Implementation of Game-Based Learning in Educational Contexts: Challenges and Intervention Strategies

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Abstract: In addition to being a fundamental part of human culture, games are also important for social interaction, personal growth, and development. These premises have led to a growing body of research on game-based learning (GBL) as a pedagogical advance in both formal and informal education. Even though GBL has many potential benefits, some challenges need to be taken into account while developing and implementing GBL. In this context, the goal of this study is to accomplish two goals: (a) map the primary barriers encountered when applying GBL approaches in educational settings; and (b) provide an intervention diagram that links each kind of barrier with potential strategies to overcome it. To achieve these aims, a Systematic Literature Review (SLR) was carried out using the PRISMA criteria and methodology. This includes procedures for eligibility and screening that were based on inclusion criteria that were established with the goals of the research. The analysis of the articles obtained for the systematic review reveals four different types of barriers to more regular GBL implementations. These barriers include (1) behavioural and attitudinal barriers; (2) school policy barriers; (3) material and technology barriers; and (4) barriers related to game literacy. Based on these barriers, we propose certain methodological strategies that might help practitioners get beyond the identified barriers. The strategies include: (a) adopting a participatory-driven and co-creation approach; (b) carefully considering whether to use digital, analogue, or hybrid games; (c) using a range of educational actors in the process; and (d) pushing for GBL training in projects. It is possible to argue that attitudinal barriers are related to the other barriers that have been discussed. For example, material barriers affect teachers' belief that there are currently not enough suitable educational games. Although policy makers' attitudes can be examined as a part of the macro-level attitudinal barriers, the effectiveness of their measures in the daily educational context is influenced by a separate set of barriers, which will now be investigated. Assessment literacy in GBL refers to teachers' beliefs about adopting games and how these affect students' motivation and cognitive development and is similar to an attitudinal aspect. In line with this result, it can be stated the potential strategies are also interrelated. Co-creative processes can be enhanced by integrating a multi-stakeholder approach to GBL, where finalized entertainment works successfully reflect the experiences of all participants. This article corroborates, evaluates, and groups the intervention streams as the basis of a comprehensive program of intervention where existing scientific literature on studies of GBL interventions naturally suggests the solutions.

Keywords: Game-Based Learning, Education, Games, Barriers, Systematic literature review

1. Introduction

The benefits of using gamified concepts in education have been extensively studied. However, previous research has primarily focused on the potential advantages of Game-Based Learning (GBL); comparatively little has been written regarding the difficulties and obstacles associated with using GBL methods. Even though GBL has many potential benefits, there are also challenges as well as drawbacks that need to be taken into account while developing and implementing GBL. The purpose of this article is to examine and comprehend the barriers and hindrances to the efficient implementation of GBL in educational contexts. It's challenging to include games in course designs. This research consolidates the most commonly encountered challenges in GBL and presents an intervention scheme tailored to those challenges. This goal elicited the following research questions:

- What are the main obstacles experienced in the implementation of GBL approaches in educational contexts?
- How can we offer an intervention diagram that connects potential strategies to overcoming these obstacles?

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1.1 The Role of GBL in Education

Games have been an integral component of human culture for thousands of years, fulfilling diverse functions ranging from amusement to fostering social connections and enhancing cognitive abilities. The advantages and uses of games are wide-ranging. By connecting imagination and reality, games that support children's social development allow them to expand their horizons (Vygotsky, 1978). Games are fundamental to children's cognitive development and evolve with it (Piaget, 1962). Games enable the integration of extrinsic and intrinsic motivational elements, fostering an environment where players are more inclined to engage in the desired behaviours (Hartt et al., 2020). Games intrinsically stimulate and maintain players' attention, drawing them in. In the past decades, advances in digital technology have facilitated the emergence of GBL as a form of pedagogical innovation in formal and non-formal education. GBL is generally characterized as "the application of game design features in a non-game situation" (Deterding et al., 2011, p. 10). In order to cover the subject in depth, it is necessary to explain what GBL is. In order to engage students in learning success, GBL incorporates certain gaming elements into real-life scenarios (Liu, Shaikh, and Gazizova, 2020). In general, the term "game-based learning" describes an educational approach that uses a game or game-like components to motivate students (Van Eck, 2006). Another relevant definition in an educational context is that GBL is the act of solving issues and engaging people by employing game thinking and game mechanics (Zichermann and Cunningham, 2011). GBL encourages students to learn via experience. Since GBL exercises differ from those in the usual curriculum, they could be seen as a way to break up the routine and get students more interested in learning new material. The learning experience in GBL is created by the game itself. Teachers can model complicated systems and reproduce phenomena in an environment that is provided by GBL techniques. Students may apply and test what they have learnt from lectures and study materials in a gamified learning environment. In order to comprehend the underlying impacts and find effective designs, researchers have studied and created different kinds of GBL structures over the past decade (Ke, 2016; Linehan et al., 2011). To encourage students to engage in activities that support computational thinking, game elements—specifically, clear goals and rules, progressive difficulties, instant feedback, story, avatar, social engagement, and varied reward systems—were employed (Wang, Cheng, and Li, 2023). There is a clear consensus that games should be useful teaching tools and some studies have found that games have positive effects on educational outcomes.

