

Gaming for the Public Good: Unraveling the Outcomes and Challenges of Serious Games in the Public Sector

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Statements and Declarations

Ethical considerations

This article does not contain any studies with human or animal participants.

Consent to participate

Not applicable.

Consent for publication

Not applicable.

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Data availability

The datasets generated during and/or analyzed during the current study are available in the OSF repository, https://osf.io/phuxs/overview?view_only=5cd1b2a1c88548e4b2978ae75e310df4

Abstract

Serious games are increasingly recognized as low-risk and less costly environments for fostering competencies in the public sector. They are used internationally in the fields of military, policing, sustainability, citizen participation, and healthcare. When properly designed, serious games are considered feasible for encouraging learners' motivation, advancing training success, and enhancing task performance. This article reviews the current state of research on serious games for vocational training in the public sector. This article pursues the question: "What are the outcomes and challenges of the purposeful use of serious games in the vocational training of public employees and students?" Using a systematic literature review, we classified selected records concerning their applied methods, theories, outcomes, challenges, and point towards avenues for further research. Hence, we set a research agenda for the use of serious games training in the public sector.

Keywords: Serious Games, Public Sector, Vocational Training, Game-based Learning, Systematic Literature Review

Introduction

Serious games have emerged as interactive pedagogical tools in vocational training. Defining *vocational education and training* (VET) as encompassing “formal, non-formal, and informal learning that equips individuals with the requisite information and skills for the workplace” (Dahalan et al., 2023: 3), we note that the outcomes of serious games extend beyond mere engagement. They allow employees and students to engage in simulations that would be impractical to replicate in real life owing to constraints such as safety, cost, or time (Santana-Mancilla et al., 2015). An immersive learning environment fosters active participation and promotes critical thinking through experiential learning (Vigoroso et al., 2021). Serious games create an environment in which learners are empowered and engaged, which can lead to a positive change in their attitudes towards learning and personal development (Ren et al., 2024; Hu et al., 2024). By incorporating instant feedback mechanisms, serious games can further maintain learners’ motivation and encourage learners to reflect on their actions during training scenarios (Raminhos et al., 2015).

The *Gamification of education* became fashionable in 2013 (Landers et al., 2019), resulting in a fuzzy realm of different concepts and ideas. A notion of ‘gamification science’ has evolved, bringing more clarity into related concepts (Landers et al., 2018). Within gamification science, researchers have clarified definitions that distinguish between Play, (Entertainment) Games, Gamification, and Serious Games as analytical terms.

First, there is a clear distinction between *Play* and *Games*, where the first one refers to an open and unstructured approach to voluntarily engaging in just-for-fun activities (Landers et al., 2019). *Games* are defined as “a voluntary activity, obviously separate from real life, creating an imaginary world that may or may not have any relation to real life and that absorbs the player’s full attention [...] Games are played out within a specific time and place, [and] are played according to established rules” (Michael and Chen, 2006: 8).

Gamification is the process of adding game elements to non-game contexts (Deterding et al., 2011). Existing instructional methods are altered by the addition of game elements to overcome psychological barriers, enhance motivation, and improve learning experiences. Therefore, gamification is not an instructional method in itself (Deterding et al., 2011). Users can learn from a gamified environment, yet they cannot learn directly from gamification (Landers et al., 2019).

In contrast, *Serious Games* are “game[s] in which education (in its various forms) is the primary goal, rather than entertainment” (Michael and Chen, 2006: 10; Abt, 1987). They are used to

facilitate learning in several training contexts, including the government, education, business, and healthcare (Garris et al., 2002). Players can learn about certain topics interactively and engage in rule-based, fun activities. Considering the downsides of online learning, such as the lack of involvement, motivation, or high dropout rates, serious games might present a promising activation approach (Rohan et al., 2020). Serious games and *game-based learning* (GBL) are sometimes used interchangeably. According to Corti (2006), GBL is an educational approach about “leveraging the power of computer games to captivate and engage end-users for a specific purpose, such as to develop new knowledge and skills” (Corti, 2006: 1). Serious games can be a specific artifact of the GBL curriculum. In this article, we consider all kinds of games used in the VET of public sector employees and students, including digital and physical games.

