

Unlock Financial Knowledge in Managers Through Games

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Abstract Financial literacy for managers and owners of Micro, Small and Medium Enterprises (MSMEs) is defined as the combination of awareness, knowledge, skills, attitudes, and behaviours that a potential entrepreneur or business owner should have to make effective financial decisions to start a business, run a business, and ensure its sustainability and growth (OECD, 2020). To ensure this combination of financial knowledge and skills, different educational perspectives may emerge as the solution. The use of gamification and digital game-based learning (DGBL) are educational methodologies largely used in formal and informal environments, for different target audiences and different fields of knowledge, including finance. However, it is largely used by children and younger people in the same contexts described above. We find a gap that justifies further research on the formal use of DGBL in the adult population, namely for the development of financial literacy. For the use of gamification in this context to be effective is essential to identify which knowledge, skills and attitudes are required for MSMEs managers. The OECD (2020) questionnaire is an example of an instrument used to measure adult financial knowledge namely in managers, owners and future entrepreneurs of MSMEs. The financial literacy content for managers includes questions on basic concepts of asset management, inflation, investments, cash flows and risk analysis. However, at the top of our knowledge, we find little research to support how can we actively develop this awareness and knowledge through games. In this study, through exploratory analysis of government documents and literature, we sought to understand the three scales for measuring financial literacy, namely, financial knowledge, financial attitudes, and financial behaviour, which are the main contents that should be included in the pre-game's assessment and on the learning objectives. The second concern is how to include these scales in the game to positively impact the behaviour, attitudes and knowledge of the managers of MSMEs. Thus, the contribution of the study is to create through the metrics used to measure financial literacy and the game mechanisms used a proposal for a model for designing digital games for financial literacy. Policymakers, private associations connected to MSMEs, and other players may take, for sure, lessons to be learned to prepare better the managers to guarantee stable and sustainable enterprise support.

Keywords: Digital game-based learning; Gamification; Serious games; Managers; Financial literacy; Entrepreneurship skills

1. Introduction

The low level of financial literacy among the population is a global issue and needs further attention, also in developed countries such as Portugal (OECD, 2016). Evidence suggests that individuals with better financial education will make better investment and savings decisions during their lifetime. And will improve their financial well-being in subjective and objective terms (Klapper and Lusardi, 2020). Lack of financial education among individuals has serious implications not only for the decisions people make for themselves but also for society. Therefore, the stakeholders involved will need to continue to identify new alternatives and strategies to disseminate knowledge in a sustainable way to the general population (Oliver-Márquez, Guarnido-Rueda and Amate-Fortes, 2020). In this study, our focus study was on the adult population, more specifically owners and managers of micro, small and medium-sized enterprises (MSMEs). The complexity of finance and access to financial markets is one of the main challenges confronting an entrepreneur (Kumar *et al.*, 2022). Considering that MSMEs represent the majority of enterprises in the world and are responsible for much of the growth and development of countries' economies, initiatives for the development of financial and entrepreneurial skills for this public need to be explored (European Central Bank, 2022).

What we usually identify in the different studies is that financial education is not linear, and there isn't one single way to implement a financial education programme for different members of the population (Urban *et al.*, 2020; Li, 2020). An effective financial education programme should effectively identify the needs of its target audience,

analyse vulnerable groups accurately, provide clear objectives and be based on rigorous evaluation metrics (Lusardi, 2019; OECD, 2020b). In this context, game-based learning (GBL), serious games and gamification are being used as an innovative approach to specific content development and transversal competencies. These methodologies encourage active learning, enhance, or introduce specific knowledge and increase users' confidence and attitude (Ikhida, Timur and Ogunmokun, 2022). While there is a significant amount of research exploring individually the importance of financial literacy in MSMEs and the use of GBL to promote innovation in education, the relationship between these two issues for the development of financial competencies in managers still has many research gaps.