Studies have found that GBL enhances students' understanding and improves the achievement of learning objectives for a given course or class (Barzilai and Blau, 2014; Liu, Shaikh, and Gazizova, 2020; Karakoç et al., 2022; Riopel et al., 2019; Sung et al., 2017) and computer educational games positively impact students' academic achievement motivation (Partovi and Razavi, 2019). One of the main advantages of GBL is its ability to engage students, which can help them stay motivated and focused on learning (Balaskas et al., 2023; Hartt et al., 2020; Liu, Shaikh, and Gazizova, 2020; Liu, Wang, and Lee, 2021). It is believed that educational games will inspire students extrinsically—for rewards from outside sources—as well as intrinsically—for enjoyment or challenge. In addition to motivating for students to participate in class, games can generate positive psychological responses, improve concentration, and strengthen memory (Zeng, Parks, and Shang, 2020). Because of their engaging nature, gamified methods of instruction are frequently favoured by both teachers and students. Generally, student motivation appears to be positively impacted by gaming in a learning environment (Balaskas et al., 2023; Liu, Wang, and Lee, 2021; Subhash and Cundey, 2018). Students are motivated by cooperation and competitiveness, which are made possible by the use of gamified techniques and games. Additionally, games encourage active learning and can be personalized to fit the needs of individual students (Orji, Mandryk, and Vassileva, 2017). Students' engagement and learning efficiency are increased by the GBL approach, which is seen to be enjoyable, stimulating, and demanding (Mathrani, Christian, and Ponder-Sutton, 2016). Through GBL, students can manage their learning, gain the knowledge they require, and apply general skills like self-control and self-management (Chen and Law, 2016). Games also provide immediate feedback, which can help students learn more quickly and understand their mistakes (Liu, Wang, and Lee, 2021; Plass, Homer, and Kinzer, 2015). A GBL environment can allow the freedom to fail without worrying about unpleasant consequences. With GBL, students may experiment with various techniques and ways of making decisions as they move toward the objectives of the game. GBL allows students to apply theory to simulated real-world scenarios. They also learn how to use information and procedures based on theory in a simulative setting. Students learn how to manage relationships between people and activities in game contexts by integrating uncertainty and integration (Jääskä, Aaltonen, and Kujala, 2021). Collaboration is another benefit of GBL, as it promotes social skills and teamwork (Chen and Law, 2016). GBL may also help students develop skills like teamwork (Hartt Hosseini and Mostafapour, 2020), decision-making, and problem-solving (Qian and Clark, 2016)—all of which are competencies that require practice and mastery. 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, Homer, and Kinzer, 2015, p. 278).

1.2 Challenges and Strategies in Implementing GBL in Educational Settings

Researchers have warned that the success of GBL depends on the use of suitable and theoretically effective learning mechanisms (Chang & Hwang, 2019). Both the design and implementation of Game-Based (GB) activities may be guided by one or more theoretical foundations, such as experiential learning theory and constructivist learning theory (Wang, Cheng, and Li, 2023). Scaffolding strategies in teacher-student interactions can help students face challenges and make GBL more structured (Sun et al., 2023). Additionally, adding extra scaffolding to the game enhances students' engagement and interest in the educational process (Taub et al., 2020). A collaborative GBL environment offers enduring learning and is appropriate as a teaching and assessment tool for computational thinking skills in primary school (Zapata-Caceres et al., 2021). The simplest method is using game content as a multiple-choice test, with the game serving as a learning reward for primary school students (Park et al., 2019). A GBL system that integrated a "Prediction-Observation-Explanation" learning strategy can significantly improve students' learning achievement and learning retention (Yang and Chen, 2023). Students' learning effectiveness and intention to continue with digital GBL systems are strongly impacted by information feedback, game quality, and autonomous motivation (Liu, Wang, and Lee, 2021). Although GBL has great potential, its implementation in actual educational settings has encountered numerous obstacles and limitations that restrict its potential impact. Reported problems might include issues with game complexity (Lomas et al., 2017), technological unreliability (Marklund and Taylor, 2016) or instabilities and imbalances. Furthermore, in GBL, students could experience discomfort regarding competitiveness and outcomes comparison (Šćepanović, Žarić, and Matijević, 2015). Students may consider gamified classrooms as hard and may choose more traditional methods of learning (Šćepanović, Žarić, and Matijević, 2015). GBL might be laborious for students and the time the game needs to be played for meaningful effects to occur can be highly variable and unpredictable. Putting the GBL approach into practice can be extremely challenging and expensive because it frequently calls for customizing a freely available game to meet the needs of the specific course and making additional investments in the right equipment (Al-Azawi, Al-Faliti, and Al-Blushi, 2016). Students typically encounter unfavourable effects when teachers face challenges. Educators frequently lack the time and resources necessary to put in extra effort to find, study, and instruct educational games (Jääskä and Aaltonen, 2022). Although most teachers say they use learning games, many are unsure of how to include games in their lessons and wish it were simpler to find games that match their curricula (Takeuchi and Vaala, 2014). According to Molin (2017), there are several obstacles to implementing and embracing GBL, including instructors' lack of availability to plan gameplay periods (Jääskä, 2023), their lack of technical proficiency, their sense of alienation (Steiler-Hunt and Jones,2017), and their inability to select and include appropriate games. While most teachers are aware of their necessity and efficacy, they do not have the skills and knowledge needed to implement them in the classroom (Hamari and Nousiainen, 2015; Lindgren, 2018). Constraints associated with the adoption of games in education include the financial barriers related to equipment costs (Al-Azawi, Al-Faliti, and Al-Blushi, 2016; Moizer, et al., 2009), disparities in access to technology (Hsu, et al., 2011), potential distractions from educational activities due to entertainment risks (Rowan, 2016), the time constraints of implementing games within a single day's lesson (Justice and Ritzhaupt, 2015; Baek, 2008), the influence of teachers' gender-related self-perception and their motivation and proficiency in handling technology (Hamlen, 2010; Justice and Ritzhaupt, 2015), the lack of customisation options for games (Al-Azawi, Al-Faliti, and Al-Blushi, 2016; Embi, 2008; Javora et al., 2021), challenges in obtaining game analytics and analysing student progress (Hauge et al., 2014), and concerns from educators and parents regarding the use of games in education (Barko and Sadler, 2013; Koh et al., 2011). To fully optimise the potential of GBL, it is imperative to identify and overcome these obstacles and create efficient intervention strategies. To present these strategies, we performed a Systematic Literature Review (SLR) following the PRISMA methodology and guidelines (Page et al., 2021).