Nevertheless, the serious game literature on public sector training is in its infancy. Recent public sector reviews have focused on gamification in e-service design, citizen engagement, e-government, or e-participation (Contreras-Espinosa and Blanco-M, 2021; Oliveira et al., 2022; Purwandari et al., 2019; Hassan and Hamari, 2020; Satrio et al., 2025). A recent review on VET outcomes in various fields yielded 24% public sector games, mostly in the fields of healthcare and nursing (Dahalan et al., 2023), but no core administrative tasks. Hence, the aim of this study is practical in nature. We want to summarize existing empirical evidence on how and under what conditions to design and implement successful serious games in the public sector context. This article aims to answer the following question:

What are the outcomes and challenges of the purposeful use of serious games in the vocational training of public employees and students?

We will refer to the term ‘challenge’ when deriving, summarizing, and explaining the experiences of trainers and learners during serious games’ design, play, and evaluation. Also, from our researchers’ point of view, the term ‘challenge’ is used to highlight blind spots in the literature (‘challenges to the field’). In this regard, ‘challenges’ should not be confused with challenges *within* serious games.

The next chapter provides a literature review and conceptual model on serious games in VET. Next, we describe the systematic literature search approach. The results are presented in two parts: first, a quantitative analysis of a large sample of public sector serious games using the literature as a proxy; second, a qualitative analysis of selected, relevant serious games with proper evaluation. We conclude by discussing the outcomes and challenges of serious games in the public sector and recommend future research areas.

Literature Review and Conceptual Model

Understanding Serious Games as Learning Interventions

While many gamification studies apply theoretical frameworks, such as Self-Determination Theory or Flow Theory, a consistent theory for serious games has not yet been developed (Kleiman et al., 2020). Instead, the *Input-Process-Outcome-Model* by Garris et al. (2002) proposes that *instructional content* and *game characteristics* are inputs to a recurring game cycle that triggers user judgements (e.g., enjoyment and interest), user behaviors (e.g., greater persistence), and further system feedback (Figure 1).

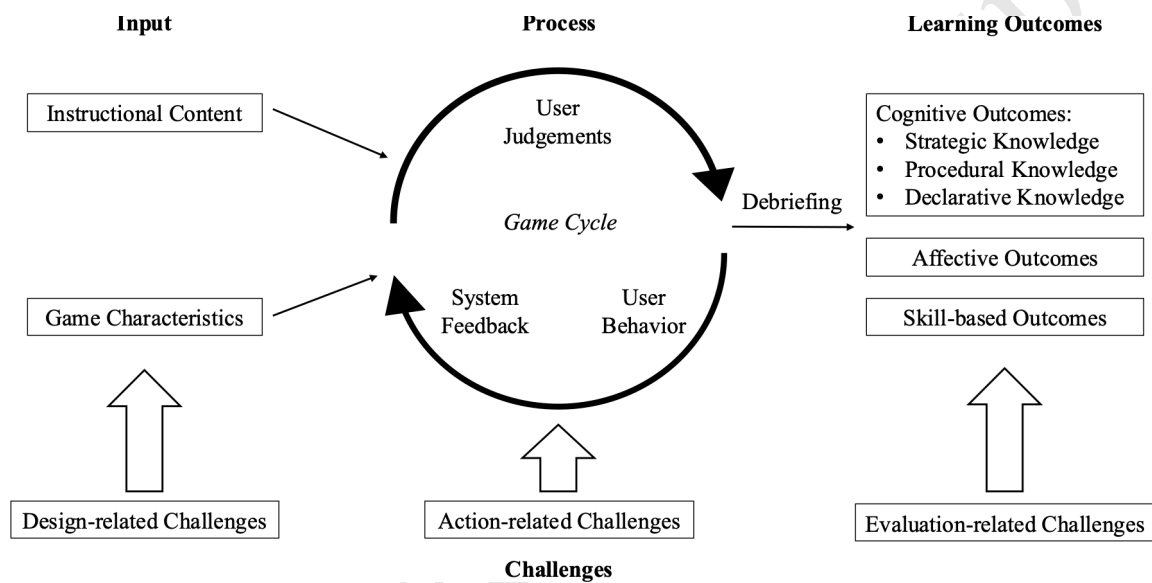


Figure 1: Input-Process-Outcome Model of Serious Games expanded with Challenges (adapted from Garris et al., 2002).

According to Garris et al. (2002), the central hallmark is that people are drawn into playing serious games almost endlessly, involving repeated judgment-behavior-feedback loops. The end state is a motivated learner who is likewise “engaged, focused and enthusiastic” (Garris et al., 2002: 444).

