Barriers and Hindrances to the Effective use of Games in Education: Systematic Literature Review and Intervention Strategies

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Abstract: Games play a central role in human culture, as well as in interaction, interpersonal relationships, and overall development. Based on these premises, game-based learning (GBL) has been increasingly studied as a form of pedagogical innovation in formal and non-formal education. However, the implementation of these types of interventions in real educational settings has faced several barriers and constraints that reduce their possible impact. In this context, the present study aims to fulfil two aims: (a) mapping the main obstacles experienced in the implementation of GBL approaches in educational contexts; and (b) proposing an intervention diagram that matches each type of barrier with potential strategies to address it. Towards these aims, a Systematic Literature Review (SLR) was conducted, following the PRISMA methodology and guidelines. This included screening and eligibility processes based on inclusion criteria, which were defined considering the research's aims. Non-peer-reviewed research and studies aimed at other pedagogical approaches, such as gamification, were excluded to obtain a final sample of 11 studies and 1952 individuals, with an average of 195.20 participants per study (*SD* = 266.14). Through the analysis of the studies, a model of four types of barriers emerged: (1) attitudinal and behavioural barriers; (2) school policy barriers; (3) technological and material barriers; and (4) game literacy barriers. Through the critical evaluation of the barriers emerging from the analyzed empirical studies, we propose some potential methodological strategies that might support practitioners in overcoming them. This includes: (a) the implementation of a co-creation and participatory-driven methodology; (b) the appropriate selection of analogue, digital, or hybrid games; (c) the inclusion of the different educational stakeholders in the process; and (d) the promotion of GBL training within the projects.

Keywords: Game-Based Learning, Education, Games, Barriers, Systematic Literature Review

1. Introduction

Games have been a part of human culture for millennia, serving various purposes from entertainment to socialization and skill development. In the past decades, advances in digital technology have facilitated the emergence of game-based learning (GBL) as a form of pedagogical innovation in formal and non-formal education. One of the main advantages of GBL is its ability to engage students, which can help them stay motivated and focused on learning (Hartt et al., 2020). Additionally, it encourages active learning and can be personalized to fit the needs of individual students (Orji et al., 2017). Games also provide immediate feedback, which can help students learn more quickly and understand their mistakes (Plass et al., 2015). Collaboration is another benefit of GBL, as it promotes social skills and teamwork (Chen and Law, 2016). Studying GBL must, therefore, represent "the integrated viewpoints of cognitive, motivational, affective, and sociocultural perspectives", including both game design and game research as complementary aspects of the learning process (Plass et al., 2015, p. 278).

Despite the potential of GBL, the implementation of these types of interventions in real educational settings has faced multiple barriers and constraints that reduce their possible impact. Barriers related to the cost of equipment (Moizer, et al., 2009), the inequities in access to technology (Hsu, et al., 2011), entertainment risks to education activity (Rowan, 2016; Baalsrud et al., 2013), the available time required to implement games in one day lesson (Justice and Ritzhaupt, 2015; Baek, 2008), teachers gender and their motivation and abilities to deal with technology (Hamlen, 2010; Justice and Ritzhaupt, 2015), lack of game customizations (Embi, 2008; Javora et al., 2021), difficulties to get game analytics and to analyze the student progress (Hauge et al., 2014), educators and parents worried about using games in education (Barko and Sadler, 2013; Koh et al., 2011), are a portion of the constraints caused by the adoption of games in education. To maximize the potential of GBL, it is crucial to identify and address these barriers and develop effective intervention strategies. To propose these strategies, we conducted a Systematic Literature Review (SLR), following the PRISMA methodology and guidelines (Page et al., 2021).

2. Method

2.1 Eligibility Criteria

The main research aim was used to establish the eligibility criteria. To be included, studies had to approach GBL interventions, with a specific focus on the obstacles experienced in its implementation in educational contexts. Empirical peer-reviewed research within this scope was included in the sample. Conversely, studies that were excluded included book reviews, systematic reviews, and theoretical articles in any form. Additionally, studies that focused on Gamification instead of GBL were excluded.

2.2 Information Sources and Search Strategy

The electronic search was carried out across various databases, namely All Collections in Web of Science, EBSCO, ERIC, IEEE Xplore, Elsevier, and Springer, through the subsequent survey of the equations:

- "game-based learning" AND barriers;
- "game-based learning" AND challenges;
- "game-based learning" AND obstacles;
- games AND education AND barriers;
- games AND education AND challenges.