1.3 Previous GBL Studies and the Present Study

A number of literature review studies have attempted to analyse GBL from diverse focuses in recent years (e.g. Chang & Hwang, 2019; Guan et al., 2024; Noroozi, Dehghanzadeh, Talaee, 2020; Qian & Clark, 2016; Tokac, Novak, and Thompson, 2019). Some reviews (e.g., Chang & Hwang, 2019) concentrated on a specific type of technology supporting games; others (e.g., Gomez, Ruipérez-Valiente, and Clemente, 2023; Guan et al., 2024; Lester et al., 2023; Sun et al., 2023; Tokac, Novak, and Thompson, 2019; Videnovik, Bogdanova, and Trajkovik,, 2024; Zainuddin et al., 2020) reported findings on a specific topic; still others (e.g., Chen et al., 2021; Noroozi, Dehghanzadeh, Talaee, 2020; Qian and Clark, 2016) emphasized the results of GBL. For example, in order to find empirical data about the impact of GBL on 21st-century abilities, Qian and Clark (2016), examined 137 studies.

They found features of good game design that were in line with well-established learning theories. Ekin, Polat, and Hopcan (2023) analysed all studies on games in education conducted between 1968 and 2021. The primary goal of the study was to guide researchers and to identify trends and changes in GB research in education. Of all the research, almost 70% were carried out within the previous ten years. The primary focus of one-third of the research is GBL. In terms of topic usage acceleration, GBL, serious games, and student science games had the greatest values, in that order. Furthermore, Gomez, Ruipérez-Valiente, and Clemente (2023) conducted a systematic literature review of trends and challenges in GB assessment studies. The results indicate that GB assessments are primarily employed in K–16 education and for assessment, with the majority of GB assessments concentrating on assessing STEM content as well as soft and cognitive skills. In addition, the six areas into which the challenges faced by the researchers were classified were game design, data sample, methodological, technical, integration, and validation. They also offered suggestions for the GB assessments' future research goals. For instance, given the size of the data sample gathered was one of the primary limitations of the current research, the future research of GBA studies should make sure that enough data is collected to provide significant and reliable findings. Additionally, they should discuss the game design that will be utilized for the assessment, as many studies involve games designed for other goals (like enjoyment) and fail to consider the crucial connection between game design and gathering the data needed for the assessments. Lester et al. (2023) systematically examined the drivers and barriers to the use of gamification and GBL in universities from the perspectives of educators. According to the educators at universities, the main factors that positively impacted their use of gamification and GBL were their beliefs that it promotes student interactions and collaborative learning, is enjoyable and increases engagement, and is simple for students to use. On the other hand, the primary barriers faced by educators were a lack of time to create gamification strategies, the absence of evidence of their advantages, and problems with the classroom environment. The study classified drivers and barriers as attitudinal, design-related or administrative and suggested that future research and practice could benefit from collaboration among university educators, instructional support staff, and administrators to develop strategies that address these three categories of drivers and barriers to improve student learning outcomes. One may argue that while a suggestion has been made to address these drivers, it has not been thoroughly explained. Another study provided a comprehensive explanation of the procedures and stages involved in a comprehensive implementation of GBL for lecturers in higher education. Fernández-Raga et al., (2023), specifically outlined the procedures and stages of a comprehensive GBL implementation that is appropriate for lecturers. The thirteen phases in this paper's complete introduction to GBL in higher education were designed to assist lecturers in incorporating GBL into their teaching methods. Further, three subsequent phases consisted of the order of the process: preparation, game design, and practicing and evaluation. Dimitra et al. (2020) identified seven key GBL types (flashcard type games/memory games, simulation games, interactives, quiz games, puzzles, strategy games, reality testing games) that are used in education across all levels and situations and talked about the primary benefits and drawbacks in educational circumstances in order to provide an overall evaluation. They stated games can be used to assess several learning-related cognitive or emotional aspects, including individual differences, self-efficacy, and self-concept. However, they said that games have drawbacks in education, such as impacting students' performance, mental conditions, or attitude toward learning. Despite stating both the advantages and disadvantages of GBL in education, these studies either conclude that only the barriers are identified or that, even if implementation ways are proposed, they are restricted to a certain field (e.g., higher education). By identifying challenges with GBL in the field of education and suggesting intervention strategies in parallel with these challenges, our study differs from the current literature.

2. Method

To determine eligibility requirements, the primary research aim was utilised: for studies to be considered for inclusion, they needed to approach GBL interventions, with a particular emphasis on the challenges that were encountered during its implementation in educational settings. Within the scope of this study, empirical research that had been reviewed by peers was included in the sample. Book reviews, systematic reviews, and theoretical articles of any kind were among the types of research that were not considered for inclusion in the study. In addition, studies that concentrated on Gamification rather than GBL were not considered.

2.1 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.

2.2 Selection Process

Following the transfer of the search results, Endnote X9 was utilised to perform an automatic removal of duplicate entries. After that, the results were transferred to an Excel sheet, where they were subsequently screened in two stages. Study titles and abstracts were reviewed and "included" or "excluded" were assigned based on the previously defined inclusion and exclusion criteria. All of the studies that were deemed eligible during the first phase were subjected to a comprehensive full-text screening during the second phase. This procedure led to the collection of a total of eleven studies, which are presented in a standardised format in Figure 1.