System feedback refers to performance in the context of a serious game. When feedback indicates that current performance does not meet established standards, learners attempt to reduce this inconsistency, resulting in higher commitment (Garris et al., 2002). Intermediate *user judgements* relate to “gameful experiences” (Koivisto and Hamari, 2019: 193). These are commonly associated with psychological experiences such as competence, autonomy, relatedness, enjoyment, and engagement during gameplay. The affective judgements formed from ongoing gameplay regulate the direction, intensity, and quality of *user behavior* (Garris et al., 2002).

Further, the *learning outcomes* of serious games depend on a ‘*debriefing*.’ Although the model implies that serious games ‘cause’ learning by providing instructional content directly to the learner, active and thoughtful reflection with an instructor assists in revisiting the educational objectives and framing them towards real-world phenomena (Landers, 2015). Debriefing involves a description of events that occurred, an analysis of why they occurred in the game, and the discussion of learners’ mistakes (Garris et al., 2002). Hence, debriefing is not part of the game cycle but an essential part of the overall game session.

Finally, learner engagement may lead to the expected *learning outcomes*. Garris et al. (2002) differentiated learning outcomes as cognitive, affective, and skill-based. Whereas *skill-based outcomes* refer to purely technical skills (e.g., accrual accounting), *affective learning outcomes* primarily focus on attitudinal changes. *Cognitive outcomes* are characterized as declarative, procedural, or strategic. Declarative knowledge is purely informational, procedural knowledge refers to the know-how of performing a certain task, and strategic knowledge provides a greater understanding of the underlying principles in novel situations (Garris et al., 2002).

In addition, serious games emphasize peer interaction for social learning. Multiplayer games involve ways to increase interaction, such as group size, distribution of resources, careful design of situations, common objectives, and different roles (Wendel et al., 2010). Yet, learning from peer interaction depends on the involvement of the whole group because unequal participation leads to frustration (Johnson and Johnson, 1999). Equal peer interaction strengthens cooperation between the learners and reinforces learning through the collective construction of meaning, based on the process of sensemaking (Weick, 1995).

Expanding the Model: Challenges of Serious Games

According to Troyer (2017), three essential elements are necessary for a serious game approach: (1) Knowledge about the topic to be taught (i.e., public administration), (2) knowledge about games and game technology, and (3) knowledge about psychology or pedagogy. Since the original Input-Process-Outcome-Model provides a conceptualization for the first part of our research question (outcomes), we expanded the model by incorporating and linking challenges that can occur during game design (input), play (process), and outcome (evaluation), as defined before.

Design-Related Challenges: Considering the Public Sector Context

A meta-analysis by Hamari et al. (2014) found that the long-term success of games depends on various factors, including the fit of the game characteristics to the target group and context. In particular, serious games must be developed carefully and elaborately (Klapztein and Cipolla,

2021). Public sector organizations may struggle to identify serious games that align with specific learning objectives and training needs (Rotter et al., 2022; Ghannem, 2014).

Specific administrative cultures could make GBL more difficult, and this context is yet to be researched with regard to serious games (Harviainen and Hassan, 2019). Prior research on gamification in civic engagement platforms has highlighted that public administration cannot be treated as a neutral context for game-based interventions (Hassan, 2017). Anecdotal evidence suggests that public administration employees show some reluctance towards gaming (Stubbé et al., 2014). Yet, this assumption can be challenged, as recent studies have identified a gaming-savvy group among public employees as well (Gießmann et al., In Press). Therefore, the concept of *player types* has gained traction, especially with frameworks that classify players based on their motivations, play styles, and preferences within gamified systems (Klock et al., 2020).

Action-Related Challenges: Making Serious Games Motivating

Unlike entertainment games, serious games are not necessarily intrinsically motivating (Yi et al., 2020), particularly in VET contexts. According to Landers (2015), many reviews and research designs compare gamified and non-gamified learning contexts and imply that any use of gamification in education—regardless of the specific *game elements* employed—will lead to positive outcomes for learners. Yet, he argued that this assumption is incorrect. Player motivation research suggests that individuals engage in games for different reasons and in different ways (Hamari and Tuunanen, 2014). This has direct implications for game design, as different game genres and characteristics within the same game appeal to different player types (Jimenez et al., 2019).