In this research, the aim is to understand the relevant contents to insert in the games to improve the financial literacy development of managers, owners, and potential entrepreneurs of MSMEs. To measure financial literacy, three core competencies are used as a basis, namely financial knowledge, financial attitudes, and financial behaviour. But how do insert these scales in digital GBL to develop these competencies? To answer this question, the study initially used a critical literature review on financial literacy and its impact on MSMEs. This is followed by a review of game mechanics and how these can be applied to finance. Finally, the author sought the connection between the contents of financial literacy for managers and the use of digital games and proposed a framework with the union of these themes.

2. Financial literacy for MSMEs

Financial literacy can be described as the acquisition of the knowledge and skills necessary to manage financial services and to make more assertive lifetime decisions about saving and planning. Low levels of financial literacy are a concern for the well-being of the general population (Ye and Kulathunga, 2019; Li, 2020). According to the European Central Bank (2021), Portugal has the lowest levels of the measure of financial knowledge in the adult population of the Eurozone. The global evidence on financial literacy points to Klapper and Lusardi (2020) in the adult population shows that governments and businesses should take note of the emerging literature on these topics, as financial inclusion becomes an important part of the development policy agenda and digital financial products proliferate (Prete, 2022). Lusardi (2019), also considers that an individual's financial knowledge should be delineated as an intrinsic choice variable, similar to investment in human capital. Making this choice can allow individuals to better allocate resources throughout their lives in a world of uncertainty and constant change. Review studies on the topic, show a lack of research in the area of financial education and inclusion in the face of new digital products and the increased creation of fintech (Morgan and Trinh, 2019; Goyal and Kumar, 2021; Daud *et al.*, 2022).

For managers and owners of MSMEs, financial literacy is defined as the combination of awareness, knowledge, skills, attitudes and behaviours that a potential business, owner or entrepreneur should have to make effective financial decisions to start a business, manage a business and assure its sustainability and growth (OECD, 2020a). Different studies highlight the importance of financial knowledge, aligned to other key competences such as business knowledge and experience as essential items to ensure the sustainability of MSMEs (Eniola and Entebang, 2017; Bongomin *et al.*, 2017; Anwar, Shuangjie and Ullah, 2020). In contrast, Nikitina, T. *et al.* (2020), obtains positive evidence that soft skills such as motivation and perseverance are considered more important for entrepreneurs than financial and economic skills. Thus, the educational content for these managers should be different from the content for the adult population and should include basic accounting concepts, cash flow analysis, business environment analysis, risk analysis and investment management, since these topics are relevant for the financial future of organisations. All of this is aligned with the development of the transversal skills required by entrepreneurs (Ye and Kulathunga, 2019).

The OCDE research (2021), showed existing evidence on the fact that the impact of MSMEs that were severely affected by the COVID-19 crisis, differed not only in terms of sectors and size but also concerning to the financial literacy and digitalisation of these companies. Thus, many MSMEs owners have had to use their financial skills, develop new financial management strategies, and adapt their businesses to further digitalisation to confront the challenges of the pandemic. The literature evidence that the financial literacy level in MSMEs is key when it to accessing finance (Tuffour, Amoako and Amartey, 2020). Knowledgeable owners and managers can potentially reduce market failures that are driven by information asymmetries between the provider and receptor of finance (Imarhiagbe, Saridakis and Mohammed, 2017; Hussain, Salia and Karim, 2018). A positive relationship is observed in Ghana by Adomako, Danso and Ofori (2016), where access to finance and risk capital is facilitated for managers with greater financial knowledge and argumentative power and in China by Xu *et al.*,