The definitive search for retrieving all relevant results from the databases was performed on November 14, 2022.

2.3 Selection Process

After the search results were imported, Endnote X9 was employed to automatically remove duplicate entries. The results were subsequently exported to an Excel sheet, where they were screened in two phases. The first phase involved reviewing the titles and abstracts of the studies and assigning labels of 'included' or 'excluded' following the pre-defined inclusion and exclusion criteria. The second phase entailed a thorough full-text screening of the studies deemed eligible during phase one. This process resulted in a final sample of 11 studies and is systematized in Figure 1.

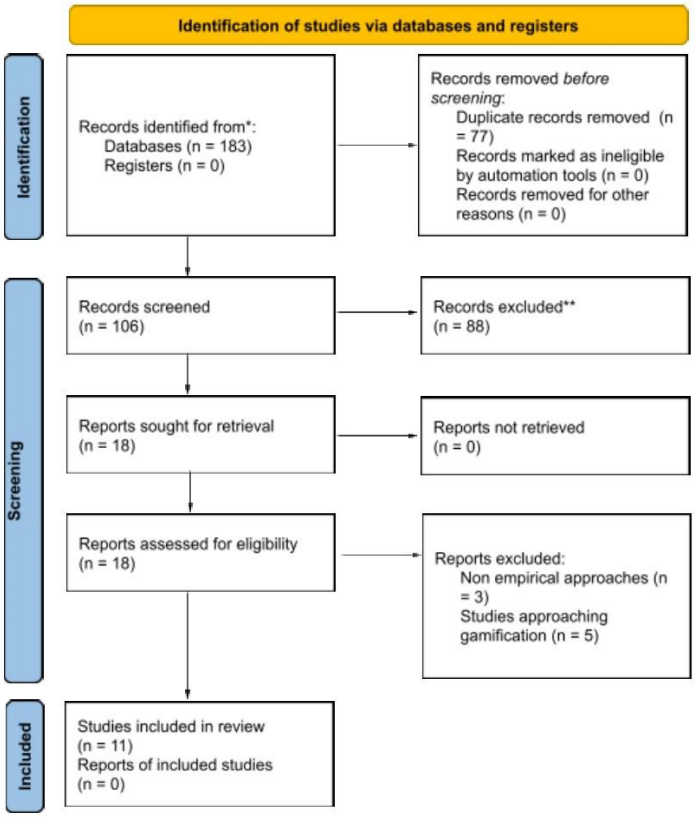

Figure 1: Flow diagram showing the process of the identification studies to include in the review

2.4 Data Extraction and Analysis

For purposes of analyzing the selected articles, the sample was subjected to coding to identify the most frequent barriers and hindrances to the effective use of games in education. Afterwards, a more qualitative lens was used to explore each barrier and its contextual factors, according to the authors. Critical reflection and triangulation with the existing conceptual models allowed the development of a proposal for an intervention diagram. Statistical analysis techniques (descriptive statistics) were also employed to analyze sample characterization data.

3. Overview of the Results

The obtained studies (*N* = 11) resulted in an aggregate sample of 1952 individuals, with an average of 195.20 participants per study (*SD* = 266.14). It is important to note that five articles had teachers as participants (45.45%), two had education students/pre-service teachers (18.18%), one had students as participants (9.09%), while another one adopted a multistakeholder approach (9.09%), to include the views of parents, youth, and teachers. The study conducted by Marklund and Taylor (2016) only mentioned the inclusion of 17 classrooms in the study without mentioning the number of individuals included. The sample description is schematized in Table 1.

Table 1: Characteristics of the studies' participants (*N* = 11)

Article	Sample
(Alqurashi and Alqurashi, 2017)	930 teachers
(Arnab et al., 2016)	122 students
(Chen et al., 2020)	231 teachers
(Hu and Sperling, 2022)	130 pre-service teachers
(Jääskä and Aaltonen, 2022)	22 teachers
(Kaimara et al. 2021)	170 pre-service teachers
(Khodabandeh, 2022)	75 students
(Manesis, 2020)	148 teachers
(Marklund and Taylor, 2016)	17 classrooms (participants not specified)
(Martins and Oliveira, 2019)	18 teachers
(Sousa et al., 2017)	106 teachers, parents, and youth

4. Barriers to the Effective use of Games in Education

Through the analysis of these articles, it is possible to highlight and discuss the most common barriers to the implementation of game-based interventions in educational settings, as follows.

