (*What Remains of Edith Finch* functions as an interactive fiction) that would prompt reflection on relevant sociocultural themes such as morality, systemic biases, and information literacy (the central mechanic of *Alba: A Wildlife Adventure* is photographing and helping endangered species).

Although innovation, socially motivated plots, slow-paced game mechanics, and accessibility were shared traits among the filtered games, as Škripcová (2022) notes, the effectiveness of teaching critical digital literacy depends on how the games are used. From a practical standpoint, experts pointed out that successful implementation should rely on discursive classroom dynamics, such as guided debates or group analysis, rather than solitary gameplay. Both experts and students also highlighted the appeal of varied activity

formats and concise, customized support materials. Resources like gameplay guides, thematic glossaries, and analysis templates were recommended to help teachers overcome potential barriers related to time and unfamiliarity with specific games.

All in all, these indie or counterculture games contrast with the often-passive consumption patterns associated with mainstream digital media and the multiplayer, infinite, competitive commercial games that 90% of students suggested in Session 1. Still, I would argue that the topics explored in the selected COTS – such as the treatment of immigration in *Papers, Please* – align closely with the areas students expressed interest in. For example, this game's depiction of an authoritarian regime can be used to discuss the critical digital literacy concept of "*brainwashing tools*").

Moreover, although it remains a subject for future research following the module's implementation, contrasting a commercial mobile game like *Brawl Stars* with an indie game like *Papers, Please* may help students recognize the different practices used. While both games feature short matches (> 7 minutes), *Papers, Please* is less intense and requires greater reflection from the player.

By contrast, *Brawl Stars* is a fast-paced mobile game designed to "*hook*" users through various user manipulation techniques (dark patterns). Meanwhile, *Papers, Please* presents morally complex scenarios involving immigration control, closely mirroring real-world dilemmas, and includes a notable amount of text. From a practical standpoint, I believe dedicating time to compare the two games' attention-grabbing techniques could be a useful exercise in developing critical digital literacy – illustrating both the dangers of short-form content (Xie et al., 2023) and the existence of alternatives.

By following an open-ended preregistration approach, the study was able to incorporate new questions and ideas from session to session, with the aim of creating a tailor-made module with the format, length, lessons, games and content that the majority of students had asked for.

Just as there are multiple drivers of polarization, education too is shaped by a range of competing factors. Designing a module top-down – created by academics for students and teachers – dismisses the target audience's ecological needs. For this reason, I felt that a localized, non-generalizable approach was the most appropriate for this context.

5.2. Research validity and limitations

Regarding internal validity, it should be noted that the sample was not randomized, there were no control groups, and the data were not blinded. However, this traces back to the nature of the study, which was exploratory rather than experimental, given the novelty of the topic.

As for external validity, while the game choices were based on the specific context of students at Pedralbes high school, the expert input – combined with insights on game selection criteria drawn from the literature (e.g., age ratings, playtime, and difficulty) – could still point towards "*useful*" games for urban schools with similar profiles to those in Barcelona (without falling into generalizations).

Ecological validity arose from the co-developed design of the study, which took place in a real classroom environment. We also jotted down both verbal and non-verbal responses. That said, the data showed a partial skew towards male students – something I

observed firsthand during the sessions, where female students tended to participate less, possibly reflecting the underrepresentation of young women in gaming culture.

The fact that student-recommended games emphasized fun over depth underscores the importance of including experts in research of this kind. I would have liked to include teachers in the process (and had initially planned to do so), in order to gain a more complete perspective – leaving only policymakers outside the process. I hope that future research will be able to address this gap.

Finally, I would like to acknowledge several incidental limitations. The sample size was relatively small, and the sampling technique was intentional rather than random. Data analysis was conducted by a single researcher, which may have introduced confirmation bias, blind spots, or multiple comparisons issues.

There was also some loss to follow-up in the survey responses, and a potential bandwagon effect during class sessions cannot be ruled out. To tackle these limitations, I avoided the use of *p*-values, thus preventing p-hacking, and limited the analysis to descriptive statistics using simple mathematical operations such as means and ranges.

The surveys had limitations as well, including inconsistencies due to time constraints that impaired the internal validity and exhaustivity of the instruments. For instance, demographic variables such as ethnicity and disability were not collected, and the analyses did not account for variables such as genre.

Despite these limitations, I reiterate that this is preliminary research in a nascent academic subfield. As a participatory science project, it holds intrinsic value for the students involved. Additionally, since one of my goals was to make the findings accessible to them, I strove to keep the analysis and explanations within a manageable vocabulary.

This research followed a scheduled, systematic process that can be openly verified via ResearchBox and OSF. The resulting educational module (in Catalan) is available on Figshare: Including materials for both students and teachers (https://doi.org/10.6084/m9.figshare.26044705 and https://doi.org/10.6084/m9.figshare.26044870).

Author Statement

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