(2020), a positive relationship between business owners with higher levels of financial literacy and access to bank loans. Moreover, financial literacy significantly moderates the relationship between firms' risk management practices and gaining competitive advantage. Managers with higher financial literacy will effectively execute risk management practices and capital market investments to gain a competitive position in the market (Kadoya, Khan and Rabbani, 2017; Songling, Ishtiaq and Anwar, 2018; Baihaqqy *et al.*, 2020). Thus, better financial analysis and reporting capabilities will enhance how MSMEs describe their financial profile to their creditors during the loan application process, improving their chances of success (European Central Bank, 2021). Cash flow analysis and projections, as well as an understanding of the basic financial situation, are essential for monitoring the agreements that are often included in loan documentation (Eniola and Entebang, 2017). Financial knowledge is also important for micro-enterprises that are tempted to lend against personal assets, such as their home or property, as collateral, without fully understanding the risks involved (Bacha and Azouzi, 2019).

2.1 Measuring financial literacy

To measure financial literacy in adults, Lusardi (2019) used questions to assess basic knowledge of four key concepts in financial decision-making: knowledge of interest rates, interest compounding, inflation and risk diversification. The results showed that only one in three participants could answer all the questions correctly. The OECD conducted extensive research and created a framework in 2016 to measure the financial literacy of the adult population and to be a reference for studies in the area (OECD/INFE, 2016). Thus, the initial framework was divided into three core competencies, namely awareness, knowledge and understanding; skills and behaviour; or confidence, motivation and attitudes. In Figure 1, the core competencies and contents that are priorities are highlighted. The remaining core competencies are then listed vertically according to their typical level of importance as agreed by the OECD/INFE experts (those competencies considered highly important are listed first).

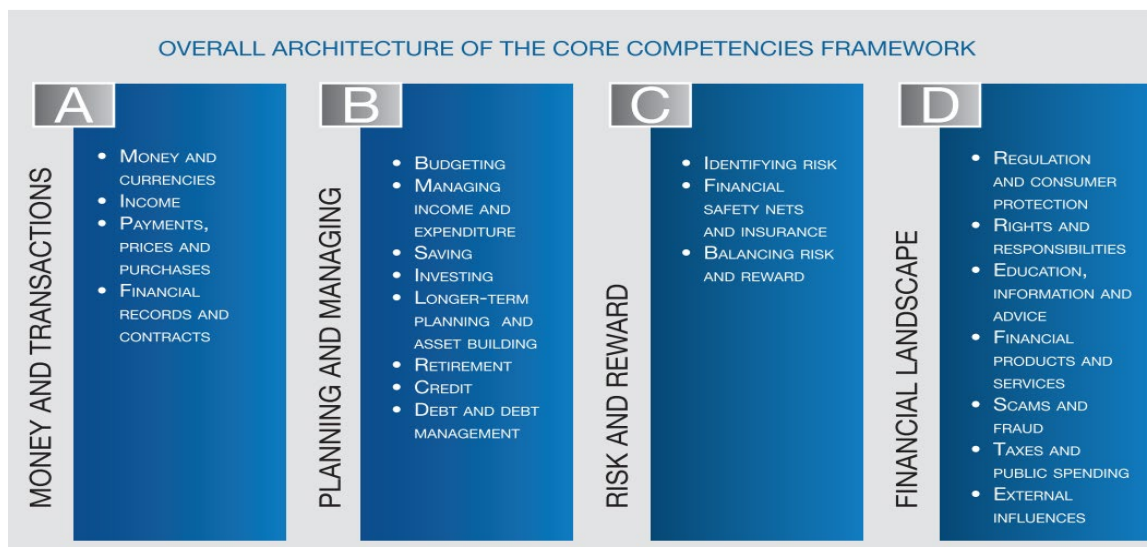


Figure 1. Overall architecture of the core competencies framework on financial literacy for adults, retrieved from OECD/INFE (2016, p. 7)

After the framework was created, the questionnaire was designed and applied to the adult population of more than 30 economies, using their levels of financial knowledge, behaviours and attitude in the years 2016 and 2020 (OECD, 2016; 2020). The main core competencies in the questionnaire are analysed as follows:

- *Awareness, knowledge and understanding:* Refers to information the individual has acquired.
- *Skills and behaviour:* It describe the competencies related to individuals' actions. It also describes the behaviours that are most likely to result in financial well-being.
- *Confidence, motivation and attitudes:* Capture the internal and psychological mechanisms that may support or impede decisions, behaviours and well-being.

