

MERVE SUNA / CARMELA APREA

# Digital Serious Games in Financial Education

A Scoping Review and Critical Appraisal

## Digital Serious Games in der Finanzbildung

Ein Scoping Review und kritische Würdigung

**KURZFASSUNG:** Digital Serious Games gelten als vielversprechender Ansatz zur Förderung finanzieller Kompetenz, da sie domänenspezifische Kenntnisse, Problemlösefähigkeiten und Motivation fördern können. Voraussetzung hierfür ist ein hochwertiges Game Design, das in der Finanzbildung bisher kaum systematisch untersucht wurde. Ziel des Beitrags ist es, vorhandene Digital Serious Games zur Finanzbildung zu identifizieren und mithilfe eines entwickelten Auswertungsrasters zu analysieren. Insgesamt wurden 91 Games identifiziert und anhand kontextueller, ethischer, curricularer sowie game-designbezogener Kriterien untersucht. Die Ergebnisse liefern einen strukturierten Überblick, bilden eine Grundlage für weiterführende Evaluationen und unterstützen Auswahl, Einsatz und Entwicklung geeigneter Serious Games.

*Schlagwörter:* Digital Serious Games, Spielbasiertes Lernen, Game Design, Finanzbildung, Inpotevaluation

**ABSTRACT:** Digital serious games are considered a promising approach to promoting financial literacy, as they can foster domain-specific knowledge, problem-solving skills and motivation. However, this requires high-quality game design, which has hardly been systematically investigated in financial education to date. The aim of this article is therefore to identify existing digital serious games in the context of financial education and analyse them using an analysis scheme specifically developed for this field. A total of 91 games were identified and analysed based on contextual, ethical, curricular and game design-related criteria. The results provide a structured overview, form a basis for further evaluations and support the selection, use and development of suitable serious games.

*Keywords:* Digital Serious Games, Game-based Learning, Game Design, Financial Education, Input Evaluation

## 1. Introduction

Since the global financial crisis of 2007/08, financial literacy has become increasingly important and is now considered a key competence (APREA/BUCHER-KOENEN, 2023). This growing significance can be attributed to various social and economic developments, such as demographic change, advances in digitalisation, changes in career paths, and the increasing diversity of financial products and services. Rising life expectancy combined with consistently low birth rates is putting pressure on pay-as-you-go pension systems and shifting more responsibility for retirement planning onto individuals. At the same time, financial markets are changing rapidly, offering an expanding range of complex products that involve risks difficult to assess. Technological progress is further reinforcing this trend. New digital services and payment methods, such as “buy now, pay later” models, expand consumer choice, but also place higher demands on financial literacy and decision-making skills (LUSARDI, 2019).

Consequently, individuals must take more responsibility for their own financial decisions. At the same time, financial decisions are becoming more complex and riskier, further increasing the demands on financial literacy. Financial literacy is essential not only for investment decisions but also for everyday financial tasks such as budgeting, saving for emergencies, or using basic banking services. Addressing these challenges requires targeted and well-designed educational programmes that equip individuals with the knowledge and skills needed to navigate an ever-changing financial landscape.

Although these developments affect all population groups, they are particularly relevant to teenagers and young adults, who may face higher financial risks during their lifetime than previous generations. They start using financial services, such as online payments and mobile accounts, at an earlier age, further heightening the need for financial literacy (APREA et al., 2016).

A wide range of financial education programmes is offered in different formats, such as books, podcasts, videos, apps, teaching materials, lectures, and workshops (APREA/SUNA, 2024). Recent meta-analyses (KAISER/MENKHOFF, 2017; KAISER et al., 2021) have shown that financial education programmes generally improve participants’ knowledge and influence their behaviour. However, the impact of these programmes on knowledge has been found to

be stronger than their impact on behaviour. Behavioural effects tend to be minimal and not sustained over time. Consequently, the intended goals of financial education, especially the promotion of sound financial behaviour, are only partially achieved. While some researchers conclude that financial education does not work in principle (e.g. WILLIS, 2011), an alternative explanation is that existing financial education programs are overly knowledge-oriented and place too little emphasis on motivation and decision-making skills (APREA et al., 2018).

Given these limitations, alternative approaches to financial education are needed. Moreover, the needs of the digital native's generation (born around 1990) need to be considered. This generation extensively uses technology, multitasks, reads primarily from screens, plays computer games, engages in social media, and outsources cognitive tasks to digital tools (LONKA, 2012). Digital serious games are considered a promising approach for promoting financial literacy. Research across various domains has shown that they can enhance domain-specific problem-solving skills as well as learners' interest and intrinsic motivation (WOUTERS et al., 2013). For example, in science education, serious games have been shown to be more effective than conventional teaching methods in improving learning outcomes, including declarative knowledge, knowledge retention, and procedural knowledge (RIOPEL et al., 2019). They have also proven effective in fostering cognitive skills, positive affect, and overall learning mood, and are regarded as a valuable educational medium addressing learners' diverse needs and expectations (ZHONGGEN, 2019). While research highlights the potential of serious games across various domains, it should be noted, that their benefits are not realised automatically. A key condition for unlocking this potential is that serious games have high-quality game design (APREA et al., 2018).

The potential benefits of serious games have also been recognised in the context of financial education, and numerous digital serious games have been developed for this field. However, empirical evidence regarding their suitability for learning in this domain remains limited. This study seeks to address this gap by analysing and critically examining the design features of existing serious games. Specifically, it seeks to answer the following research questions:

RQ1: Which digital serious games are available in the field of financial literacy?

RQ2: How can these games be analysed in terms of their suitability for learning purposes?

RQ3: What are the strengths and weaknesses of existing serious games in the context of financial literacy?

By answering these questions, we intend to provide a structured overview of existing digital serious games in financial literacy and to analyse their potential for financial education. Thus, the study intends to serve multiple purposes: first, to provide a basis for future analyses, examining whether and to what extent the games effectively promote financial literacy; second, to guide developers in designing and refining games that are relevant, pedagogically sound, and tailored to the target group; and third, to give educators and trainers in financial education a solid foundation for making informed decisions when selecting suitable serious games.

The study is part of the research project “Digital game-based learning in the fields of economics, finance and sustainability” (DGBL-WiFiNa: Digital game-based learning in den Bereichen Wirtschaft, Finanzen und Nachhaltigkeit)<sup>1</sup> within the research network “Business Education and Economic Education: Teacher Training and Digital Instruction” (WÖRLD: Wirtschaftspädagogik und Ökonomische Bildung: Lehrkräftebildung und Unterricht digital). The main objective of the DGBL-WiFiNa project is to review serious games in the fields of economic, financial and sustainability education, analyse them based on domain-specific and media education criteria, and then develop game-based learning environments for selected curriculum content as best practice examples.

The article is structured as follows: In the next section, we introduce the concept of financial literacy and describe how serious games can promote learning. We also explain which design elements should be considered when analysing such games. Section 3 (Methodology) describes our game search process and presents the analysis scheme that we used. In section 4, we present the results of the analysis and the critical appraisal of the identified serious games. In Section 5 we discuss the results and outline the limitations. Finally, Section 6 provides a conclusion along with practical recommendations and implications for future research.

---

<sup>1</sup> Funded by the German Federal Ministry for Education, Family Affairs, Senior Citizens, Woman and Youth (BMBFSFJ), grant number 01JA23S02B

## 2. Conceptual background

### 2.1 The concept of financial literacy

As outlined in the introduction, the importance of financial literacy is widely recognised, and it has gained increasing significance in research as well as in education policy and practice. Although definitions of financial literacy vary (e.g. REMUND, 2010), there is broad agreement that it encompasses both knowledge and the ability to apply this knowledge in financial decision-making situations (e.g. HUSTON, 2010; LUSARDI, 2019). What remains unclear, however, is which content areas should be considered part of financial literacy. To address this, various frameworks have been developed that define the dimensions, competencies, and domains of knowledge constituting financial literacy (APREA et al., 2026). These frameworks differ in the aspects they cover, the extent to which they incorporate systemic and non-cognitive dimensions, and the ways in which they link to financial behaviour (e.g. SCHLÖSSER et al., 2011; DAVIES, 2015). Among these frameworks, LEUMANN et al. (2016) propose a differentiated framework that organises competence facets into detailed categories and subcategories. This structure allows a precise and systematic analysis of the content. For this reason, we adopted the framework as the basis for analysing the game content (see Chapter 3.2).

In our study, we focus on the competence facet within the framework that addresses financial decisions in everyday private life as well as to consulting and sales situations in which the individual, acting as a consumer, is in the centre. This facet consists of nine categories and seven sub-categories. It refers to knowledge and skills relating to consumer financial decisions, focusing on topics such as “Earning/taking money”, “Planning and managing financial matters”, “Spending money” and “Saving money/building assets”. Figure 1 shows an overview of the topic areas.