To account for these characteristics, GBL should recognize the employed game elements instead of the game itself (Landers, 2015). According to Toda et al. (2019), a wide range of game elements are used to make a GBL approach more motivating. They can be grouped along five dimensions: The first dimension, '*performance*,' refers to the feedback that learners receive when they have completed an action. The second dimension, '*ecology*,' refers to the environment created by gamification. Some games contain additional *social* components designed to strengthen interactions between players. Social embedding can be characterized by (1) competition with each other, (2) cooperation, (3) reputation in the form of titles or social status, and (4) peer pressure. Fourth, games contain an important *personal* component that encourages users to enjoy engaging with the content. The fifth dimension refers to the *fictional* element in which the environment and players are integrated. Those dimensions can help to explain why players perceive a serious game as motivating.

According to Landers (2015), serious games contain a mixture of all game elements and not a limited selection as in gamification. Different genres of serious games have emerged, based on the weighting of those game elements. Dimitra et al. (2020) propose seven genres implemented in serious games: (1) memory games, (2) simulation games, (3) interactives, (4) quizzes, (5) puzzles, (6) strategy games, and (7) reality testing games. Reality testing games are a genre in which players both see and interact with a virtual world, imagined or real, for example via VR (Dimitra et al., 2020).

Evaluation-Related Challenges: Measuring Game Effectiveness

To evaluate the effectiveness of a serious game, the evaluation strategy must be clear from the outset. The Kirkpatrick model breaks training evaluation into four levels: (1) reaction, (2) learning, (3) behavior, and (4) results (Smidt et al., 2009; Kirkpatrick, 1996). The distinction is valuable because serious games trigger (1) positive reactions through favorable experiences. If the serious game itself is not deemed relevant by the learners in the first place, instructors must stop and adjust the game design. Relying on pre- and post-test measures, (2) learning refers to the degree to which the target audience acquired the expected skills. (3) In contrast, behavior measures the degree to which the target audience performs the critical behaviors in its environment. Finally, (4) results measure the degree to which targeted organizational outcomes occur because of an initiative (Smidt et al., 2009). Most serious game evaluations seem to target initial stages of the Kirkpatrick model (Aster et al., 2024).

This section outlined the conceptual model guiding the literature analysis. First, we will apply coding towards the introduced taxonomies (e.g., Toda et al. (2019)) to allow for a mapping of the field. Second, we will qualitatively summarize selected serious games and their outcomes and challenges.

Methods

For public administration research, George et al. (2023) call for a more practical view on literature reviews centered on purpose (Why?), object (What?), subject (Who?), and community (For whom?), and practices (How?). As Van Eck (2006) argued, not all serious games are good for all learning outcomes, which is why research needs to show why serious games are engaging, effective, and how (when, with whom, and under what conditions). Therefore, this review attempts to broadly map and describe the body of literature for practical reasons and in a narrative manner.

In the first step, we defined keywords for the phenomenon of interest, ‘serious games’ and ‘game-based learning’ in a public sector context (see **Error! Reference source not found.**). Besides those two apparent terms, we added related terms such as ‘simulation games,’ ‘business games,’ ‘scenario-based learning,’ and the older term ‘edutainment.’ The keywords were combined into a search string, and wildcards were added to account for slight variations in spelling.

In the second step, we queried academic databases (Web of Science, Scopus, IEEE Xplore, ACM Digital Library) using the search string. The databases index the top 15 public administration journals according to Google Scholar in 2025 (GIQ, JPART, PAR, PA, ARPA, PMR, RoPPA, IPMJ, IRAS, Governance, IJPA, AAS, P&S, PSJ, PPMR).¹ We ensured the databases contained teaching journals such as TPA, JPAE, JPSE, and S&G. The latter two databases include leading conferences in the e-government and human-computer-interaction domains, which might contain serious games studies in the public sector as well. In all databases, we searched within the title, abstract, and keywords. We included peer-reviewed studies. Because of the authors’ language competencies, studies written in English and German were considered. If possible, we excluded retracted publications directly from the database query. The timeframe was open-ended, and queries were performed on 2025-10-16.