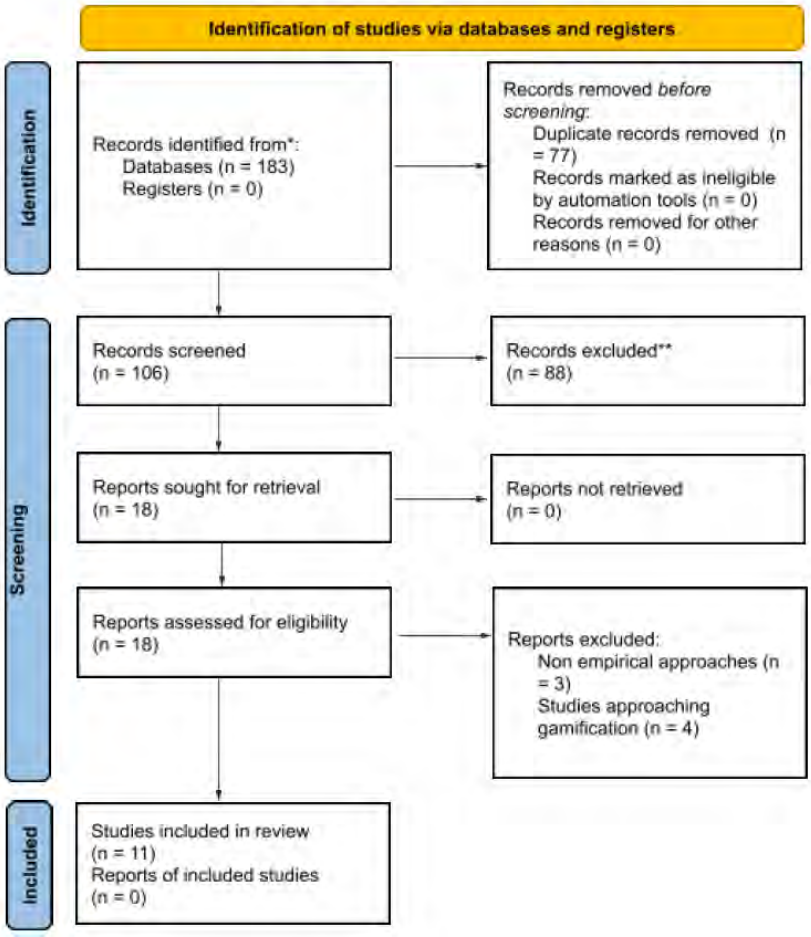

Figure 1: Flow diagram showing the identification process for studies to include in the review

2.3 Data Extraction and Analysis

The sample was coded to determine the most common obstacles and challenges that stand in the way of the more regular and ordinary (through better feasibility) application of games in educational settings. This was done to analyse the articles that were chosen. Following that, a more qualitative lens was utilised to investigate each barrier and the contextual factors that were associated with it, as stated by the authors. The development of a proposal for an intervention diagram was made possible through critical reflection and triangulation with the conceptual models that were already in existence. In addition, statistical analysis methods, specifically descriptive statistics, were utilised to analyse the data about sample characterization.

3. Overview of the Results

The sample description is schematized in Table 1. Of the 11 studies, four were based on a mixed-methods approach (Arnab, Clarke, and Morini, 2019; Chen et al., 2020; Hu and Sperling, 2022; Kaimara et al. 2021), five using a quantitative method of evaluation (Alqurashi and Alqurashi, 2017; Khodabandeh, 2022; Manesis, 2020; Martins and Oliveira, 2019; Sousa, Henriques, and Costa, 2017), and two using a qualitative approach (Jääskä and Aaltonen, 2022; Marklund and Taylor, 2016). It is important to note that five articles had teachers as participants, three had education students/pre-service teachers, one had students as participants, and another one adopted a multistakeholder approach 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. Two studies combined instruments with one or more data-gathering techniques. These included interviews and surveys (Chen et al., 2020), questionnaires and the final reflection pieces (Arnab, Clarke, and Morini, 2019). Two studies utilized questionnaires (Alqurashi and Alqurashi, 2017; Manesis, 2020), four used surveys (Hu and Sperling, 2022; Kaimara et al. 2021; Martins and Oliveira, 2019; Sousa, Henriques, and Costa, 2017), one used interview (Jääskä and Aaltonen, 2022), one study used tests (Khodabandeh, 2022) and one study used recordings (Marklund and Taylor, 2016). Quantitative (Alqurashi and Alqurashi, 2017; Khodabandeh, 2022; Manesis, 2020; Sousa, Henriques, and Costa, 2017) and qualitative (Arnab, Clarke, and Morini, 2019; Jääskä and Aaltonen, 2022) approaches were used to analyse the data that had been gathered. Chen et al. (2020) employed quantitative, qualitative analysis, "Analytic Hierarchy Process", and systematic review analysis. Hu and Sperling, (2022) and Kaimara et al., (2021) preferred both quantitative and qualitative analysis methods. Table 1 summarises all 11 studies.

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

Author(s), Year	Methodological approach, Sample, Instruments and Assessment	Main objective and Main outcome(s)
Alqurashi and Alqurashi, 2017	*Methodological approach:* Quantitative *Sample:* 930 teachers *Instruments:* Questionnaire *Assessment:* Quantitative analyses	*Main objective:* "The purpose of this quantitative study was to identify significant factors that prevented teachers in Saudi Arabia from using video games in their classroom (…)"
Arnab, Clarke, and Morini, 2019	*Methodological approach:* Mixed-methods *Sample:* 122 undergraduate students *Instruments:* The Module Evaluation Questionnaire (MEQ), The final reflection pieces *Assessment:* Qualitative analyses	*Main objective:* "This article discusses the application of game design thinking as a learning process for scaffolding co-creativity in Higher Education (…)"
Chen et al., 2020	*Methodological approach:* Mixed-methods *Sample:* 231 teachers *Instruments:* Interviews and Surveys *Assessment(s)*: A systematic review analysis, Qualitative analysis, Quantitative analysis, and Analytic Hierarchy Process (AHP)	*Main objective:* "The present research aims to explore what GBL informed games literacy for teachers is and what teachers think about their needed capabilities in games literacy for the implementation of GBL in the classroom."
Hu and Sperling, 2022	*Methodological approach:* Mixed-methods *Sample:* 130 pre-service teachers *Instruments:* Survey *Assessment(s):* Quantitative analysis, and Qualitative analysis	*Main objective:* "This study investigates pre-service teachers' perceptions of adopting games in education (...)"
Jääskä and Aaltonen, 2022	*Methodological approach:* Qualitative *Sample:* 22 project management teachers *Instruments:* Interviews *Assessment(s):* Qualitative analysis	*Main objective:* "(…) to gain an in-depth understanding of teachers' perceptions of applying game concepts in the project management education context."