Based on the adult questionnaire, the OECD identified the need to measure this knowledge specifically in owners, managers and potential entrepreneurs of MSMEs. Thus it expanded its research to this target audience and in 2018 released the *Core competencies framework on financial literacy for MSMEs* (OECD/INFE, 2018).

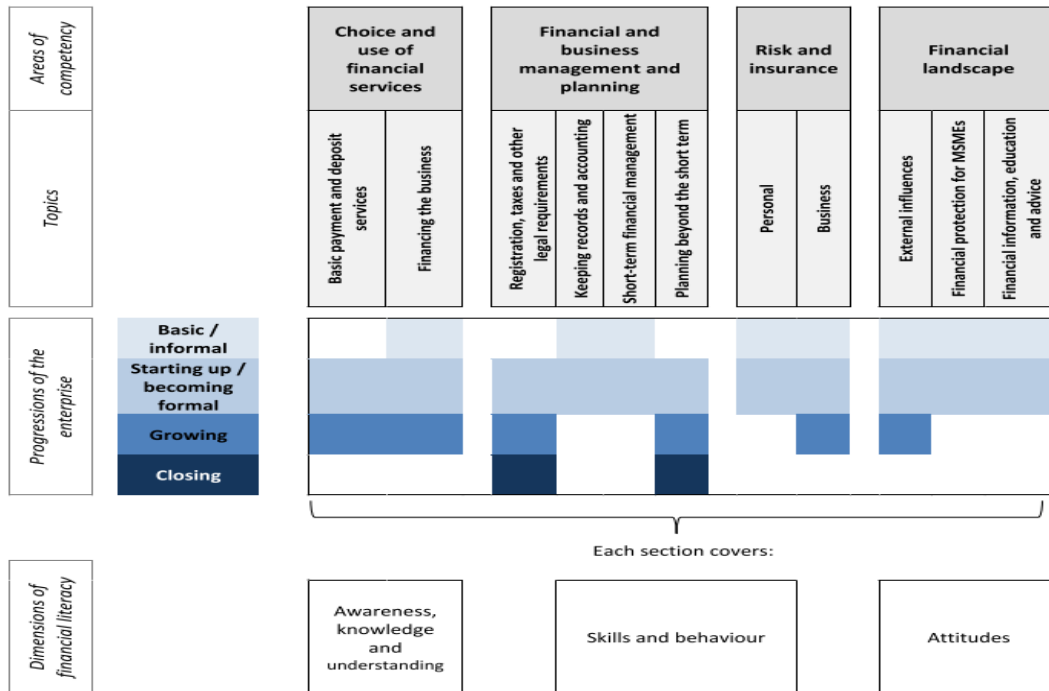


Figure 2. Overall architecture of the core competencies framework on financial literacy for MSMEs, retrieved from (OECD/INFE, 2018, p. 13)

The structure of the framework is divided in core competencies areas, dimensions of financial literacy and enterprise progressions. The core competencies areas include content on the choices and uses of financial services, financial and business management and planning, risk and insurance, and finally content on the financial landscape, which also involves external influences. The framework also considers the three dimensions of financial literacy, and the competencies are ordered along the main stages of enterprise development. This concern, with phases and content, differs largely from the content for measuring adult financial literacy. The first questionnaires were applied in the years 2018 and 2019 (OECD, 2020a).