¹ https://scholar.google.com/citations?view_op=top_venues&hl=en&vq=soc_publicpolicyadministration (last accessed: 07.03.2025)

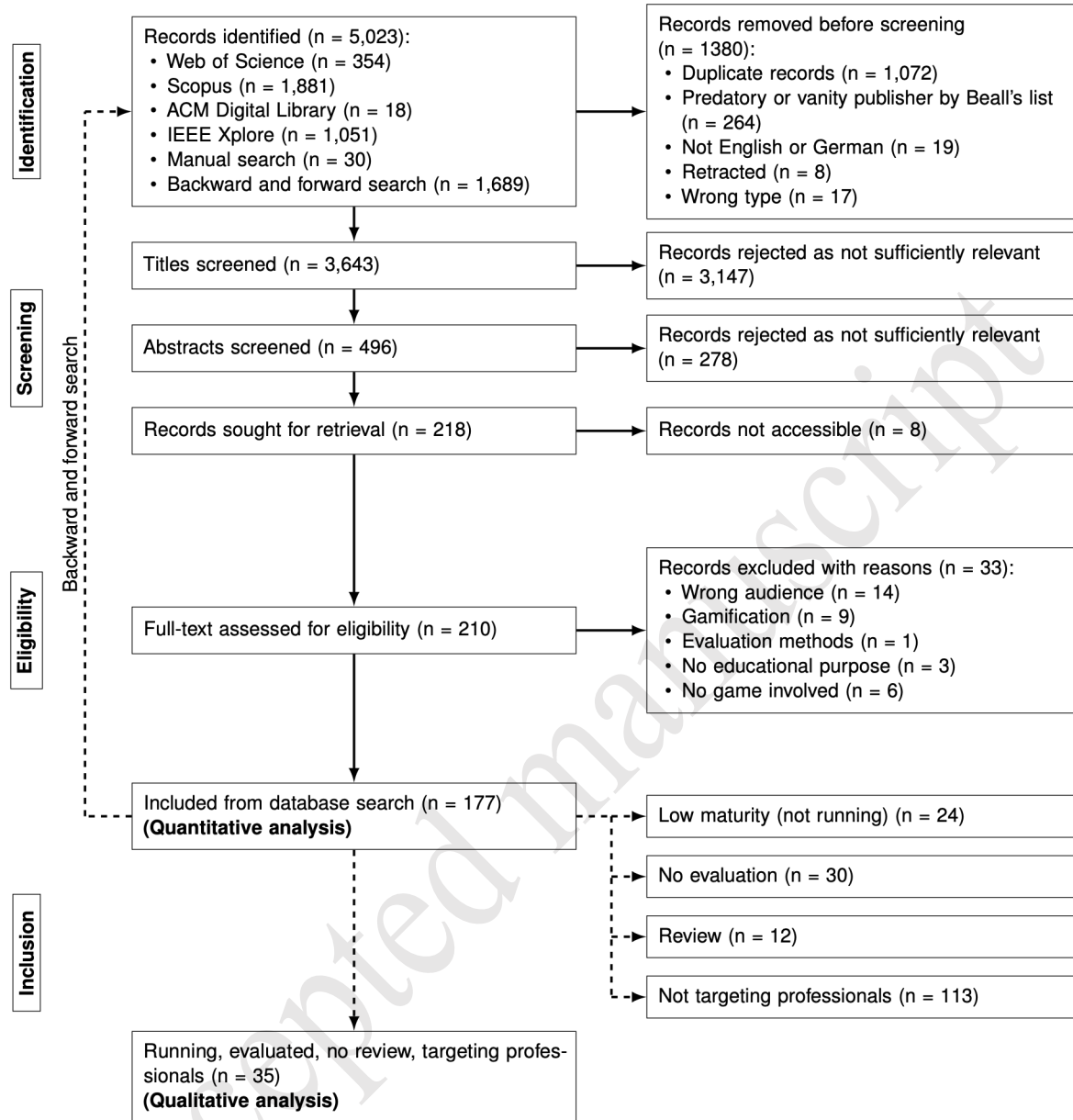


Figure 2: Flowchart of the Literature Search (adapted from Page et al., 2021).

The following screening steps were documented based on the PRISMA guidelines (Figure 2). We obtained the highest initial hits on Scopus ($n = 1,881$) and IEEE Xplore ($n = 1,051$). Fewer studies were found via Web of Science ($n = 354$) and ACM Digital Library ($n = 18$). During the review phase, 30 records were added manually.² Backward and forward searches were performed in the first round on the included studies using the *citationchaser* R package (Haddaway et al., 2022), resulting in 1,689 additional records. We performed automated deduplication, removal of predatory and vanity publishers by Beall's list³, removal of non-English and non-

² The manually added records are a result of previous studies and largely overlap with the database queries (removed during deduplication).