<b>Financial literacy competence facets</b>
1 Earning/taking money
2 Planning and managing financial matters
2.1 Evaluating own revenues
2.2 Planning expenses in agreement with own needs and possibilities
2.3 Gathering short-term reserves of money
2.4 Drawing up a budget
2.5 Using banking and financial services for daily needs
2.6 Dealing with credit cards
2.7 Filling out tax declaration

3 Spending money
4 Prevent (over-)indebtedness
5 Saving money/building assets
6 Borrowing money/raising a credit/financing methods
7 Retirement planning
8 Comparing/contracting assurances
9 Knowing information and counselling services in the context of monetary and financial affairs

Figure 1: Financial literacy competence facets

## 2.2 The concept of digital serious games

Play has long been recognised as an important factor in cognitive development and learning (PLASS et al., 2015). PIAGET (1962) described it as an integral part of children’s cognitive development, evolving through different stages. As children mature, their play becomes more abstract, symbolic, and social, enabling them to explore ideas beyond immediate reality, such as assigning new meanings to objects. This supports the development of symbolic thinking, which is one of the key advances in early childhood (DELOACHE, 1987). VYGOTSKY (1978) regarded play as a “crucial factor” in development, creating a “zone of proximal development” in which children grow beyond their current abilities. This principle applies not only to traditional play but also to well-designed digital games, which can similarly foster learning and development (PLASS et al., 2015).

Play and game are related but not synonymous. HUIZINGA (1949) defined play as a “voluntary activity or occupation executed within certain fixed limits of time and place, according to rules freely accepted but absolutely binding, having its aim in itself and accompanied by a feeling of tension, joy, and the consciousness that it is “different” from “ordinary life”” p. 28. By contrast, a game is “a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome” (SALEN/ZIMMERMAN, 2004, p. 80). SALÉN and ZIMMERMAN (2004) therefore view games as a “subset of play” and consider play to be an element of games, p. 72. A key distinction is that games involve quantifiable outcome or winning states, whereas play does not (KAPP, 2012, p. 8). Similarly, CAILLOIS (2001) distinguishes between *playing* (*paidia*) and *gaming* (*ludus*) as follows: Playing is a freer form involving the expressive and improvised recombination of behaviours and meanings, whereas gaming encompasses playing according to rules and competing for goals.

Beyond such conceptual distinctions, games can also be categorised according to their medium. A common distinction is made between digital and non-digital games. Non-digital games are physical or visual activities based on game boards, cards or other tangible learning

materials. Digital games, in contrast, include various types of activities on mobile devices, computers or video game consoles (NAIK, 2014).

In addition to this medium-based categorisation, it is important to differentiate between serious games and gamification. Gamification refers to “the use of game design elements in non-game contexts” (DETERDING et al., 2011, p. 10). It applies game-based mechanisms, aesthetics, and thinking to motivate people, encourage learning, and support problem-solving (KAPP, 2012). Serious games, on the other hand, are not limited to isolated elements but are fully developed games designed for purposes beyond entertainment. They can be defined as “any form of interactive computer-based game software for one or multiple players to be used on any platform and that has been developed with the intention to be more than entertainment” (RITTERFELD, 2009, p. 6).

In our study, we focus only on digital serious games, i.e. digital games that are designed not only for entertainment, but also to support learning and educational objectives.

### Potentials of digital games

Digital serious games offer an innovative and engaging approach to learning. Their potential becomes particularly evident when considering through contemporary learning theories, such as constructivist, situated, and experiential approaches (e.g. COLLINS et al, 1989; GREENO, 1998; LAVE/WENGER, 1991; MOON, 2004). Influenced by sociocultural, cultural-historical (e.g. VYGOTSKY, 1978), cognitive and motivational psychology (e.g. MALONE/LEPPER, 1987; SUCHMAN, 1987), these theories view learning as an active, context-dependent and socially embedded process, in which individuals construct meaning from their experiences. Teaching, from this perspective, involves designing learning environments that foster engagement and provide purposeful guidance. Based on these theoretical assumptions, APREA et al. (2018) summarised the following potentials of digital games:

- (1) *Digital games can support the development of domain-specific knowledge and higher cognitive skills:* Learning takes place through active engagement with complex, information-rich virtual environments. During gameplay, learners face challenges, receive feedback, learn from mistakes and solve problems (SQUIRE, 2008). This experiential engagement makes digital games suitable for promoting domain-specific knowledge as well as strategic decision-making and problem-solving skills (BARAB et al., 2010).
- (2) *Digital games can increase enjoyment, intrinsic motivation and positive attitudes:* The entertaining qualities make them particularly appealing to learners, especially digital natives, and promote greater engagement and sustained intrinsic motivation. Key intrinsic

motivators like challenge, curiosity, control and fantasy (MALONE, 1981) are embedded through game elements such as goal achievement, sensory, cognitive stimulation and narrative. In addition, their immersive nature can promote flow experiences (CSÍKSZENTMIHÁLYI, 2008).

- (3) *Digital games can promote both generic skills and psychomotor skills*: Generic skills include metacognitive abilities such as dealing with complexity, processing information under risk and uncertainty, persistence, tolerance of ambiguity and self-efficacy. Depending on the type of game, psychomotor skills such as reaction speed and hand-eye coordination can also be improved (GRANIC et al., 2014).

These potentials can only be realised if a game possesses certain fundamental characteristics. These characteristics define what constitutes a “serious game” and are implemented through appropriate design elements.

### Characteristics and game design elements of serious games

Mayer (2014) concludes that a game can be defined as having the following five characteristics: (1) Games are *rule-based*, simulated systems. Based on simple, clearly defined rules, they create a simplified world in which events occur for specific reasons and in accordance with those rules. (2) Games are *responsive*. They respond quickly and clearly to players’ actions, allowing players to act and immediately receive feedback on the consequences. (3) Games are *challenging*. They enable players to overcome difficult tasks and experience a sense of accomplishment. (4) Games are *cumulative*. The simulated environment reflects the players’ previous actions and allows their progress to be assessed in relation to their goals. (5) Games are *inviting*. The simulated system is designed to be interesting and appealing, making the experience more engaging and enjoyable.

Game elements form the foundation of games and contribute to the motivation and interest of players. However, it should be noted that individual elements or only a small number of them are not sufficient to create a captivating and immersive learning environment. Only the interaction of various elements enables a lasting gaming experience (KAPP, 2012). Designing a good game involves adding appropriate elements in a way that aligns with the five defining characteristics (MAYER, 2014).

KAPP (2012) identified key game elements and described their contribution to the course of the game. These elements can be assigned to the characteristics of games defined by MAYER (2014), which are explained in more detail below (see Table 1). These game elements are reflected in the analysis scheme used in this study (see section 3.2).

Table 1: Characteristics of games and game elements

Characteristic (MAYER, 2014)	Description	Game elements (KAPP, 2012)
(1) Rule based	Events occur within a causal system, based on a knowable set of rules	Abstraction of concepts and reality Rules
(2) Responsive	Environment allows for player to act, and responds promptly and saliently	Feedback Replay
(3) Challenging	Environment provides opportunities for success on tasks that are difficult for the player	Goals Levels Conflict, competition, or cooperation
(4) Cumulative	Current state of the environment reflects player's previous actions and allows for assessment of progress toward goals	Time Reward structure
(5) Inviting	Environment is interesting, appealing, and fun for the player	Aesthetics Curve of interest Storytelling

Adopted from PLATZ (2022)

(1) *Rule-based:*

*Abstraction of concepts and reality:* Games simplify and model complex real-world systems, creating an abstract reality in which players can engage with concepts without having to experience all the complexities of real life. This abstraction has several advantages:

1. It makes it easier for players to understand and manipulate the system (e.g. abstract Monopoly).
2. Games quickly reveal the consequences of actions, unlike in real life, where results are delayed or influenced by many factors.
3. Unimportant events from real life are omitted so that players can focus on the core game. Finally, complex processes are simplified through abstractions in controls and mechanics, making them easier to understand.

*Rules:* Games operate on multiple levels of rules. It is crucial to understand these levels when designing a game or using game-based elements to enhance learning

(SALEN/ZIMMERMAN, 2004):

1. Operational rules: Describe how the game is played (e.g. collecting a key to open a door).
2. Constitutive rules or foundational rules: Underlying formal structures that dictate game functionality (usually relevant for designers).
3. Implicit rules or behaviour rules: Unwritten social or etiquette rules (e.g. fairness, good sportsmanship). Violating them can lead to social penalties or exclusion from the game.
4. Instructional rules: Rules integrated into educational games to teach specific lessons (e.g. making a wrong decision led to negative consequences). These rules guide learning within the game.

(2) *Responsive:*

*Feedback:* There are two main types of feedback in games. Informative feedback tells players whether an action is right, wrong, or partly right, but doesn't tell them how to fix it. Instructional feedback, on the other hand, provides players with the information they need to achieve the correct result. For instance, when players make a mistake, they should be prompted or guided towards a more appropriate action or activity without being told exactly what to do.