3. Using digital games to unlock financial skills

Different methods of teaching and learning are being used in financial education programmes around the world. These new approaches to teaching are changing from a traditional approach in which the individual passively receives content, to a competency-based approach in which the individual active learning (Josef and Vera, 2017). Among these approaches, the use of GBL and gamification has been increasing in relevance in recent years, especially in schools and universities (Bayuk and Altobello, 2019; Nadolny, Nation and Fox, 2019; Hanghøj *et al.*, 2020). Tews, Michel and Noe (2017), Costin, O’Brien and Slattery (2018) and Suh *et al.* (2017), suggest that organisations should consider the use of gamification as a viable strategy to promote informal learning in addition to traditional learning supports, which reinforces the idea that financial literacy in MSMEs managers can be developed through games.

The concepts of GBL, gamification, serious games and educational games can be ambiguous and often get confused. Serious games are part of the GBL methodology and provide employees with a relevant storyline for the development of technical and transversal competencies (Nadolny, Nation and Fox, 2019). The gamification uses storylines and achievable goals, feedback on progress and rewards such as achievement badges and recognition. These methodologies implanted in the business context also offer employees opportunities to fail, learn from their mistakes and try again in a safe environment (Bayuk and Altobello, 2019).

Organisations are finding that applying a GBL and gamification approach to corporate training is helping them to increase employee engagement and drive performance beyond traditional training approaches. However, poor game design is a major shortcoming of many "gamified" applications. For this reason, games need to be analysed according to the specific learning objectives you wish to develop (Bitrián, Buil and Catalán, 2021).

Learnovate Centre (2012), evidence the use of some serious games used in the corporate environment in the financial services sector. For example, *€conomy* is a serious game based on the monetary policies of the European Central Bank to teach employees about the impact of interest rate changes on unemployment, output growth, inflation, and other vital economic indicators. Another initiative *BankersLab* provides a suite of 'gamified' training products for the retail banking industry that includes *CollectionLab*, a serious game designed to train employees. Another example is *True Office*, this game allows employees to explore scenarios through interaction, gameplay and immersion. The analytics dashboard allows management to globally analyse employee performance and provide early intervention and support. And playfully *CoCo Sim*, is a game based on fictional chocolate in New York, where the player must manage cash flow and stock levels to achieve a high level of satisfaction while remaining profitable. The game integrates modules on the business process, problem-solving and basic accounting.

In the academic literature, there is not much evidence of serious digital games applied to organizations in the field of finance. Rodrigues, Costa e Oliveira (2017), use gamification to motivate customers to use e-banking and improve their financial literacy. The study provides guidelines for the design, development and content of e-banking for stakeholders. Hoffmann and Matysiak (2019), developed *InvestNuts* to motivate the youth population in Germany to invest in stocks. The results of the prototype showed promise.

Designing serious games, as opposed to casual games, involves applying best practice guidelines to provide challenge, curiosity, control and fantasy to participants (Learnovate Centre, 2012). We analyse below, each of these elements and modes of use in game design.

Control: The feeling of control is an important motivator in gaming. Thus, for a game to be successful must elicit a sense of the power of choice and personal control in the player. This will generate motivation and engagement. Concrete challenges using timers, clues, and level scores are usually used, presented for the involvement of the target user. Limited amount of time to complete an objective (Suh et al., 2017).

Challenge: The game should have clear and fixed goals that are relevant and achievable by the player. The narrative must provide context and meaning for learning. Challenge will encourage participants to embrace difficult tasks through obstacle courses or trials. To increase financial literacy the content should use the decision-making and or problem-solving skills of the participants (Hanghøj et al., 2020).

Flow: To maintain flow the challenges must be appropriate to the target audience. There should be a balance between frustration (games that are too hard) and boredom (too easy). In this case, it is advisable to use skill levels proportional to the level of difficulty. To challenge the learner to a point where they could still succeed in the game (Devraj, Colyott and Cain, 2021). For example, within the financial content, the content can be organised hierarchically in order of increasing difficulty, with the end point of a sector being a cumulative test or quiz on content from previous levels.

Feedback: Players must receive this feedback as the game progresses. All types of feedback should be unambiguous and immediate. Supportive or guiding feedback should guide and prompt the player into the correct action, rather than explicitly telling them what to do (Nadolny, Nation and Fox, 2019).