Author(s), Year	Methodological approach, Sample, Instruments and Assessment	Main objective and Main outcome(s)
Kaimara et al. 2021	*Methodological approach:* Mixed-methods *Sample:* 170 pre-service teachers *Instruments:* Survey *Assessment(s):* Quantitative and Qualitative data analysis	*Main objective:* "The purpose of this study was to examine pre-service teachers' views on DGBL [Digital game-based learning], and the possible obstacles that they consider to hinder its implementation in primary and secondary schools in Greece."
Khodabandeh, 2022	*Methodological approach*: Quantitative *Sample*: 75 English foreign language students *Instruments*: Oxford Quick Placement Tests, Multiple-choice test, *Assessment(s)*: Quantitative analysis	*Main objective*: "The purpose of the study was to compare the effects of flipped and blended classes on students' learning of how to give and ask for directions through the use of ARG [augmented reality game]-based enhanced education."
Manesis, 2020	*Methodological approach*: Quantitative *Sample*: 148 early childhood teachers *Instruments*: Questionnaire *Assessment(s)*: Quantitative analysis	*Main objective:* "The main aim of this research is to investigate teachers' perceptions of barriers to accepting and integrating GBL in Cyprus pre-school settings."
Marklund and Taylor, 2016	*Methodological approach*: Qualitative *Sample*: 17 classrooms (participants not specified) *Instruments*: Recordings *Assessment*: Qualitative data analysis	*Main objective:* "This paper aims to highlight the demands that the implementation and use of an educational game in formal educational settings puts on teachers' working processes and skill sets."
Martins and Oliveira, 2019	*Methodological approach*: Quantitative *Sample*: 18 elementary and middle school teachers *Instruments*: Survey *Assessment*: No information	*Main objective:* "This research examines teachers' perceptions about educational games and the use of video games in their teaching practice."
Sousa, Henriques, and Costa, 2017	*Methodological approach*: Quantitative *Sample*: 106 teachers, parents, and youth *Instruments*: Survey *Assessment*: Quantitative analyses	*Main objective:* "(…) the present study aims to explore the main attitudes, motivations, perceptions and barriers to the adoption of digital games as a pedagogical tool, mainly in formal educational contexts."

4. Barriers to the Effective Use of Games in Education

To analyse the selected articles, the sample underwent coding to identify the most common obstacles and impediments to the successful utilisation of games in education. Subsequently, the authors employed a qualitative approach to examine each barrier and its contextual factors. By critically reflecting on and triangulating with the existing conceptual models, a proposal for an intervention diagram was developed. Sample characterization data was analysed using descriptive statistics, which are statistical analysis techniques. The analysis of the articles gathered through the systematic review suggests four types of barriers to more regular implementations of GBL. These are Attitudinal and Behavioural, School Policy, Technology and Material, and Game Literacy barriers.

4.1 Attitudinal and Behavioural Barriers

While the majority of data supports the idea that the school community acknowledges the benefits of using and developing educational games, such as their impact on communication, transferable knowledge, problem-solving skills, and self-expression (Sousa, Henriques, and Costa, 2017), there are noticeable barriers in attitudes and behaviour within the analysed sample. These attitudinal barriers can be classified into various categories and subcategories, as depicted in Figure 2.

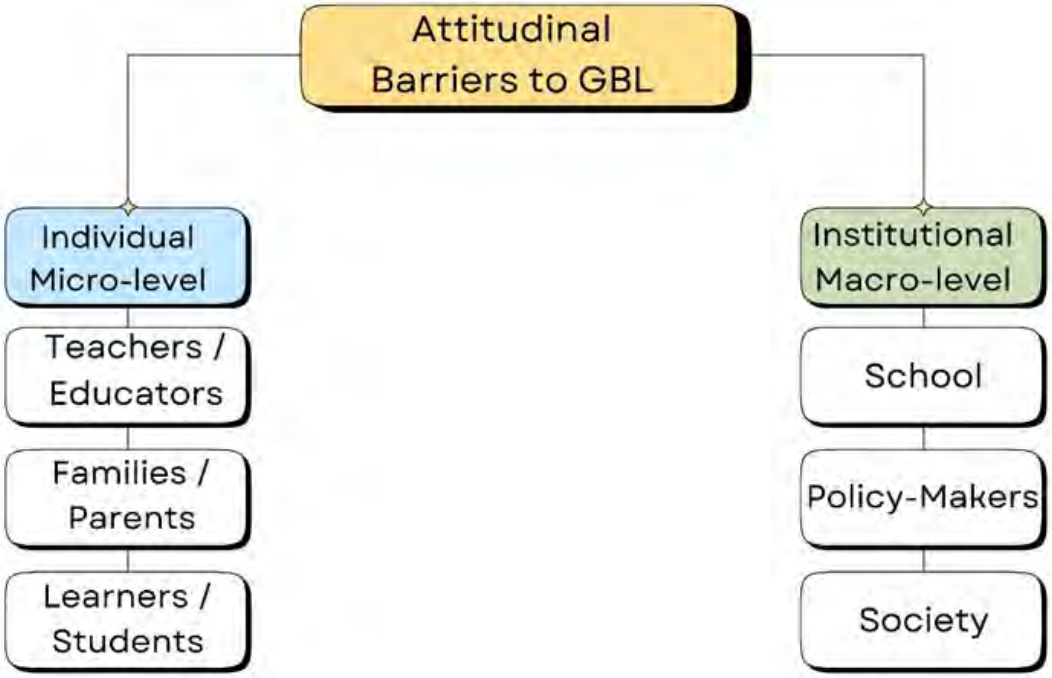

Figure 2: Attitudinal barriers to GBL interventions, according to the sample

The sample revealed that there are two categories of attitudinal barriers to GBL interventions: individual micro-level and institutional macro-level. The micro-level of attitudinal barriers can be understood as the different ways in which 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. Teachers may be discouraged from implementing GBL due to uncertainty about how to incorporate the method into their teaching practice and the relatively novel nature of GBL teaching techniques. 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. Teachers who have high levels of self-efficacy will find it easier to push themselves to meet a range of expectations in their professional lives (Manesis, 2020), where this extends to making the most of employing games in the classroom.