*Replay:* Replay and "Do over" are central game design elements. They enable players to experiment without facing serious consequences, fostering curiosity and the learning process while enhancing playability. Through failure, players develop new strategies and experience greater freedom. Many games facilitate this with helpful features or easier levels to avoid frustration. Repeated failure makes subsequent success more satisfying.

(3) *Challenging:*

*Goals:* The main "difference between a game and play is the introduction of a goal" (KAPP, 2012, p. 52). Goals structure activities, allow players to track progress, and provide clear indicators of success or failure. They also support decision-making and strategic thinking while promoting autonomy. However, an end-goal should be complemented by sub-goals (smaller goals) to maintain continuous challenge, foster gradual skill development, and sustain engagement. (SALEN/ZIMMERMAN, 2004)

*Levels*: One advantage of levels is that they keep the game clear and do not overwhelm the player. In addition, skills are built up and reinforced at each stage. The initial levels introduce fundamental skills that must be combined and applied in subsequent levels. Furthermore, completing a level motivates players to continue. Levels can be distinguished into three different types.

1. Mission-based level, where players progress from one stage to the next as they advance toward the end of the game.
2. Difficulty level, which the player typically selects at the start of the game.
3. Player's experience and skill level, often represented by so-called "experience points" awarded for completing missions, overcoming obstacles and enemies, and reaching higher levels.

*Conflict, competition and cooperation*: A successful game design often comprises all three elements. Conflict arises when players encounter opponents or obstacles and attempt to overcome them to win. Competition involves optimising one's own performance without hindering others directly, as in racing games, where success depends on speed, skill, or strategy. Cooperation requires players to work together towards common goals, often achieving outcomes that benefit all participants, as in cooperative role-playing games.

(4) *Cumulative*:

*Time*: As an important element in game design, time has several dimensions e.g. in form of a timer or countdown that motivates players to act immediately and simulates stressful situations that occur in real working life. Time can also be a limited resource that must be allocated to tasks to successfully achieve goals. In this way, players learn to set priorities and plan tasks effectively. Games can accelerate time so that the consequences of actions become visible more quickly than in real life, for example, the consequences of long-term investment decisions. The limited time in the game encourages pressure to act and strategic thinking and makes it possible to experience complex processes in a short period of time.

*Reward structure*: Badges, points and rewards are further game design elements. However, it is crucial that they are embedded in a well-thought-out reward structure. Leaderboards, i.e. lists or tables that show the ranking of players in a competition, add a social dimension and create motivation. "It also gave bragging rights and social capital to the individuals who achieved the high scores" (KAPP, 2012, p. 56) Points can be directly

linked to game activities or represent additional goals (e.g. coins in Super Mario). Rewards such as upgrades or special abilities increase motivation but work best when linked to meaningful achievements (e.g. gaining special abilities that make the character stronger).

(5) *Inviting*:

*Curve of interest*: The interest curve shows how games structure events over time to maintain players' interest. It starts with initial interest, which is reinforced with a "hook", maintained with targeted highlights, and finally leads to the "climax". A well-designed interest curve prevents boredom and players dropping out, helping to secure their attention and motivation throughout the game.

*Aesthetics*: A central component of every game. These can range from simple distinguishing features to entire worlds. "The aesthetics help the players become caught up in the game experience. The artistry, careful mingling of descriptions, and attention to design elements becomes compelling" (KAPP, 2014, p. 69). Visual details that convey meaning are important. Poor or lacking aesthetics can make games boring.

*Storytelling*: Another essential element of game design is storytelling, as it creates relevance, context and meaning. In educational games, task-related narratives ensure that learners practise actions in a relevant context and can remember them more easily. The combination of games and storytelling creates an interactive experience that engages players. Well-designed educational games use task-related narratives and game elements to teach desired behaviours, actions and thought patterns. They provide a visual and contextual space to practise skills relevant to the player's profession or learning goals. The core elements of a good game story are characters, plot (something happens), tension and resolution.

## 3. Methodology

### 3.1 Search strategy and selection criteria

#### Search procedure

To identify digital serious games in the context of financial literacy, we conducted a systematic search using three distribution channels: the Internet (via Google), the Apple App Store, and the Google Play Store. The aim was to obtain a comprehensive overview of existing digital serious games in this field. The search was conducted in several steps: First,

various combinations of search terms related to the topics of “financial education” and “games” were tested. Ultimately, the terms “financial education games”, “financial literacy games” and “finance games” proved particularly suitable as they offered high relevance and broad coverage. These search terms were used in both English and German.

The search was conducted between September 2024 and March 2025. Each term was entered individually into Google, and the resulting websites were reviewed. Games that appeared relevant based on their titles were recorded in a table, including the name and URL of each game. The same search terms were then used in the Google Play Store and the Apple App Store. In these cases, all retrieved results were added directly to the table, also including the name and URL of each game. If a game appeared on multiple channels, it was recorded only once and assigned to the channel where it was first identified to prevent double counting. Availability on additional channels was noted in the table. In addition to the search results, the table also includes already known digital serious games that we have identified through analyses of financial education providers and their programmes.

### **Inclusion and exclusion criteria**

In the next step, we examined the identified games individually to determine their relevance for the subsequent analysis. We checked whether they were related to financial education and whether they were digital serious games. Based on these considerations, we defined specific inclusion and exclusion criteria.

Games were included in the analysis if they had a clear focus on financial topics and fulfilled the characteristics of a serious game (see definition section 2). Conversely, games without a thematic focus, as well as those that contain finance-related content but could not be classified as serious games - i.e. games without an explicit learning objective and primarily intended for entertainment or those that solely contain gamification elements - were excluded. These included games of chance such as casino, real-money, and bingo games; household budgeting apps and expense tracking tools; children’s games that focus solely on counting or sorting money, as well as card simulator apps that enable only basic interactions with digital payment systems. In addition, so-called tycoon games, which focus on building and managing financial companies or systems, were also excluded from the analysis, since they lack an explicit learning objective and are primarily designed for entertainment.

Furthermore, learning platforms that addressed financial topics but only contain isolated game elements and are therefore not serious games but rather gamification was not considered. Applications related to banking and financial services, stock trading, crypto and blockchain,

financial news, and social media, all of which were also excluded from the analysis, since they do not meet the criteria of a serious game.

Moreover, only games that were freely accessible at the time of the search and available in either English or German were considered. Applications that required payment or were only available as demo versions were excluded (see Table 2).

Table 2: Inclusion and exclusion criteria

	Included	Excluded
Topic	Games with a clear focus on financial topics	Games without a thematic focus or only partially finance-related
Type	Serious games with explicit learning objectives	Games primarily for entertainment; platforms or applications containing only isolated gamification elements
Accessibility	Freely accessible at the time of the search	Paid application or demo versions only
Language	Available in English or German	Games not available in English or German

## Search Results

The search across the selected distribution channels, supplemented by already known games, resulted in a total of 2,358 titles. Of these, 124 were found on the Internet, 765 in the Apple App Store, and 1,469 in the Google Play Store. After removing duplicate entries, 1,553 unique games remained: 701 from the Apple App Store, 728 from the Google Play Store, and 124 from the Internet. An overview of these results is provided in Figure 2.

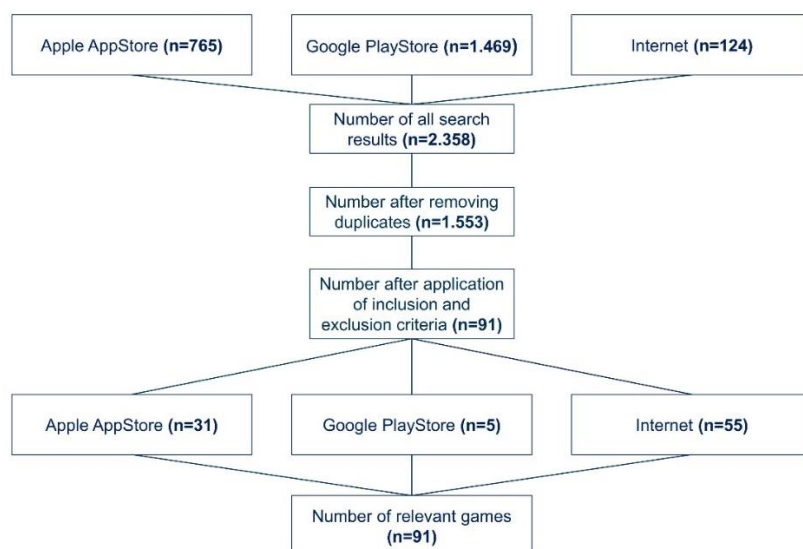


Figure 2: Search results

We first checked the accessibility of the games. Of the 124 internet games, 17 were inaccessible. In the App Stores all games were accessible. We then checked the remaining inclusion and exclusion criteria. Of the 701 Apple App Store games, 31 met the inclusion criteria and were thus included in the analysis, while the remaining games did not. In the Google Play Store, 5 out of 728 games were relevant according to those criteria. Among the 124 internet games, 52 did not meet the criteria. This left 55 internet games that were ultimately included in the analysis. In total, 91 relevant games were identified and included in the analysis.