4.1 Attitudinal and Behavioral Barriers

Although most data seems to reinforce that the school community recognizes the potential of using and creating games for learning purposes, namely considering their role in communication, transferable knowledge, problem-solving skills, and self-expression (Sousa et al., 2017), different attitudinal and behavioural barriers become apparent in the analyzed sample. These barriers can be grouped into different categories and subcategories, as represented in Figure 2.

Figure 2: Attitudinal barriers to GBL interventions, according to the sample

The micro-level of attitudinal barriers can be understood by how the beliefs or behaviours of different individual stakeholders can work as drivers or hindrances in the implementation of GBL interventions. According to Martins and Oliveira (2019), teachers and educators tend to rate their technological knowledge as low, which extends to their lack of experience in incorporating games into their teaching practice. Although this can be better explained by the game literacy dimension that we will later approach, it can also be examined as an attitudinal issue, since it stems from a structural disbelief in one's ability to support their pupils to thrive in innovative pedagogical approaches.

Regarding students, analysis of the sample showed some unexpected results regarding their negative attitudes towards GBL. When implementing GBL interventions, depending on learners' profiles, they may prefer more conventional teaching methods, including lectures, written assignments, and exams, that allow them to play a more passive role in the learning process (Jääskä and Aaltonen, 2022). This aspect was also found in data from Sousa et al. (2017), which showed that students have much more positive attitudes toward the recreational role of games than towards their pedagogical role.

We advance potential reasons for a possible disconnect between some learners and the GBL approaches. One potential reason is student frustration with cases of lack of clear instructions in GBL which are often related to the issue of instructors' low game literacy, which will be addressed below. This can also be motivated by an apparent disconnect between an educational game and the educational objectives that were initially proposed to the student. For this aspect, the promotion of reflection in debriefing processes becomes an important protective factor against loss of interest as well as a promoter of meaningful learning (Jääskä and Aaltonen, 2022; Marklund and Taylor, 2016).

Transversal to the three groups of individuals – educators, families, and students – is the attribution of a negative connotation to games as solely and exclusively a form of entertainment. That is to say, there is a noticeable cleavage between the idea of "serious games" – perceived as having relevance and pedagogical value – and commercial games – perceived as a mere "waste of time" (Sousa et al., 2017). It should be noted that considering the current state of the art, this can be seen as a fallacy, since research by now has been documenting the learning potential of both digital and analogue games, from learning about probabilities with Settlers of Catan (Austin and Molitoris-Miller, 2015) to high-level decision making in Counter-Strike: Global Offensive (Kiourti, 2022).

Regarding the macro-level of attitudinal barriers from both school and policy-makers' perspectives, it is important to note the existence of negative attitudes related to GBL that negatively impact its potential implementation (Kaimara et al., 2021). On a societal level, one of the most salient attitudinal barriers is the so-called "digital natives" narrative. There is a prevalent notion, especially associated with pre-service or younger teachers, that they are completely familiar with how to implement innovation-driven pedagogical strategies – including GBL – due to the context in which they have grown up. This discourse can be understood as a barrier in that it promotes preconceived notions about individuals' backgrounds, socioeconomic contexts, technological access, and literacy, which runs against the inclusive potential of games (Hu and Sperling, 2022; Marklund and Taylor, 2016). Although this macro-level of attitudinal barriers includes policy-makers' attitudes as explored by Kaimara et al. (2021), the impact of their effective measures in the daily educational context is framed in another set of barriers that will be now explored.

4.2 School Policy Barriers

While research can reinforce the pedagogical benefits of game-based approaches, they often come up against institutional issues faced by schools and higher education institutions. These issues can even extend to non-formal education contexts. The analyzed sample of articles highlights issues related to limited instructional time available to educators for including innovative pedagogical practices in their work. This is exacerbated by difficulties in aligning games with learning goals as stated by a national curriculum (Alqurashi and Alqurashi, 2017; Hu and Sperling, 2022; Marklund and Taylor, 2016). The lack of policies and frameworks for supporting this task makes it more challenging to ensure the desires of all stakeholders – students, teachers, schools, and education ministry – are met (Kaimara et al., 2021).