Regarding students, analysis of the sample showed some unexpected results regarding their negative attitudes towards GBL. Students may experience additional stress as a result of scoring and competitiveness under pressure among peers or feel uncomfortable with competitiveness, or the comparison of game results (Jääskä and Aaltonen, 2022). Students 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 over GBL implementations, depending on the students' profiles as learners (Jääskä and Aaltonen, 2022). This aspect was also found in data from Sousa, Henriques, and Costa (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. Students become frustrated if they are not given enough or clear instructions on how to take part or play the game. Failure to develop a sense of confidence between instructors and students before properly implementing GBL makes the learning environment look unpleasant, resulting in negative feedback (Jääskä and Aaltonen, 2022). This can also be motivated by an apparent disconnect between an educational game and the educational objectives that were initially proposed to the student. Students may view gamified instruction as irrelevant or as being separated from the learning objectives if they are unable to see how the game relates to and connects to the objectives. 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).

The negative connotation attributed to games as being exclusively a form of entertainment is common among educators, families, and students. There is a clear distinction between "serious games" which are seen as having educational value, and commercial games which are seen as being a waste of time (Sousa, Henriques, and Costa, 2017). It is important to acknowledge that, based on current knowledge and research, this viewpoint can be considered incorrect. Studies have demonstrated the educational value of both digital and analogue games, ranging from teaching probabilities through games like Settlers of Catan (Austin and Molitoris-Miller, 2015) to developing advanced decision-making skills in games like Counter-Strike: Global Offensive (Kiourti, 2022).

When considering the broader perspective of attitudinal barriers concerning GBL, it is crucial to acknowledge the presence of negative attitudes held by both schools and policy-makers. These attitudes have a detrimental effect on the successful implementation of GBL (Kaimara et al., 2021).

The sample of articles reviewed sheds light on policy-makers unfavourable perceptions of games as instructional tools and disapproval of educational games on the part of ministries of education in different countries are regarded as significant barriers (Kaimara et al., 2021). Education policy-makers have operated on the basis that technology is better suited for leisure activities rather than as a tool to improve teaching and learning (Manesis, 2020). At a societal level, a significant obstacle in terms of attitudes is the widely recognised "digital natives" narrative. Many pre-service or younger teachers believe that they are well-versed in implementing innovation-driven pedagogical strategies, such as GBL, because of the environment they have been raised in. This discourse can be interpreted as an obstacle because it reinforces preconceived ideas about people's backgrounds, socioeconomic situations, technological opportunities, and literacy levels. This goes against the inclusive possibilities that games offer (Hu and Sperling, 2022; Marklund and Taylor, 2016). While Kaimara et al. (2021) examined policy-makers' attitudes as part of the macro-level attitudinal barriers, the effectiveness of their measures in the daily educational context is influenced by a separate set of barriers, which will now be investigated.

4.2 School Policy Barriers

While research can reinforce the pedagogical benefits of GB approaches, they often come up against institutional issues faced by schools and higher education institutions. The process of integrating games into formal educational environments is laborious and complicated, requiring significant time and resource commitments to be accepted as a practical component of the process. This is caused in part by the fact that schools are not set up for GBL (Marklund and Taylor, 2016). These issues can even extend to non-formal education contexts. The analysed sample of articles highlights issues related to limited instructional time available to educators for including innovative pedagogical practices in their work. Teachers are far more likely to discontinue the educational use of games if they have little teaching time or if the content is not appropriate (Hu and Sperling, 2022). Policy and curriculum were two examples of the barriers that affected the perceptions of educators. Teachers have identified that the people who create curriculum, set educational policies, and organize the educational system are the drivers of these barriers (Kaimara et al., 2021). Another problem is that the games aren't aligned with the national curriculum or academic expectations. These studies consistently show that incorporating games into existing curricula is difficult in the absence of appropriate resources. 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. One fundamental issue with GBL in formal education is that, in their current form, games are not highly trustworthy as instructional tools. It takes a significant amount of time and resources to set up the technological framework necessary for games to run smoothly and consistently, as well as to maintain them during every lesson (Marklund and Taylor, 2016).

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). Particularly when it comes to computer games, technical issues brought on by a lack of technical expertise, a lack of assistance, a lack of instructions, device incompatibility, or just plain poor luck can cause disruptions in the classroom (Jääskä and Aaltonen, 2022). To effectively implement the approach, the instructor must get familiar with the logic and game mechanics. Because of the technology involved, the use of digital educational games requires teachers to have more technical abilities compared to traditional approaches(Jääskä and Aaltonen, 2022). A wide range of skill sets are needed to complete tasks successfully, including subject-matter knowledge, game literacy and technological proficiency.

Material barriers are associated with the lack of games *per se*, or the lack of funding to acquire them. This is made apparent by the fact that teachers believe that there aren't enough appropriate educational games available currently (Jääskä and Aaltonen, 2022). 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). Educational game fees also vary significantly. The game may be too expensive to use. 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). In the case that a course lacks funding, teachers will need to defend their game purchases to the university's administration (Jääskä and Aaltonen, 2022). It takes more work on the part of the teacher to provide a framework appropriate for the usage of educational games. Another obstacle is the idea that there aren't enough tools to help teachers use games. Lesson plans that include games, techniques for evaluating students' comprehension of academic information, and extra materials or activities centred around the GBL sessions are examples of supporting resources (Hu and Sperling, 2022).

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) conducted a study to investigate how teachers' lack of knowledge and understanding about games affects the effectiveness of GBL interventions. They utilised a framework that clearly defined different dimensions of literacy, including:

- The literacy of instructional design in GBL refers to the proficiency of teachers in aligning game design with desired learning outcomes before applying these strategies in their classrooms.
- The evaluation literacy in GBL refers to teachers' beliefs about adopting games and how they impact students' motivation and cognitive development, similar to an attitudinal aspect.
- Proficiency in organisational and managerial aspects of GBL, encompassing the aptitude to overcome obstacles related to technology and resources.
- Fundamental understanding of games, which is connected to the choice of games and the overall grasp of concepts, impacts the teachers' ability to actively involve students in the educational process.
- Proficiency in understanding complex game systems and applying strategic thinking.