After removing duplicates and excluding unsuitable games based on the defined inclusion and exclusion criteria, a detailed analysis was performed on the remaining games. The analysis of the games was conducted by three coders.

### 3.2 Analysis scheme

Currently, there are several models and frameworks available for analysing serious games (e.g. CARVALHO et al., 2015). We decided to use the analysis scheme developed by SCHULTHEIS and APREA (2019) since it was specifically designed for analysing serious games in the context of financial literacy and covers key aspects that should be considered when analysing such games. This analysis scheme also allows to analyse the interplay between playful and educational elements, taking learning objectives and learning tasks into account. In addition, it considers ethical aspects, such as whether games contain violence, discrimination, or advertising. Another reason we chose this scheme is that it provides a solid foundation for input evaluations, particularly regarding the way we record and interpret information.

The analysis scheme consists of four types of criteria: *contextual criteria*, *ethical criteria*, *curricular criteria* and *game-design criteria* (see Table 3).

Table 3: Analysis scheme

Contextual criteria	Ethical criteria	Curricular criteria	Game-design criteria
- Publisher - Financing - Distribution channel - Technical requirements - Language - Target group - Supporting materials	- Violence - Advertising - In-game purchases - Fairness	- Learning objectives - Learning tasks - Competence facets	- Game genre - Interaction possibility - Narrative & goal - Characters - Structure - Game tasks - Duration - In-game support - Level of difficulty

Note. Adopted from SCHULTHEIS/APREA (2019)

- The *contextual criteria* include information about the publisher, funding, distribution channel, technical requirements, language, and target group. This information can be obtained through research on the game without having to play it beforehand. We have also added the category “Supporting materials”. This is intended to indicate whether the publisher provides supporting materials in addition to the game, e.g. in form of teacher kits, teaching materials or lesson plans. All these factors represent objective criteria. We used a dichotomous coding scheme for these contextual criteria, i.e. we recorded whether the relevant information or resources were available and indicated this accordingly.
- The *ethical criteria* provide information on whether a game contains violence or advertising, whether in-game purchases are necessary, and whether the game is designed to be fair to all users or if certain groups are discriminated against. Violence is present when the game includes fighting or combat scenes (e.g. shooting, hitting, stabbing), graphic depictions of injuries, blood, or death, or aggressive interactions between characters that are central to the gameplay. Fairness is not ensured when discrimination is present, such as when role stereotypes are reproduced, for example when certain groups (e.g. women) are consistently presented as weak or subordinate. Checking these criteria is essential, as SCHULTHEIS and APREA (2019) found that both parents and educators consider it important for games used for learning purposes to be free of violence and discrimination. Educators also pointed out that many games are funded by insurance companies or banks and emphasised the importance of avoiding advertising from such sponsors, which is why we included the criteria advertising and in-game purchases in our analysis. The contextual and ethical criteria provide

information about a game's general suitability for educational use without going into detail about its content or design. While the presence of advertising or in-game purchases can be assessed objectively, the criteria of fairness and violence require subjective judgement. We also applied a dichotomous coding scheme to the ethical criteria, recording whether each feature was present.

- *Curricular criteria* are divided into three categories: learning objectives, learning tasks, and competence facets. The category learning objectives identifies the educational goals that players are expected to achieve through the game. Where available, learning objectives provided by the publisher or developer were recorded dichotomously, i.e., only whether they were present or not. Learning tasks are in-game activities specifically designed to support the achievement of the set learning objectives. These tasks are didactically grounded and must be completed by players to develop the intended competencies. Finally, the competence facets category outlines the specific aspects of financial literacy the game aims to address or promote. This classification is based on the framework developed by LEUMANN et al. (2016); see section 2.1. In the context of serious games, the curricular criteria are linked to the game design criteria, as the individual tasks in the game usually also include a learning task (SCHULTHEIS/APREA, 2019). While the presence of learning objectives was recorded objectively, the identification of learning tasks and competence facets rely on interpretation and therefore represent subjective criteria.
- The last type of criteria, the *game design criteria*, is used to analyse a game in terms of its design aspects, considering the key game design elements summarised by KAPP (2012); see section 2.2. The first factor is the game's genre, which was recorded categorically. Games are assigned to one of the following categories: arcade/action, strategy, simulation, or sports. A game may belong to more than one category. However, as our study also included quiz games that did not fit into any of these categories, an additional category, "quiz", was introduced. In addition, the criteria "interaction possibility" is used to examine whether players can interact with other players within the game. This was coded dichotomously, i.e. it was noted whether such interaction is possible or not. The game design elements storytelling and goals are reflected in the criteria narrative and game goal, which were derived from gameplay. Characters, were recorded dichotomously, noting whether they were present or not. The design elements rules, feedback, replay, levels, and reward structure are covered

by the criteria game structure and game tasks, which were also derived from gameplay.

The remaining criteria relate to the duration of the game (element time), the availability of in-game support and the difficulty level of the game. Game duration was coded categorically, distinguishing between short (completed in minutes or hours), medium (lasting several days) and long (lasting several weeks or months, e.g. as part of project weeks) as well as open-ended games, i.e. games without a defined ending. The in-game support criterion was coded dichotomously, noting whether players receive support during the game. This could be in the form of a character who provides tips, for example, or visual cues that offer hints and tricks. Level of difficulty refers to how easy the game controls are to use and was coded on an ordinal scale with three levels: easy, medium and hard. The level of difficulty is classified as “easy” when the operation is intuitive using mouse clicks and the keyboard. It is classified as “medium” when some coordination or timing is required and as “hard” when precise control and quick reactions are necessary. Criteria, such as interaction possibility or game duration, can be observed objectively as they require little interpretation. In contrast, criteria derived from gameplay, such as genre, narrative or tasks, involve interpretation and are therefore subjective.

The study leaders provided each of the three coders with individual instructions on the analysis scheme, using an application example as guidance. To assess inter-rater reliability, two additional coders were included. They coded a random sample of 20 games independently, each coding 10 games. Their ratings were then compared with those of the three original coders. Cohen’s kappa was calculated for criteria that required subjective judgement and therefore involved a risk of disagreement between the coders. These included ethical-, curricular- and game-design criteria. In contrast, inter-rater reliability was not calculated for contextual criteria since they can be verified objectively and do not depend on coder interpretation.

The coding of the ethical criteria showed overall high reliability. Due to the low prevalence of violence, unfairness, and advertising in the sample, Cohen’s Kappa could not be calculated; instead, we report the observed agreement, which was 90% or higher. The average value of Cohen’s kappa was 0.6 for the curricular criteria and 0.7 for the game design criteria.

## 4. Results

In this section, we present the results of our analysis based on the previously presented analysis scheme. As outlined in Section 3.1, a total of 91 games was identified and analysed: With 55 titles, the serious games identified on the internet represent the largest group in the analysis. Four of these are also available in both the Apple App Store and the Google Play Store, while one is available exclusively in the Apple App Store. The next largest group are the games from the Apple App Store, with a total of 31 titles, 26 of which are also available in the Google Play Store and 9 of which can also be played as browser games. Among the 5 games found in the Google Play Store, 4 are likewise available in the Apple App Store.

### 4.1 Contextual criteria

A closer examination of the publishers shows that they can be divided into several categories. Commercial publishers, such as banks and financial service providers (e.g. #5 *Borrowing Money*), account for 36 games. Non-profit publishers, including non-governmental organisations (e.g. #8 *Build Your Stax* or #9 *Cat Insanity*) and foundations (e.g. #11 *Chasing Money Adventures*), account for 30 games. Public institutions contributed 10 games (e.g. #12 *Claim Your Future*), while private individuals published 3 games (e.g. #73 *My Fortune*; #76 *Planspiel - CASHFLOW*). In addition, there are collaborations that combine different types of publishers: public–commercial partnerships (e.g. #15 *Credit Score Millionaire*) include 7 games, while non-profit–commercial collaborations (e.g. #21 *Finance Hero*) account for 5 games.

Regarding financing, no reliable information on the sources of financing was available for many of the games examined (43). The sources of financing could only be determined in 48 cases.

When checking the technical requirements, we found that 42 of the 55 internet games require a web browser and a mouse. In 8 cases, a keyboard is required in addition to the web browser and mouse. Furthermore, 3 games require a web browser with Adobe Flash Player and a mouse (e.g. #7 *Bring Home the Bacon*). The remaining 2 games require a keyboard in addition to the web browser with Adobe Flash Player and mouse. Since 5 of these games are also available in the app stores, they are compatible with smartphones or tablets. By contrast, the games identified directly in the app stores require a smartphone or tablet with the corresponding iOS or Android operating system.