4.3 Technological and Material Barriers

Access is a necessary precursor to participation in media, as well as participation in democratic civic structures (Carpentier, 2011). From the standpoint of this premise, the thematic analysis of our sample showed a set of technological and material barriers that impact GBL interventions in the educational context, including funding constraints.

For technological barriers, several studies in the sample emphasized the negative impact of infrastructure issues in GBL interventions, such as inadequate internet network service, outdated computers, or a lack of technical staff and software (Alqurashi and Alqurashi, 2017; Jääskä and Aaltonen, 2022; Kaimara et al., 2021; Manesis, 2020; Marklund and Taylor, 2016). This combined with the literacy phenomenon and the inability of teachers to solve technical issues that may emerge during interventions contribute to a sense of frustration and negative game experiences both for teachers and students (Jääskä and Aaltonen, 2022).

Material barriers are associated with the lack of games *per se*, or the lack of funding to acquire them. Lack of games – more specifically educational games in schools – is a salient aspect of this study, as well as their high cost (Alqurashi and Alqurashi, 2017; Jääskä and Aaltonen, 2022; Manesis, 2020). Besides games, a more general issue of lack of funding for educational activities is also noted as a fundamental hurdle to the implementation of GBL in these contexts (Kaimara et al., 2021).

As stated above, there are effective technological barriers, but there are also skill gaps and low awareness of one's skills (Martins and Oliveira, 2019). This brings us to the issue of game literacy.

4.4 Game Literacy Barriers

Chen et al. (2020) explored how the lack of teachers' game literacy impacted GBL interventions, through a framework that distinguishes multiple literacy dimensions. These included:

- the literacy of instructional design of GBL, or how teachers were able to correlate game design and learning outcomes, before adopting such strategies in their classrooms;
- the literacy of evaluation of GBL, which could also be seen as an attitudinal dimension, comprising teachers' beliefs regarding the adoption of games, and how these impact students' motivation and cognitive gains;
- the literacy of organization and management of GBL, which comprises the required skills to manage technological and material barriers;
- basic games literacy, associated with games selection and the overall notion of the concepts, considering how this is associated with their ability to engage students in the learning process;
- and high-level game literacy, which represents systems-based game thinking.

Teachers' lack of game literacy is also highlighted by Hu and Sperling (2022), emphasizing how they tend to perceive games as supplementary activities and not as pedagogical tools in themselves. This might be associated with other recorded barriers, like the need for better awareness of the relationship between game mechanics and learning (Jääskä and Aaltonen, 2022) or the difficulties in spotting students' issues with the game interface (Marklund and Taylor, 2016). Overall, it seems relevant to acknowledge how game literacy is not only important for monitoring gaming sessions but also for the success of all the contextualizing activities surrounding them, most specifically critical reflections and debriefings (Marklund and Taylor, 2016).

Game literacy needs to arise from training programs that prepare educators to fully support their pupils in the context of game-based interventions. Analysis shows how current teacher-preparation programs lack exposure to game-based instruction (Hu and Sperling, 2022), aligned with an overall lack of Information and Communications Technology (ICT) training that neglects the role of playfulness in education (Kaimara et al.,

2021). This issue needs to be addressed since providing educators with knowledge about the pedagogical value of games is considered central to their democratization in education. Martins and Oliveira (2019) propose making training more accessible and appealing and even integrated with pre-service teacher education.

5. Potential Strategies for Dealing With the Identified Barriers

We propose some potential methodological strategies that might support practitioners in overcoming the identified barriers, as suggested by our critical analysis identifying these barriers. The strategies comprise: (a) the implementation of a co-creation and participatory-driven methodology; (b) the critical option for using analogue, digital, or hybrid games; (c) the inclusion of different educational stakeholders in the process; and (d) the promotion of GBL training within projects.

5.1 Co-Creation

Co-creation is an ontological position that arises from the constructivist scientific paradigm, adopting a relativist position and believing that reality is a construction of the human mind. For the specific issues of GBL and gaming in general, the constructivist paradigm is relevant since it focuses on how participants construct meanings from their reality, emphasizing the variety and multiplicity of interpretations (Guba and Lincoln, 1994).

More concretely, co-creation in this context means that the voice of the player is also included in the creative processes. Namely, the audience moves from a more passive role to a more active role in defining the game itself (Kafai, 2006; Rüller et al., 2022). In the context of learning, it is related to person-centred learning or personalized learning environments (Zhang et al., 2020).