Hu and Sperling (2022) highlighted the insufficient game literacy among teachers, emphasising their inclination to perceive games solely as supplementary activities rather than as pedagogical tools. This perception may be associated with other recognised obstacles, such as the necessity for heightened awareness regarding the correlation between game mechanics and learning (Jääskä and Aaltonen, 2022), or difficulties in identifying students' concerns with the game interface (Marklund and Taylor, 2016). It is important to understand that game literacy is necessary not only for monitoring gaming sessions but also for the success of contextualising activities, especially critical reflections and debriefings (Marklund and Taylor, 2016).

Game literacy can be fostered through specialised training programmes that aim to empower educators in effectively assisting their students within the framework of GB interventions. An examination of existing teacher-preparation programmes shows them to have insufficient exposure to GB instruction (Hu and Sperling, 2022), along with a general lack of training in Information and Communications Technology (ICT) while failing to recognise the importance of playfulness in education (Kaimara et al., 2021). This matter begs for consideration, as the dissemination of information regarding the educational significance of games is regarded as crucial for their widespread use in education. Martins and Oliveira (2019) suggest improving the accessibility and attractiveness of training by integrating it with pre-service teacher education.

5. Potential Strategies for Dealing with the Identified Barriers

We suggest some methodological approaches that might support practitioners in overcoming the recognised barriers, as indicated by our critical analysis of these barriers. The strategies consist of: (a) employing a co-creation and participatory-driven strategy; (b) making a deliberate choice between using analogue, digital, or hybrid games; (c) involving various educational actors in the process; and (d) advocating for GBL training in projects.

5.1 Co-creation

Co-creation is an intellectual perspective that emerges from the constructivist scientific paradigm, embracing a relativist stance and asserting that reality is a product of human cognition. Concerning the specific matters of GBL and gaming as a whole, the constructivist paradigm is applicable as it centres on how individuals create significance from their experiences, highlighting the diversity and multitude of interpretations (Guba and Lincoln, 1994).

Specifically, in this context, co-creation refers to the inclusion of the player's voice in the creative processes, whereby the audience transitions from a relatively passive position to a more engaged position in shaping the game itself (Kafai, 2006; Rüller et al., 2022). Regarding the process of acquiring knowledge, it pertains to person-centred learning or personalised 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). By including students as a critical part of the teaching process, co-creation increases student involvement and engagement in the learning process (Blau and Shamir-Inbal, 2017). The co-creative process is regarded as an effective way to foster communication, student creativity, and positive group dynamics (Zarandi et al., 2022). Student success, retention and persistence all increase with co-creation. When users participate in the co-creation process, gamification's advantages usually increase as well (Lopes et al., 2022). 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, Clarke, and Morini, 2019).

5.2 Analogue Games VS Digital Games

In the initial stages of academic discourse on GBL, Gee (2005, p. 34) advocated for the conceptual definition of this field by establishing the learning principles inherent in "good games". According to Gee (2005), a "good" game needed to inherently embody the latest scientific principles of skill acquisition in cognitive science within its gameplay, including identity, interaction, production, risk-taking, customization, agency, well-ordered problems, challenge and consolidation, "just-in-time" and "on-demand" situated meanings, pleasantly frustrating experiences, system thinking, exploration, lateral thinking, goal reconsideration, cross-functional teams, and performance before competence.

While initially framed within a digital context, these principles apply to board games as well. The literature now strongly supports the learning potential of board games, emphasizing the role of play in human development (Gobet et al., 2004) and how these artefacts reflect the culture of each society (Booth, 2021).

Although empirical research has supported the learning potential of digital games, particularly in terms of motivation, engagement, and confidence levels (Abdul Jabbar and Felicia, 2015), recent approaches underscore specific advantages of analogue games for both educators and students. These advantages include the development of skills such as collaboration, communication, creativity, problem-solving, and decision-making (Sousa et al., 2023). Analogue games are characterized by their flexibility and are easily adaptable to the specific requirements of any classroom or group of players (Maratou et al., 2023).

The ability to make an informed choice between digital, analogue, or hybrid games is pivotal for the sustainability of an intervention, considering issues like technological barriers or micro-level and school policy barriers to GBL adoption. No option is inherently superior or more pedagogical than another; their contextual feasibility relies on a detailed assessment of the target audience, available funding, existing technology, the literacy of trainers and trainees, and potential accessibility needs, among other factors.

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 more highly 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). Considering that parents' views on games in the classroom appear to have an impact on educators, students, and policy-makers (Bourgonjon et al., 2011), integrating innovative strategies through stakeholders may be possible with strong reactions from scholars, teachers, practitioners, policy-makers, families, students or others. Therefore, the successful adaptation of educational change processes related to GBL requires the participation of all stakeholders, from student needs to teacher preparation programs, as well as from the gaming industry to policymakers. For example, teacher preparation programs should offer greater opportunities to explore and closely examine GB educational practices while resources should be made available for the purchase of modern hardware, software, and equipment as well as for the training of administrators and educational officials and teachers. 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. According to Marklund and Taylor (2015), for teachers to acquire game literacy they require opportunities to play a broad range of games regularly. Pre-service and in-service teachers need to be knowledgeable both practically and pedagogically to select and apply the most effective uses of games in their lessons. This will support teachers in developing adaptable, innovative, and flexible educational techniques that effectively integrate game-playing sessions into non-game elements of the course (Hu and Sperling, 2022). These authors also acknowledge the relevance of teachers in the promotion of digital competencies, since training teachers in these competencies contributes, in an indirect manner, to the development of these competencies in students. Furthermore, teachers who possess a reasonable level of technical proficiency will be better equipped to choose a game that matches learning objectives, have access to the resources needed to continue using the game, and put the best integration strategies into practice (Hu and Sperling, 2022). Professional training in digital GBL implementation might facilitate and encourage the use of GBL approaches, particularly if more and more digitized learning settings are employed in the future.

Sousa and Costa (2019) propose the application of GBL to teacher training, namely in the areas of digital competence and media literacy. The pedagogical premises in GBL of using 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 GB 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.