In terms of language, most of the games are available only in English (53 out of 91), with a smaller number available exclusively in German (5). 23 games are bilingual, most commonly in English and Spanish (14 games), English and German (1 game), English and Chinese (3 games) or English and Arabic (3 games). The remaining games are multilingual, offering three or more languages, or are available in more than five languages.

Regarding the target group of the offered games, the exact age range was not always specified by the publisher. Instead, general terms such as “children”, “teenagers” or “young adults” were used, or reference was made to school and grade levels, such as lower secondary (middle school) and upper secondary (high school). Based on this information, the target audiences can be divided into two groups: (1) children or lower secondary school students aged approximately between 5 and 14 years, and (2) teenagers and young adults, corresponding to upper secondary school and university students aged 15 and above. Although these categories are only approximate, as the groups sometimes overlap, our analysis shows that the second group is larger and therefore represents the main target audience for the identified games. Approximately 33 games are aimed at the first group, with the remaining 58 directed at the second group.

Finally, we examined the availability of supporting materials. We found that 41 publishers provided such resources, while 50 did not. These included, for example, workbooks, worksheets, reflection sheets, teachers’ or instructors’ manuals and lesson plans (see Table 4).

Table 4: Contextual criteria

Publisher	Financing	Language	Target group	Supporting material
Commercial (36)	Specified (48)	English (53)	Children/lower	Available (41)
Non-profit (30)	Not specified (43)	German (5)	secondary school/5-14	Not available (50)
Public (10)		Bilingual (23)	years (33)	
Private (3)		Multilingual (10)		
Collaborations (12)			teenagers/young adults/ upper secondary school/15+ years (58)	

## 4.2 Ethical criteria

In terms to the criterion of violence, two games were found to contain violent elements. In one of these (#6 *Break the Bank*), players must attack their opponents with hammers. In

another (#39 *Money Ninja Warrior*), players use so-called “WeAppon” as metaphorical tools to answer quiz questions.

In addition, we examined whether the games contained advertising. This was the case in 8 instances. For example, three games (#31 *Klarna Money Talks*; #84 *Visa Financial Football*; #85 *World Financial Football*) were classified as containing advertising because the logo of the commercial publisher was displayed within the game. Moreover, some games included optional advertisements that players could watch to, for example, restore lives (#69 *Komuniti Kita*) or gain additional spins (#89 *Money Race the Finance Game*).

Furthermore, 16 of the games require in-game purchases. In six cases, additional content becomes necessary once a certain level or stage has been reached (e.g. #61 *Finance Heroes*; #76 *Planspiel - CASHFLOW*). In the other ten cases, in-game purchases are optional and not required to progress (e.g. #87 *Forest Fables: Cozy Life Sim*). Moreover, the criterion of fairness was always ensured (see Table 5).

Table 5: Ethical criteria

Violence	Advertising	In-game purchases	Fairness
Given (2)	Given (8)	Required (6)	Given (91)
Not given (89)	Not given (83)	Optional (10)	Not given (0)

### 4.3 Curricular criteria

Regarding learning objectives, we found that 21 of the publishers specified explicit learning objectives. For the remaining 70 publishers, no such objectives could be identified.

Considering the learning tasks that players must perform during the game, we found that these tasks can be grouped into categories. The largest category, which includes most learning tasks, relates to money management and budget planning. This includes tasks such as “Making decisions about expenses” or “Managing a savings account”. The second category focuses on purchasing and consumption decisions, including tasks like “Distinguishing between needs and wants” or “Weighing up offers”. Following these are tasks related to debt, credit, and creditworthiness, such as “Deciding on the use of credit and debit cards” or “Tracking and improving one’s credit score”. Other tasks concern investments and wealth building (e.g., “Making investment decisions”) or income generation and earning money. Less frequent learning tasks address topics such as risk (e.g. making decisions about taking risks, identifying and managing investment risks), life decisions and career (e.g. decisions about

career, further education, investments, and consumption), insurance (e.g. distinguishing between different types of insurance), fraud and security, long-term financial planning and reflection, as well as entrepreneurial activities.

When examining which specific aspects of financial literacy are addressed by the games, the results show that the facet “Spending money” is the most frequently represented, followed by the facets “Planning expenses in agreement with own needs and possibilities”, “Earning/taking money”. Table 6 provides an overview of the frequency with which the individual facets are addressed.

Table 6: Frequency of financial literacy facets covered in the games

Categories	Sub-categories	
Earning / taking money		60
Planning and managing financial matters	Evaluating own revenues	50
	Planning expenses in agreement with own needs and possibilities	64
	Gathering short-term reserves of money	41
	Drawing up a budget	44
	Using banking and financial services for daily needs	34
	Dealing with credit cards	3
	Filling out tax declaration	2
Spending money		65
Prevent (over-) indebtedness		59
Saving money / building assets		59
Borrowing money / raising a credit / financing methods		35
Retirement planning		12
Comparing / contracting assurances		15
Knowing information and counselling services in the context of monetary and financial affairs		17

#### 4.4 Game-design criteria

Considering the game genres, we found that simulation games represent the largest group, with 54 titles (e.g. #11 *Cha-Ching Money Adventures*; #12 *Claim Your Future*). Another 19 games combine simulation and strategy elements (e.g. #13 *Con’Em If You Can*). In addition, there are five quiz games (e.g. #15 *Credit Score Millionaire*), four strategy games (e.g. #47 *Space Trader*), four arcade/action games (e.g. #30 *Keep Your Finances in Good Shape*), two arcade/simulation hybrids (e.g. #9 *Cat Insanity*), two sports/quiz games (e.g. #84 *Visa*

*Financial Football*; #85 *World Financial Football*), and one action/arcade sports game (#60 *Dream Racer*).

Regarding interaction possibilities, we found that 67 games offered no options for interaction, whereas in the remaining 24 games players could interact with others. Such interactions took place, for example, in classroom settings (e.g. #27 *Interstellar Investor*, #56 *Börsen Heroes*), group settings (e.g. #29 *JEOPARDY!*), or multiplayer formats (e.g. #8 *Build Your Stax*; #68 *iWealth Asset Allocation Game*).

When examining the narrative, we classified it as either weak, medium or strong. Weak narratives have a barely present storyline that functions as only a minimal framework, with game mechanics taking centre stage. An example is the game #1 *Balance My Budget*, in which a female character appears in the corner with speech bubbles, while players must allocate their budget across different categories. However, this character merely remains a background element and does not contribute to a coherent narrative. Another example of games with weak narratives are typical quiz games, in which players simply answer individual questions without a comprehensive storyline (#15 *Credit Score Millionaire*). Medium narratives have a storyline, usually involving realistic roles or everyday scenarios, but without great complexity. For instance, players may take on the role of a young adult who has just left school and is now facing the challenges of personal financial management (e.g. #24 *First Person Spender*; #81 *Stand Tall*). Similarly, some games place players in specific roles, such as an aspiring social media influencer (#26 *Influencd*), a film producer (#34 *Lights, Camera, Budget*), or an Uber driver (#53 *The UBER Game*). In these cases, the narrative provides context and motivation, but it remains relatively limited and functional, without a complex world or deeper storyline and is therefore classified as medium. Strong narratives are those in which the storyline is central to the game and often involves fictional worlds and characters with a close connection to the gaming experience. Examples include a character who has crash-landed on an alien planet (#7 *Bring Home the Bacon*), a Sky Monkey living in a forest with talking animals who must manage daily tasks, build a life and make financial decisions (#87 *Forest Fables: Cozy Life Sim*), and a sorcerer's apprentice attempting to save a magical world (#80 *Saving Magic*). In our analysis, we found 19 games with a weak narrative, 54 with a medium narrative and 18 with a strong narrative.

Accordingly, there are different types of characters. Some are realistic, everyday characters, such as teenagers, young adults, students, groups of friends, or customers. In certain games, players can even customize their own character (e.g. #78 *ProFiLE Financial Literacy*). Other

games feature professional or functional characters, including bank employees, farmers, and individuals in various civic roles. Additionally, there are fictional or adventure characters, such as cats, aliens, wizards, dragons, and heroes. In some games, players assume the central role or main character without a fixed identity or defined role, as is often the case in quiz games. Overall, characters were present in 70 of the games analysed.