Curiosity: These can be sensory or cognitive. Cognitive curiosity refers to some element unexpected by the player, which forces them to reflect and identify the information to solve the problem. Sensory curiosity, on the opposite, can be aroused through audios and visual effects, as long as these are relevant to the game and not superfluous. Sensory-based cues or game aspects add to the degree of immersion in the experience (Bayuk and Altobello, 2019).

Fantasy: Fantasy contributes to the player's intrinsic motivation. This aspect should match the narrative and the intended learning objectives. For example, the system exposes players to various points of view and sounds. Players can take on the role of an avatar that may differ from themselves in real life (Nadolny, Nation and Fox, 2019)

In order to insert these elements in a digital game, a widely used framework is based on mechanics, dynamics and aesthetics (MDA). The MDA explains the games by this structure, in which mechanics refers to the design of a system or control mechanisms responsible for creating the dynamics and elements within the context of the game, such as rules or content that provide the structure. Dynamics, on the other hand, are the interactions between users and the system, which include the actual conditions of the game, such as the definition of how participants will interact or how they will receive feedback within the game. Aesthetics corresponds to the user's

emotional response to the game, that is, it will create in the user the feelings or emotions desired through gameplay, such as fun or curiosity (Barber, Petter and Barber, 2021).

Based on the game-based design diagram proposed by Barber, Petter and Barber (2021), we have developed our framework, with the key mechanics, dynamics and aesthetics that are most suitable for teaching financial content to managers, owners and potential entrepreneurs (see Figure 3).