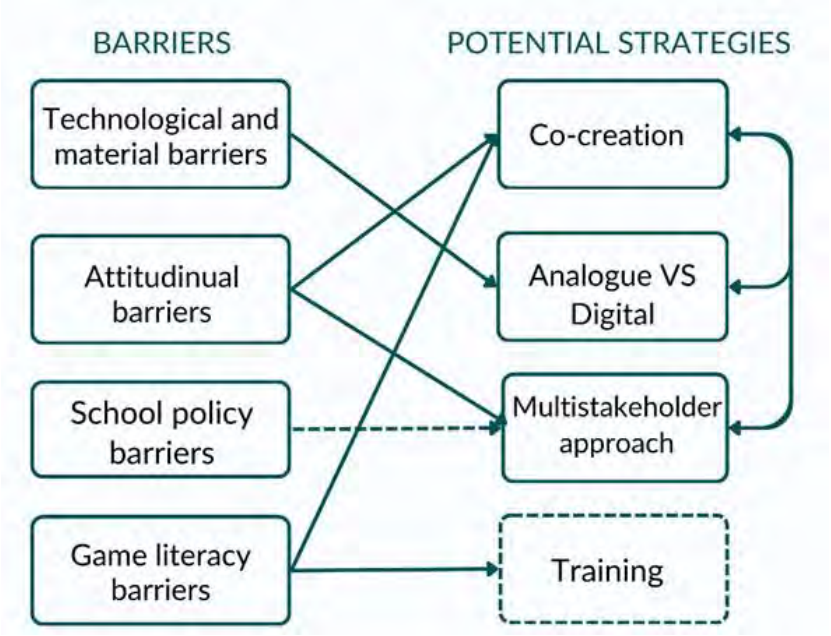

Figure 3: Proposed intervention model based on the barriers and strategies explored

Figure 3 offers concrete guidance to teachers, educators, practitioners, and others on how to connect various concepts when implementing GBL interventions.

- By conducting a thorough and timely examination of potential technological and material obstacles within the given context, certain issues can be preemptively circumvented. Specifically, by selecting either analogue, digital, or hybrid games based on the available technology, expertise, and financial resources.
- Co-creation aims to engage players as essential participants in the creative process of games, with a deeper understanding and a positive impact on player attitudes and literacy. It is thought that one of the effective ways to enhance players' attitudes and literacy is to involve them in the co-creation of the game.
- Successfully designing and implementing GBL applications involving multiple stakeholders will also have a favourable impact on their attitudes towards GBL. 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.
- Including policy-makers in these multistakeholder approaches can indirectly support change and help bridge the gap between them and the obtained results.
- While we lack control over the pre-training of participants in a GB intervention, it is crucial to raise awareness among institutions about its significance and, whenever feasible, incorporate it into the projects. Once institutions create programs that teach and train professionals with broad abilities and literacy, then they will also be prepared to encounter, adjust to, and take management responsibilities of gaming intervention.
- Co-creative strategies are contingent upon conducting a thorough analysis of the preferred technology for the game being implemented, whether it be analogue or digital. This choice will influence both the material circumstances and the capacity of individuals to participate on an equitable basis.
- Co-creation is aligned with the multistakeholder approach due to its participatory and horizontal nature, which enables the involvement of multiple actors at an equal level.

7. Conclusion

For all the potential in GBL, instructors and students still find it difficult to fit it into everyday educational activities compared to other educational technologies where this is not restricted to digital games and can include tabletop or other forms of analogue games. This is discussed and cited in the introduction to this article: the costs and risks in employing GBL seem to offset its benefits, but these costs and risks are not seemingly for

the most part inherent to GBL and thus avoidable. The costs and risks waste the potential of GBL by preventing a more consistent application of GBL to fully deliver on its potential.

The main contribution of this article is the mapping between potential strategies for driving more ubiquitous use of GBL. More than simply finding the most cited barriers and hindrances for GBL and more than simply proposing remedies, this article relates the nature of each type of barrier to associated solutions, namely (per Figure 3):

- technological and material barriers to making informed choices about using analogue games (or making more informed choices about using digital games);
- attitudinal barriers to co-creation and multistakeholder approaches;
- policy barriers linked to multistakeholder approaches;
- game literacy barriers to co-creation and training;
- co-creation, demystified analogue and digital, and multistakeholder approaches linked together as a mutually reinforcing intervention approach.

Future research and practice may benefit from university educators, teaching support staff, and administrators collaborating to develop strategies across attitudinal and school policy barriers. Analog games and digital games are not pedagogically superior to each other. Therefore, the contextual appropriateness of each choice must be carefully determined against the target audience's possible accessibility demands, available funding, available technology, instructors' and trainees' literacy, and other considerations. For games and learning to be deeply and meaningfully integrated, teachers must be specialists in both areas. Teachers should be trained and reminded that integrating gaming elements, technology choices, and instructional methodologies requires an awareness of learning theories. This could enable educators to come up with new pedagogical uses for educational games. Finally, we can suggest that answering the following questions during the design thinking process can facilitate both the co-creation process and overcoming barriers: What is important to us? Can we do anything? How can we accomplish that? How do we resolve this? Now where are we going?

The prescriptive power of these mappings comes from the Systematic Literature review enabling the issues with GBL to be triangulated, organised into categories, and handled together with solutions of countermeasures also found in literature, which are grouped into main intervention streams to enable mappings with the barrier categories. The literature provides the solutions and problems, but not in a consolidated, mutually reinforcing approach needed to fully contend with the underutilization of GBL. Where existing scientific literature on studies of GBL interventions naturally suggests the solutions; this article corroborates, evaluates, and groups the intervention streams as the basis of a comprehensive program of intervention. Where the literature overlooks possible solutions, for instance, literacy and training being a more cross-cutting approach than anticipated by the analysed GBL literature, this article argues for these solutions, rounding out the intervention program. Future work includes further consolidation of the program, including for instance analysis of teacher training and policy-making using the intervention diagram in Figure 3 as a lens. For now, this article is launching the consolidated intervention as an avenue of research.

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