When analysing game structures, we found that most games are turn-based (40) followed by scenario-based games (25). In scenario-based games, players often must make decisions within a narrative that have immediate consequences for the course of the game. An example of this is #48 *Spent*, in which players take on the role of a single parent trying to survive for a month on a budget of \$1,000. During the game, they face a series of dilemmas related to health, education and basic needs, and their decisions directly affect the outcome. Turn-based games, on the other hand, proceed in clearly defined, repetitive turns. One example is #9 *Cat Insanity*, in which players must feed all the cats in each turn. Depending on whether they are fed or not, the cats either reproduce or die. The results are recorded after each turn; having hungry or dead cats has a negative impact on the outcome. In addition, we also identified level-based (12) and module-based (13) games. Level-based games are games in which new content or topics are introduced, and the difficulty increases with each level, or the tasks become more complex (e.g. #21 *Finance Hero*; #23 *Finances 101*). Furthermore, some games allow players to choose a difficulty level, such as easy or hard, or one that is appropriate for their age (e.g. #50 *The Budget Game*; #55 *World of Cents*; #84 *Visa Financial Football*). Module-based games, on the other hand, are divided into self-contained sections, each of which deals with a specific topic or learning objective. Players work through the modules one after the other and often receive feedback or results at the end of each module before moving on to the next (e.g. #2 *Banzai Junior*). Finally, we identified one game with a simulation-based structure, where players can experiment with their actions and observe direct effects within the simulated system (e.g. #87 *Forest Fables: Cozy Life Sim*).

In terms of playing time, we found that most games (85) can be completed within a short period, often in just a few minutes or hours. Beyond these, we identified 6 open-ended games, such as a life simulation, which are played independently of levels or rounds. There is also one game in an endless runner format (#57 *CashJack*), in which players run through various environments, dodging obstacles and collecting coins.

The tasks that players must perform in the games can be divided into different categories. Decision-making and management tasks in which players primarily make financial or

resource-related decisions, such as decisions about saving and spending, budget planning, investments, debt repayment, tax returns, choosing a bank account or credit card, taking out insurance and setting prices. In addition, there are simulative or operational tasks in which players perform actions that simulate real-life activities or replicate simplified everyday processes, such as making lemonade or serving customers (*#18 Dollar a Glass*), planting a garden and feeding animals (*#20 Farm Blitz*) or selecting and moving objects (*#32 Let's Deal*). Finally, some games also contain action-oriented tasks in which players complete dynamic, movement- or reaction-based tasks such as moving pigs and attacking opponents (*#6 Break the Bank*). Most tasks in the games relate to financial decision-making and management, while simulative tasks represent the second largest group. Action-based tasks, on the other hand, occur rarely.

Concerning game support, we found that 66 games offer such support elements. However, these differ in terms of how much support they provide. The range extends from simple help buttons and prompts to feedback and explanations provided after decisions have been made or questions have been answered. It also includes jokers, tips and supporting characters who can be asked for advice.

The difficulty level of the controls was rated as “easy” for 77 games and “medium” for 14 games. For instance, one game (*#20 Farmblitz*) was rated medium because many activities, such as planting and moving vegetables or feeding rabbits, must be completed simultaneously under time pressure. There are no games whose controls were rated as “hard” (see Table 7).

Table 7: Game-design criteria

Genre	Interaction possibility	Characters	Structure	Duration	In-game support
Simulation (54)	Given (67)	Present (70)	Turn-based (40)	Short (85)	Given (66)
Strategy, Simulation (19)	Not given (24)	Not present	Scenario-based	Medium	Not given
Strategy (4)		(21)	(25)	(0)	(25)
Action/Arcade (4)			Module-based	Long (0)	
Quiz (5)			(13)	Open-	
Action/Arcade, Simulation (2)			Level-based (12)	ended (6)	
Action/Arcade, Sport (1)			Simulation-based		
Sport, Quiz (2)			(1)		

## 4.5 Critical appraisal of the identified serious games

Our analysis has shown that there is a wide variety of games available, many of which are presented in very creative ways and appeal to a broad target audience. Nevertheless, there are some points of criticism, which we will address in this section.

Firstly, the accessibility of the games needs to be addressed. During the analysis, some games were removed from the app store, or their links were updated, which made them inaccessible. Additionally, we found that game names sometimes change in the app stores, or that they have different names in different stores, which makes them difficult to find again.

Another critical point concerns the funding of the games. During our analysis, it was difficult to determine who had financed the development of a given game. In general, it can be assumed that educational offerings provided by foundations are primarily funded through endowment income, donations, or earmarked grants. By contrast, the financing of commercial providers is likely to come primarily from their own capital. Regardless of the source, however, the funding should be disclosed transparently to users.

Furthermore, we found that fewer than half of the publishers provided supporting materials. Such materials are crucial because they enable instructors to integrate the game purposefully into their teaching. At a minimum, instructors should receive an overview of the programme that clearly outlines the learning objectives and summarises the game. Without such guidance, it is difficult for educators to identify the intended learning outcomes or understand how to use the game effectively.

Another area of criticism is advertising in games. While most games are unaffected, some do contain advertising. This is problematic because it can disrupt the learning process and distract players, as well as mixing commercial interests with educational goals. In learning contexts in particular, transparency must be ensured, with a clear distinction made between educational content and advertising. It is also notable that this is often the case with app store games, which are frequently promoted as self-learning tools and are likely to be used primarily by younger audiences.

Furthermore, some games, require in-game purchases. In certain cases, these are necessary to gain access to additional content, while in others they are optional and not required to progress through the game. Such mechanisms can limit learners' access to important content and create inequalities, especially for younger or less affluent players. Even when purchases are optional, they can put pressure on learners and potentially distract them from learning

goals. In some cases, registration is also required to access the game, which can further restrict access for learners and create additional barriers. Such barriers should be avoided to ensure that all learners have equal opportunities to engage fully with the educational content.

In terms of learning objectives, we found that only a few publishers specified explicit objectives. This poses a problem both for learners and instructors. Learners should be aware of the purpose of the game, as serious games, by definition, are designed to achieve specific learning outcomes rather than merely provide entertainment. For instructors, the absence of explicit objectives makes it difficult to determine which learning outcomes the game is intended to support, limiting its effective use in educational contexts. While most games include a general description, explicit learning objectives should be formulated to clearly indicate the intended educational objectives and ensure that the game can be integrated purposefully into a learning environment.

In terms of content, we have found that certain aspects are rarely addressed in the games. These include dealing with credit cards, filling out tax returns, retirement planning, comparing or taking out insurance policies, and knowledge of information and advisory services related to financial matters. However, these topics are particularly relevant for young adults who are entering the workforce or are in a transitional phase of their lives. Furthermore, systemic aspects are rarely considered, even though they are essential for a deeper understanding of financial systems and their interrelationships.

When examining the narratives, we found that in some games they are very weak, i.e. they remain superficial and only loosely connected to the learning content, while the game mechanics take centre stage. Storytelling plays an essential role in game design because it creates relevance, context and meaning and can motivate learners, thereby contributing to learning success. Therefore, narratives should not be pushed into the background. On the other hand, we found that some narratives were too creative. In such cases, it is questionable whether learners recognise the intended connection with the financial learning content. The actions or characters in these games have metaphorical meanings that may not be recognised by learners. In educational games, the narrative should therefore be closely linked to the learning objectives without being pushed too far into the background or overshadowing the learning content.

The same issue applies to the tasks that players are required to perform. In some games, learners simply carry out actions such as collecting and placing objects, fitting characters into outlines or throwing objects at targets. In such cases, it is unclear how these tasks relate to

financial learning, which raises doubts about whether learners can recognise any meaningful connection or whether they perceive the game primarily as entertainment. In educational contexts, however, learners should be aware of the purpose behind each action they perform in the game. Game tasks should also include learning tasks that are geared towards achieving learning objectives. As a rule, the number of simulative tasks in individual games should not exceed the number of tasks related to financial decision-making and management.

## 5. Discussion and limitations

Our analysis showed that there is currently a wide range of serious games available in the field of financial literacy. Through searches on the internet, Google Play Store, and Apple App Store, we identified and analysed a total of 91 games. These games are offered by a variety of publishers, including commercial publishers, non-profit organisations such as NGOs and foundations, public institutions, private individuals, as well as collaborations between different types of publishers. Most of them are available on the internet. The main target group consists of teenagers, young adults, and upper secondary school students, but there are also many games aimed at children and lower secondary school students. Simulation games represent the largest category, followed by games that combine simulation and strategy elements. Most games are designed to be completed within a short period, often in just a few hours.

For the analysis, we used the analysis scheme developed by Schultheis and Aprea (2019), as it was specifically designed for evaluating serious games in the context of financial literacy. The framework includes key dimensions such as curricular criteria (publisher, funding, distribution channel, technical requirements, language, target audience), ethical criteria (advertising, in-game purchases, fairness), learning-related criteria (learning objectives, learning tasks, competence facets) and game design criteria (game genre, interaction options, narrative and goal of the game, characters, structure, game tasks, duration, in-game support, difficulty level). In addition to the original analysis scheme, we have included the criterion of supporting materials, which records whether publishers provide resources such as workbooks, worksheets, teacher's manuals or lesson plans. We have also removed the criterion of developer because we did not consider it relevant to the analysis. In many cases, it was difficult or impossible to find out who financed the game. Additionally, a lot of publishers did not specify any explicit learning objectives.