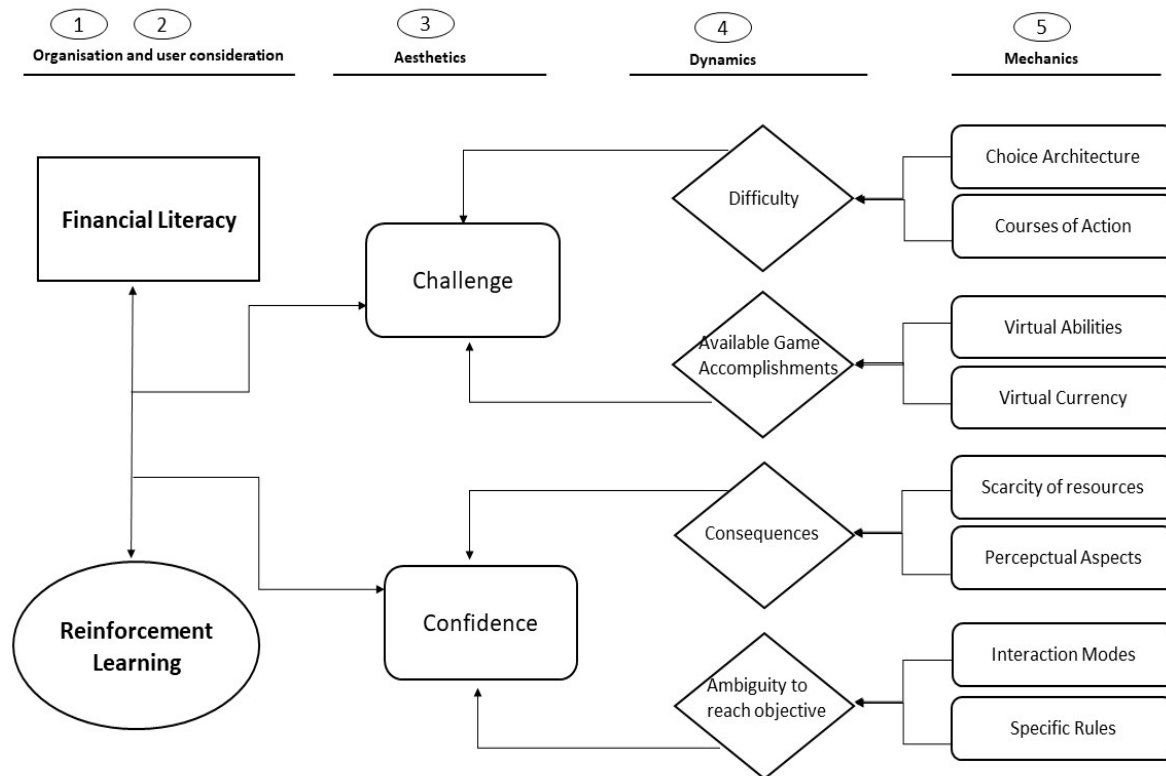


Figure 3: Framework for game design in financial literacy. Adapted from (Barber, Petter and Barber, 2021)

These are some important elements to consider when creating and organising the structure of the mechanics and design of games with learning objectives. For the creation of the framework, steps 1 and 2 comprise organisation and usage considerations. In our scenario, the problem will be *financial literacy* and the objective is the *development of content learning for training purposes*. Next, in step 3, it is necessary to understand the elements that support the aesthetic and identify which aesthetic most appropriately supports both the defined problem and the purpose of use. In our example, we chose *challenge* and *confidence* to promote intrinsic and extrinsic motivation of game participants. The main purpose of these elements is to encourage players to embrace difficult tasks to bring enjoyment, through obstacle courses or trials and to enable an individual to improve their belief in their abilities or skills.

After choosing the aesthetic, complementary dynamics need to be selected to support the desired aesthetic. Using dynamic game-based elements will identify how users will interact with the system and how the system will respond to the users' actions. The dynamics chosen in step 4, according to the elements identified by Barber, Petter and Barber (2021), that are aligned with the *challenge* and will be important for our objective, is to increase the *difficulty* over time, through phases for example, to encourage motivation and flow. We also point the *available game accomplishments*, which correspond to different forms of achievements that can be obtained in a game. These elements correspond to scores, levels of learning, finding items and completing quizzes. For the aesthetic element of confidence, we listed *consequences* and *ambiguity to reach objectives*. *Consequences* are actions (good or bad) that will occur in the game, depending on the players' decision. The *ambiguity to reach objectives* can be achieved through puzzles, mysteries, riddles, clues and locks.

Finally, step 5 consists of choosing the mechanics elements for each of the dynamics elements chosen. For our purposes, we have defined some main elements that can be visualised in Figure 3. For example, *choice architecture* refers to leaderboards, badges, and progress bars. *Virtual currency* and *virtual abilities* are

currencies or abilities that can be obtained in the game, in our example we can insert cryptocurrencies. *Perceptual aspects* are used to provide immersion, such as visual and auditory elements and *specific rules* correspond to prohibited actions, penalties, or randomness introduced to create unpredictability in the game. For the development of financial literacy for MSMEs, the content needs to be targeted at the emerging topics essential for business growth and sustainability and not necessarily for personal planning and lifelong well-being. After reviewing the specific contents for MSMEs managers and reviewing some important principles to be developed in the digital games, the authors organised in Table 1, the game design principles and possible concepts and strategies to insert in digital game design.

Table 1: Application of game design principles for the digital game in financial literacy.