Co-creation implies a certain willingness to engage with participants and incorporate their ideas into a project through different participatory approaches, for instance, design thinking (Ind and Coates, 2013). Creativity and co-creativity developed through play-inspired design thinking have the potential to sustain students' practices and mindset long term, which will impact their engagement with the community (Arnab et al., 2019).

5.2 Analogue Games VS Digital Games

In the early days of the academic discussion on GBL, James Paul Gee (2005, p. 34) supported the conceptual definition of this field by establishing the principles of learning promoted through "good games". For the Gee, a "good" game needed intrinsically operationalize the latest scientific principles of skill acquisition in cognitive science in its gameplay which included: identity; interaction; production; risk-taking; customization; agency; well-ordered problems; challenge and consolidation; "just-in-time" and "on-demand" situated meanings; pleasantly frustrating; system thinking; explore, think laterally, rethink goals; cross-functional teams; and performance before competence (Gee, 2005).

Although the principles described above have been thought of in a primarily digital context, they can be extended to board games. The learning potential of this type of game is nowadays well-founded in literature, with an emphasis on the role of play in human development (Gobet et a., 2004), and how these artefacts represent each society's culture (Booth, 2021).

While research has empirically supported the learning potential of digital games, namely at the motivational, engagement, and confidence levels (Abdul Jabbar and Felicia, 2015), more recent approaches have emphasized specific advantageous aspects of analogue games for both educators and students. These include skills such as collaboration, communication, creativity, problem-solving, and decision-making. Analogue games are very much characterized by their flexibility, and how they can be easily adapted to the requirements of any specific classroom or group of players (Maratou et al., in press).

The choice between digital, analogue, or hybrid games can prove crucial for the sustainability of an intervention given the issues with technological barriers, or other micro-level or school policy barriers to GBL adoption. None of these options is intrinsically more viable or more pedagogical than another. Their contextual feasibility depends on a detailed assessment of the target audience, available funding, existing technology, the literacy of trainers and trainees, and possible accessibility needs, among other aspects.

5.3 Multistakeholder Approach

The concept of stakeholder is used broadly to define all those who affect or are affected by the achievement of an organization's purpose (Freeman, 2010), often characterizing a systemic focus on the relationships between them. The label "multistakeholder approach" intends to emphasize interventions where different voices are heard and included in the process of educational change through play, regardless of their inherent power

relations. This horizontality means that the perspective of a teacher or a pedagogical director cannot be higher-valued than that of a student.

The methodological proposal in this paper aims to address school policy barriers, based on the notion that including different voices in educational decision-making enhances satisfaction, trust, and a sense of belonging, for educators (Rosales, 2019), families (Gülcan and Duran, 2018), and students (Mitra, 2018). It can also help circumvent other individual or institutional barriers, considering that higher levels of participation tend to promote a higher engagement in educational change processes (Cook-Sather, 2018).

Operationalizing a multistakeholder approach for GBL might be enhanced through co-creative processes, where the final playful artefacts effectively represent the experiences of all the participants.

5.4 Training

According to the empirical approach of García et al. (2022), teachers perceive that their training must be pragmatic and empower them with skills that enable their adaptation to diverse educational contexts, keeping them up to date with the most recent pedagogical interventions. These authors also acknowledge the relevance of teachers in the promotion of digital competencies, since training them is, in an indirect manner, ensuring that this knowledge reaches their students.

Sousa and Costa (2020) propose the application of GBL to teacher training, namely in the areas of digital competence and media literacy. The pedagogical premises of GBL of the use of failure as a motivational strategy or learning by doing can be effectively implemented to promote educators' media and information literacy skills. This is a less direct and possibly more cross-cutting impact for training than what the authors and studies in the SLR in this paper seemed to anticipate. Nevertheless, more informed and empowered teachers, families, educators, and other stakeholders for game-based pedagogical innovation could work as an important factor in promoting successful GBL interventions.

6. Proposing an Intervention Diagram

By reflecting on the different barriers and strategies presented above, the diagram presented in Figure 3 was created to support the development of GBL interventions.