Our analysis revealed several strengths of the identified games. First, they are widely accessible, as they are represented across all three platforms (Internet, Google Play Store, Apple App Store) and address different age groups. Second, a considerable number of publishers provide supporting materials, which facilitates and supports integration into teaching. Another strength is that relatively few games contain advertising or in-game purchases, and when purchases are included, they are usually optional rather than mandatory. Furthermore, violence is almost never present. In terms of content, the games cover a broad range of financial literacy topics. The narratives are often creatively designed and appeal to different learner interests, ranging from cosy-life simulations to sports or action settings. Most games incorporate motivating elements such as scoring systems and feedback. Some allow players to choose between different difficulty levels, enabling adaptation to the learner's skills. In addition, most games are of short duration, which makes them easy to use in classroom settings, and many provide in-game support. Finally, the game controls are generally simple, ensuring that learners' attention is not diverted from the educational content.

At the same time, the analysis also highlighted several weaknesses. In many cases, explicit learning objectives were missing, which makes it difficult for both learners and instructors to understand the educational purpose of the game. In some games, the narrative was either too weak - it remained superficial and had only a loose connection to the financial content - or too creative, making it difficult to recognize the financial relevance. Similarly, some tasks within the games were far removed from real-life financial practices (e.g. simply collecting or throwing objects), raising questions about whether learners would achieve the intended learning outcomes. In terms of content, important financial topics such as retirement planning, taxes, insurance, and credit card use were rarely addressed, even though these are particularly relevant for young adults. Finally, transparency remains an issue: information on financing is often unavailable, and some games (even a small number) contain advertising or require in-game purchases or registration, which can distract from the educational focus.

In addition, this study is subject to some limitations that should be considered when interpreting the findings. The first limitation concerns to the search. The scope of the analysis was limited to English and German-language games. However, it is very likely that there are other relevant games in different countries and languages, that were not included in our analyses but would likely provide valuable insights. Another limitation is that affective and non-cognitive factors, such as enjoyment, intrinsic motivation, engagement, and self-efficacy, were not considered. In our study, we analysed the games' suitability from media-didactic and ethical perspectives. Omitting these factors limit our understanding of their potential to foster

motivation and positive attitudes. Additionally, the results are primarily descriptive and do not offer an in-depth analysis of specific potentials, such as immersion, flow through storytelling, or graphical design elements.

## 6. Conclusion

In summary, our findings provide insights into the potential and limitations of serious games for financial literacy. Based on these insights, several recommendations for educators/instructors and game publishers/developers can be derived.

**Publishers/Developers:** When providing a serious game, it is important to publish relevant information, such as funding sources. Users would feel more confident knowing the game content is trustworthy, unbiased and focused on educational goals rather than commercial interests. This is especially important in the context of financial literacy, where commercial interests can be more easily embedded within the game.

Furthermore, supporting materials, such as game overviews with clearly defined learning objectives, should be provided. Educators/instructors need to know which objectives the game targets to select and use it effectively. It is also important to clearly present the game features, so that educators/instructors can use them efficiently and provide targeted support to learners when needed.

It is also important to avoid barriers such as in-game purchases or registration requirements. These could discourage users from playing the games or interrupt their gameplay, and could create unequal opportunities, as not all learners, particularly younger ones, may be willing or able to make purchases. In addition, registration requirements could compromise learners' privacy, which must always be protected.

Another recommendation is providing adjustable difficulty levels tailored to players' age or prior knowledge. This would support differentiation and allows diverse learners to develop their financial literacy at a level appropriate to their needs.

**For educators/teachers:** When selecting serious games, it should be ensured that they are free of advertising and commercial interests. Learning should be independent of commercial influence, accessible to all without payment or mandatory registration, and learners' privacy must always be protected. Similarly, games should avoid depictions of violence, as it is not appropriate in an educational context.

Furthermore, it should be ensured that the tasks and content of the game are clearly aligned with the learning objectives. Learners must understand the purpose and meaning of the tasks they are completing, and recognise the metaphors used within the games. Serious games should maintain a balance between “learning” and “entertainment” - neither should dominate, ensuring they retain their unique educational impact.

To fully realise their potential, serious games require not only a good design but also a meaningful integration into learning environments. Gameplay experiences should be supported through structured briefing and debriefing phases. Learners should be guided before the game (briefing) and given the opportunity to reflect after the game (debriefing). Additionally, learners should be provided with opportunities to apply the knowledge/skills gained in real-life contexts. In the project “DGBL-WiFiNa”, described in the introduction, we focus on developing game-based learning environments, using selected serious games to design and illustrate such environments. The results of the project will be published (APREA/ENGELHARDT, under review).

Looking ahead, there are several avenues for future research to build on our findings. As mentioned, our analysis was limited to games in English and German. Future research could therefore expand the search to include additional languages, especially those spoken in countries where financial literacy is actively promoted. This may help identify best-practice games that could serve as a foundation for future developments. Furthermore, the analysis scheme used in this study could be refined by defining more specific sub-criteria. For certain criteria, such as game structure, specific elements, e.g. feedback mechanisms or point systems, could be analysed in more detail. This would make the scheme easier to apply and ensure greater consistency in game analysis. Future studies should also examine affective and other non-cognitive factors to assess the games’ suitability not only from a cognitive or media-didactic perspective but also regarding their potential to support learners’ motivation and attitudes. For example, it should be investigated whether learners enjoy the games, feel motivated, and experience increased engagement and self-efficacy. Considering these aspects would provide a deeper understanding of how the games support financial literacy development and which design features most effectively foster competence acquisition.

A further question that remains open is the extent to which these games contribute to the development of financial literacy. While we analysed their overall suitability for learning in this context, we do not yet have insights into their actual impact on learners’ financial literacy. Therefore, future research should investigate how serious games affect learners’ financial

knowledge, skills, and decision-making abilities, as well as their awareness and attitudes regarding financial matters. Our analysis provides a foundation for such evaluations.

## References

- APREA, C. / BUCHER-KOENEN, T. (2023). Financial Literacy im gesellschaftlichen Kontext: Relevanz, empirische Evidenz und Erfolgsfaktoren. In B. Kaiser & M. Brandt (Hrsg.), *Data, Financial und Risk Literacy: Beiträge zu Schlüsselkompetenzen im Umgang mit Daten, Finanzen und Risiken* (S. 7–8). Deutsche Gesellschaft für Versicherungs- und Finanzmathematik e. V.
- APREA, C / ENGELHARDT, J. (under review). Identifikation und Analyse digitaler Lernspiele für die ökonomische, finanzielle und nachhaltigkeitsbezogene Bildung. In Klusmeyer, J., Schadow, S. & Thiel de Gafencio, M. (Hrsg.), *bwp@ Spezial 23: Titel der Spezial-Ausgabe* (S. 1–XY). [http://www.bwpat.de/spezial23/name1\\_name2\\_spezial23.pdf](http://www.bwpat.de/spezial23/name1_name2_spezial23.pdf) (10.01.2026)
- APREA, C. / SUNA, M. (2024). Finanzbildungsangebote in Deutschland: Bestandsaufnahme, kritische Würdigung und Perspektiven für die nationale Strategieentwicklung. *Zeitschrift für ökonomische Bildung: ZföB*, 238–335. [https://www.zfoeb.de/2024\\_13/2024-13\\_238\\_335\\_aprea.pdf](https://www.zfoeb.de/2024_13/2024-13_238_335_aprea.pdf) (02.12.2025)
- APREA, C. / SCHULTHEIS, J./ STOLLE, K. (2018). Instructional integration of digital learning games in financial literacy education. In T. A. Lucey & K.S. Cooter (Eds.), *Financial literacy for children and youth* (2nd ed., pp. 69–88). Lang. [https://www.researchgate.net/publication/321137033\\_Instructional\\_Integration\\_of\\_Digital\\_Learning\\_Games\\_in\\_Financial\\_Literacy\\_Education](https://www.researchgate.net/publication/321137033_Instructional_Integration_of_Digital_Learning_Games_in_Financial_Literacy_Education) (02.12.2025)
- APREA, C. / VONHOF, C. / ACKERMANN, N. / FÜRSTENAU, B. / BAGINSKI, R. / VOGLER, M. (2026). Financial Literacy Frameworks: A Scoping Review and Critical Appraisal. In M. Förster & M. Hommel, M. (Eds.), *Conceptualisation and Measurement of Financial Competence. SpringerBriefs in Education*. Springer. [https://doi.org/10.1007/978-3-031-95690-4\\_3](https://doi.org/10.1007/978-3-031-95690-4_3)
- APREA, C. / WUTTKE, E. / BREUER, K. / KENG KOH, N. / DAVIES, P. / FUHRMANN, B. / LOPUS, J. (Eds.)(2016). *International Handbook of Financial Literacy*. Springer. <https://doi.org/10.1007/978-981-10-0360-8>
- BARAB, S. A. / GRESALFI, M. / INGRAM-GOBLE, A. (2010). Transformational play: Using games to position person, content, and context. *Educational Researcher*, 39(7), 525–536. <https://doi.org/10.3102/0013189X10386593>
- CAILLOIS, R. (2001). *Man, Play, and Games*. University of Illinois Press
- CARVALHO, M. B. / BELLOTTI, F. / BERTA, R. / DE GLORIA, A. / SEDANO, C. I. / HAUGE, J. B. / HU, J. / RAUTERBERG, M. (2015). An activity theory-based model for serious games analysis and conceptual design. *Computers & Education*, 87, 166-181. <https://doi.org/10.1016/j.compedu.2015.03.023>
- COLLINS, A. / BROWN, J.S. / NEWMAN, S.E. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning,*