Game design principles	Game application
<u>Goal settings</u>	
Clear objectives (goal setting)	1. Quizzes, questions, challenges:
Reinforcement of learning (multiple opportunities to play each level)	○ Binary input = True\False, Yes\No, Accept\Reject.
Game design to challenge and motivate (increasing difficulty in the games, each level should be challenging but achievable)	○ Multiple choice input = One or more true answer.
	○ Number or text inputs.
	○ Simulation interface, e.g. supply and demand dynamic interface, interest, inflation.
<u>User Engagement</u>	○ Pure fun: accurate clicking (shooting), timed clicking (jumping, playing instrument), fast clicking (Whack-A-Mole type).
Engaging narrative	
For promoting extrinsic motivation	2. Game concepts:
Immediate feedback	○ Key lock picking.
Increase the difficulty level	○ Combination lock opening.
	○ Logic board: Pass power to a lamp, fan, device through AND, OR, OR gates.
<u>Financial knowledge</u>	○ Rocket payload, fuel, range puzzle.
Financing the business	○ Rotating wheel, fortune wheel (Luck).
Planning beyond the short term	○ Gears speed, torque puzzle.
Risk and Insurance	○ Squid game-style glass bridge.
External influences	○ Financial risks obstacles.
	○ Whack bad financial practices.
<u>Financial Attitudes</u>	
Financing the business	3. These will be mini-games in a larger game (Monopoly, Mario Party, or a new board game concept style)
Planning beyond the short term	4. There will be a global reward system (Stars or virtual dollars or even a crypto currency [Bonus Knowledge])
Risk and Insurance	5. Basic avatar leader board.
	6. Art style: Realistic 3D or Pixel Art.
<u>Financial behaviour</u>	7. Web app\page, suitable technology for 2D drawing and animation.
Basic payment and deposit services	8. Mongo DB for data storage.
Financing the business	9. Best software engineering practices.
Keeping records and accounting	
Planning beyond the short term	
Risk and Insurance	
External influences	
Financial protection for MSMEs	
<u>Additional competencies</u>	
Critical analysis	
Problem-solving	

The principles have been carefully thought out following the objectives set, the expected engagement and the content related to the desired financial competencies in terms of attitude, behaviour and knowledge. Transversal skills such as critical analysis and problem-solving were also listed to develop these elements in game design. For the application in the game, we consider the aspects of aesthetics, dynamics and game mechanics and list important elements in game design to be applied in this specific context. For example, we detailed the types of questions, puzzles, and challenges to insert, and how they will be inserted into the game. The type of overall reward, the characters, and the style of art to be applied.

4. Conclusion

Financial literacy is a basic and essential competence for an individual to prosper economically in society. It is increasingly important, given the rapidly evolving business and financial landscape, and considering that the digitalisation of finance, will continue to bring new opportunities and challenges for MSMEs, that research on the topic is deepened and new public policies and development programmes are created or developed in this field of knowledge.

This knowledge needs to be accessible and not the privilege of a few consumers who have greater access to education or financial advice. It, therefore, needs to be adopted in school curricula and disseminated to the context applied to businesses, to encourage entrepreneurship and for established MSMEs to grow and become sustainable over time and for managers to make better decisions regarding financial services, financial and business planning, risk and how external influences can impact their business.

In this study, it was clear that there is a large gap in the development of digital GBL within the context of financial content for MSME managers and owners. Few studies explore the topic and apply empirical studies. Most of the literature found on the topic refers to the development of games in education, for children and students. However, serious games provide an engaging opportunity for active learning in which participants are challenged and rewarded (Kadoya and Khan, 2017). Thus, whatever the barriers to adoption, the effectiveness of serious games for learning in organisations cannot be ignored. This methodology has the potential to impact learning engagement and motivation of individuals. Managers and owners of MSMEs can use this methodology as a complement to a traditional financial literacy training course or as a way to acquire important knowledge on the topic, without necessarily attending training. Serious games, have a valuable role to play in this regard and should be considered an integral part of companies' learning strategies (Learnovate Centre, 2012).

This study sought to understand the metrics used to measure financial literacy and some of the gaming mechanisms used. The study proposes a link between financial literacy and the development of serious games in MSMEs. For this, we created a framework and a model to map the game design principles to game applications in this area. As limitations, the lack of studies in the development of games for managers that are not empirically tested and published in the academic literature are pointed out and we expect to provide some impetus for future studies on the development of serious games in the area of finance and the empirical application for a larger scale of managers and owners of MSMEs, in order to measure these results and contribute to the literature on the subject.

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