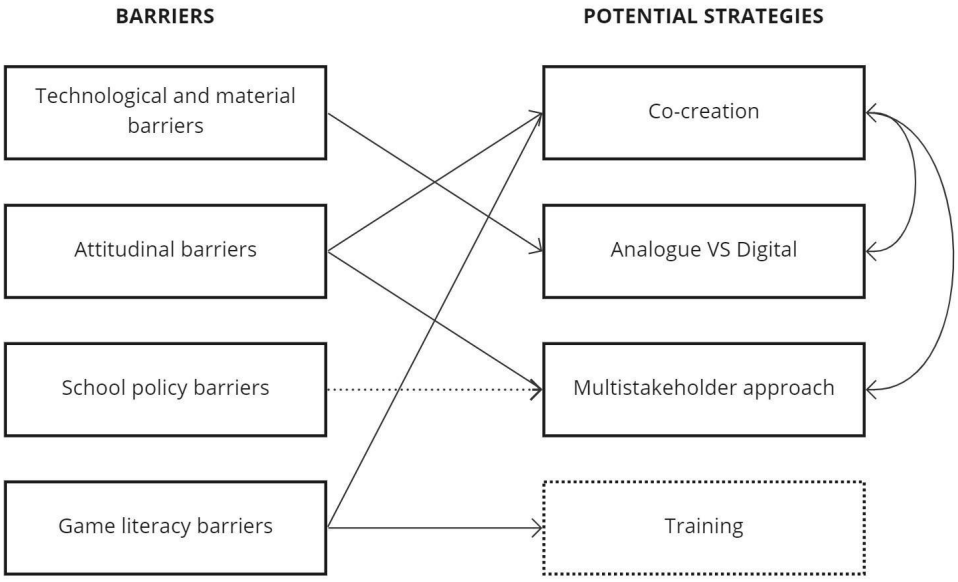

Figure 3: Proposed intervention model based on the barriers and strategies explored

This diagram provides teachers, educators, practitioners, or others with tangible advice on how to interrelate different concepts in the implementation of GBL interventions as follows:

- Through a detailed and early analysis of potential technological and material barriers in the context, some problems can be avoided. Namely, through an informed choice of analogue, digital, or hybrid games, depending on the technology, know-how, and funding available.
- Co-creation is meant to involve players as crucial agents in the creative process of games, understood in a more informed and positive manner, which impacts player attitudes and literacy;

- Ensuring that GBL interventions are multistakeholder fosters multilevel changes that bridge the attitudinal gap between educators, learners, and families, facilitating the implementation of innovative pedagogies;
- Indirectly, including policy-makers in these multistakeholder approaches can also support change and bridge the gap between them and the obtained results;
- Although in a game-based intervention, we cannot control the pre-training of those who participate, we must work to make the institutions aware of its importance and, when possible, provide it within the projects.
- Co-creative strategies also depend on a comprehensive analysis of the preferable technology for the implemented game – analogue or digital – since this will impact both the material conditions and the individuals' ability to participate in an equal manner.
- Because of its characteristics as a participatory and horizontal methodology, which allows the inclusion of several actors with the same level of involvement, co-creation appears aligned with the multistakeholder approach.

7. Conclusion

The present study aimed to identify the main obstacles faced in the implementation of GBL in educational contexts, and propose potential strategies to overcome these obstacles. The results of our systematic literature review revealed four main types of barriers: attitudinal and behavioural barriers, school policy barriers, technological and material barriers, and game literacy barriers.

Attitudinal and behavioural barriers refer to the reluctance of some teachers and students to use games for learning, either due to negative attitudes towards games or a lack of interest in them. School policy barriers refer to policies that restrict the use of games in the classroom, such as limitations on technology use. Technological and material barriers include a lack of resources and infrastructure to support the use of games in the classroom. Game literacy barriers refer to the lack of knowledge and skills needed to design, develop, and implement games for learning.

To address these barriers, potential methodological strategies were proposed, through an intervention diagram. These include the implementation of a co-creation and participatory-driven methodology that involves all stakeholders in the design and development of games. This approach promotes the creation of games that meet the needs and interests of the target audience and increase their engagement in the learning process. Additionally, an appropriate selection of analogue, digital, or hybrid games can help to address technological and material barriers as well as accommodate diverse learning needs and student preferences. The inclusion of different educational stakeholders in the process can also help to overcome attitudinal and behavioural barriers. Finally, promoting GBL training within projects can address game literacy barriers and provide educators with the necessary skills to implement GBL effectively.

This study's findings provide valuable insights for educators, policymakers, and researchers looking to implement GBL in educational contexts Further research is needed to test the effectiveness of these strategies and explore their potential to address broader educational issues.

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