- and instruction: Essays in Honor of Robert Glaser* (pp. 453–494). Lawrence Erlbaum Associates.
- CSÍKSZENTMIHÁLYI, M. (2008). *Flow: The psychology of optimal experience*. Harper Collins Publisher.
- DAVIES, P. (2015). Toward a framework for financial literacy in the context of democracy. *Journal of Curriculum Studies*, 47(2), 300–316. <http://dx.doi.org/10.1080/00220272.2014.934717>
- DELOACHE, J. S. (1987). Rapid change in the symbolic functioning of very young children. *Science*, 238, 1556–1557. <http://dx.doi.org/10.1126/science.2446392>
- DETERDING, S. / DIXON, D. / KHALED, R. / NACKE, L. (2011). From game design elements to gamefulness: Defining gamification. In *Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments* (pp. 9-15). Association for Computing Machinery. <https://doi.org/10.1145/2181037.2181040>
- GRANIC, I. / LOBEL, A. / ENGELS, R. C. M. E. (2014). The benefits of playing video games. *American Psychologist*, 69(1), 66–78. <https://doi.org/10.1037/a0034857>
- GREENO, J. (1998). The situativity of knowing, learning, and research. *American Psychologist*, 53(1), 5–26. <https://psycnet.apa.org/doi/10.1037/0003-066X.53.1.5>
- HUIZINGA, J. (1949). *Homo Ludens: A Study of the Play-Element in Culture*. Routledge & Kegan Paul.
- HUSTON, S. J. (2010). Measuring Financial Literacy. *Journal of Consumer Affairs*, 44, 296-316. <https://doi.org/10.1111/j.1745-6606.2010.01170.x>
- KAISER, T. / MENKHOFF, L. (2017). Does financial education impact financial literacy and financial behavior, and if so, when?. *The World Bank Economic Review*, 31(3), 611–630. <https://doi.org/10.1093/wber/lhx018>
- KAISER, T. / LUSARDI, A. / MENKHOFF, L. / URBAN, C. (2021). Financial education affects financial knowledge and downstream behaviors. *Journal of Financial Economics*, 145(2), 255-272. <https://doi.org/10.1016/j.jfineco.2021.09.022>
- KAPP, K. M. (2012). *The Gamification of Learning and Instruction: Game-Based Methods and Strategies for Training and Education*. Pfeiffer
- LAVE, J. / WENGER, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge University Press.
- LEUMANN, S. / HEUMANN, M. / SYED, F. / APREA, C. (2016). Towards a comprehensive financial literacy framework: Voices from stakeholders in European vocational education and training. In E. Wuttke, J. Seifried, & S. Schumann (Eds.), *Economic competence and financial literacy of young adults: Status and challenges* (pp. 19–40). Barbara Budrich. <https://doi.org/10.2307/j.ctvbkk29d.4>

- LONKA, K. (2012). Engaging Learning Environments for the Future The 2012 Elizabeth W. Stone Lecture. In R. Gwyer, R. Stubbings & G. Walton (Eds.), *The Road to Information Literacy: Librarians as facilitators of learning* (pp. 15-30). Berlin, Boston: De Gruyter Saur. <https://doi.org/10.1515/9783110281002.15>
- LUSARDI, A. (2019). Financial literacy and the need for financial education: evidence and implications. *Swiss Journal of Economics and Statistics*, 155(1). <https://doi.org/10.1186/s41937-019-0027-5>
- MALONE, T. W. / LEPPER, M. R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R. E. Snow & M. J. Farr (Eds.), *Aptitude, Learning and Instruction III: Conative and Affective Process Analyses* (pp. 223–253). Hillsdale, N.J.: Erlbaum.
- MALONE, T. W. (1981). *What Makes Things Fun to Learn? A Study of Intrinsically Motivating Computer Games*. 6(2).
- MAYER, R. E. (2014). *Computer games for learning: An evidence-based approach*. MIT Press. <https://doi.org/10.7551/mitpress/9427.001.0001>
- MOON, J. (2004). *A Handbook of Reflective and Experiential Learning: Theory and Practice (1st ed.)*. Routledge. <https://doi.org/10.4324/9780203416150>
- NAIK, N. (2014). A comparative evaluation of game-based learning: Digital or non-digital games?. *European conference on games based learning*, 2, 437-445. Academic Conferences International Limited.
- PIAGET, J. (1962). *Play, dreams and imitation in childhood*. W. W. Norton.
- PLASS, J. L. / HOMER, B. D. / KINZER, C. K. (2015). Foundations of Game-Based Learning. *Educational Psychologist*, 50(4), 258–283. <https://doi.org/10.1080/00461520.2015.1122533>
- PLATZ, L. (2022). *Spielbasierte Förderung von Financial Literacy im Wirtschaftsunterricht*. Universität Konstanz. <http://nbn-resolving.de/urn:nbn:de:bsz:352-2-7jpidw9zh8ay2> (02.12.2025)
- REMUND, D.L. (2010). Financial Literacy Explicated: The Case for a Clearer Definition in an Increasingly Complex Economy. *Journal of Consumer Affairs*, 44, 276-295. <https://doi.org/10.1111/j.1745-6606.2010.01169.x>
- RIOPEL, M. / NENCIOVICI, L. / POTVIN, P. / CHASTENAY, P. / CHARLAND, P. / SARRASIN, J. B. / MASSON, S. (2019). Impact of serious games on science learning achievement compared with more conventional instruction: an overview and a meta-analysis. *Studies in Science Education*, 55(2), 169–214. <https://doi.org/10.1080/03057267.2019.1722420>
- RITTERFELD, U. / CODY, M. / VORDERER, P. (2009). *Serious Games: Mechanisms and Effects*. Routledge
- SALEN, K. / ZIMMERMAN, E. (2004). *Rules of play: Game design fundamentals*. MIT Press

- SCHLÖSSER, H. J. / NEUBAUER, M. / TZANOVA, P. (2011, March 14). Finanzielle Bildung. *Aus Politik und Zeitgeschichte (APuZ)*, 12, 21-27. Retrieved Dezember 2, 2025, from <https://www.bpb.de/shop/zeitschriften/apuz/33414/finanzielle-bildung/>
- SCHULTHEIS, J. / APREA, C. (2019). Entwicklung und Validierung eines Schemas zur Evaluation von Serious Games im Kontext von Financial Literacy. In E. Wittmann, D. Frommberger & U. Weyland (Hrsg.), *Jahrbuch der berufs- und wirtschaftspädagogischen Forschung 2019* (S. 93-108). Barbara Budrich. <https://doi.org/10.25656/01:18438>
- SQUIRE, K. D. (2008). Video Games and Education: Designing Learning Systems for an Interactive Age. *Educational Technology*, 48(2), 17–26.
- SUCHMAN, L. (1987). *Plans and situated actions: The Problem of Human-Machine Communication*. Cambridge University Press.
- VYGOTSKY, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.
- WILLIS, L. E. (2011). The Financial Education Fallacy. *The American Economic Review*, 101(3), 429–434.
- WOUTERS, P. / VAN NIMWEGEN, C. / VAN OOSTENDORP, H. / VAN DER SPEK, E. D. (2013). A meta-analysis of the cognitive and motivational effects of serious games. *Journal of Educational Psychology*, 105(2), 249–265. <https://doi.org/10.1037/a0031311>
- ZHONGGEN, Y. (2019). A Meta-Analysis of Use of Serious Games in Education over a Decade. *International Journal of Computer Games Technology*. <https://doi.org/10.1155/2019/4797032>

SUNA, MERVE

Universität Mannheim

Lehrstuhl für Wirtschaftspädagogik - Design und Evaluation instruktionaler Systeme

L4, 1, 68161 Mannheim

[merve.suna@uni-mannheim.de](mailto:merve.suna@uni-mannheim.de)

ORCID-ID: 0009-0003-7952-2927

APREA, CARMELA

Universität Mannheim

Lehrstuhl für Wirtschaftspädagogik - Design und Evaluation instruktionaler Systeme

L4, 1, 68161 Mannheim

[carmela.aprea@uni-mannheim.de](mailto:carmela.aprea@uni-mannheim.de)

ORCID-ID: 0000-0002-3645-0746