³ <https://bealllist.net/> (last accessed: 14.05.2025)

German records, retracted records (by keywords such as “RETRACTED” in the title), and records that were not empirical (e.g., editorials).

The resulting records were screened by title ($n = 3,643$) and abstract ($n = 496$). We observed that the term ‘gaming’ was often used in public administration literature to describe when an employee circumvents rules. The economics literature used the term in the context of game theory, and addiction research has used it in the context of ‘gambling.’ We removed studies that were not related to the phenomenon of interest. The screening phase yielded 218 records, of which eight were not accessible to us, resulting in 210 records for full-text screening.

During full-text screening, we excluded 14 records targeting the wrong audience (i.e., no public employees or students in programs that typically enter public administration). Nine records were excluded because they used gamification approaches instead of serious games.⁴ One record is an evaluation framework for serious games. Three records used a simulation game without educational purposes, such as for decision support. Six records involved no game elements. The distinction between entirely digital games and physical games often appears ambiguous (e.g., using a digital blackboard in a classroom setting). Instead, we opted for a more fine-grained understanding of the digital and physical game elements. Both are within the scope of this review. This resulted in the inclusion of 177 records covering serious games in the public sector.⁵

Further analysis of the 177 records proceeded in two parts: (1) During the full-text screening, we extracted information about serious games using the categories defined in Table 1. These categories cover a wide range of information regarding games’ design and players. With this information, we can quantitatively map the body of literature on serious games in a public-sector context. (2) Using the categorized records, we filtered records that were not reviews, those describing serious games in action and that had been evaluated, and those targeting (among others) professionals ($n = 35$). These records were read in full, and information was extracted in vivo by the authors, focusing on the theoretical foundation, evaluation methods, outcomes, and challenges, aligning with the conceptual model. The authors extracted the information independently, compared the results, and complemented each other.

⁴ We included the keyword “gamifi*” in the search string, because sometimes the concepts of gamification and serious games are used interchangeably. Also, this wildcard captures papers containing any kind ‘gamified’ approaches, sometimes a fully-fledged serious game.

⁵ A full list of the 177 records can be found at <https://osf.io/phuxs/overview?view=5cd1b2a1c88548e4b2978ae75e310df4> (anonymous link).

Table 1: Categories Extracted During Full-Text Screening.

Category	Details
Name of the game(s)	-
Game mode	Singleplayer, Multiplayer
Location of play	Online, Co-located or Blended ⁶
Competitiveness	If game mode was multiplayer: Competition or collaboration among players
Content	-
Country	Country in which the playtesting was carried out
Audience	In training (students), In training (high school students), Professionals
Field of study	For student audiences
Game genres	Memory games, Simulation games, Interactives, Quizzes, Puzzles, Strategy games, Reality testing games (Dimitra et al., 2020)
Maturity	Proposal, In Development, Running,
Development	If no proposal: Self-developed, Off-the-shelf, Customized
Player types	Any kind of player type taxonomy mentioned, e.g. Bartle's HEXAD, Gamer Motivation Model or BrainHex
Game elements	For self-developed games typically created by the authors, e.g., a video-game, roles, timer, dice, scenarios, etc. Extracted from the records as worded by authors (in vivo).
Game elements (categories)	Game elements categorized within the gamification taxonomy of Toda et al. (2019: 6)
Fun	Any mentions of what makes the game enjoyable for the players.
Review	Indicates whether the record is a review of multiple serious games

In the next section, we present the results of the analysis by first mapping the body of literature on serious games in a public-sector context and, secondly, analyzing selected serious games based on the conceptual model.

Results

Mapping the Field

In the following, we report on the extracted information from full-text screening of 177 records of serious games in a public-sector context in a quantitative manner.

⁶ Online formats are played entirely remotely via the Internet, co-located formats require participants to interact face-to-face in the same physical space, and blended formats integrate both remote and face-to-face sessions.

First, Figure 3 illustrates how the records evolved, showing that the topic of serious games in the public sector emerged in the late 1960s through the late 1990s, and began slowly evolving in the 2000s. Currently, this topic has gained traction, frequently reaching 10 or more records per year.

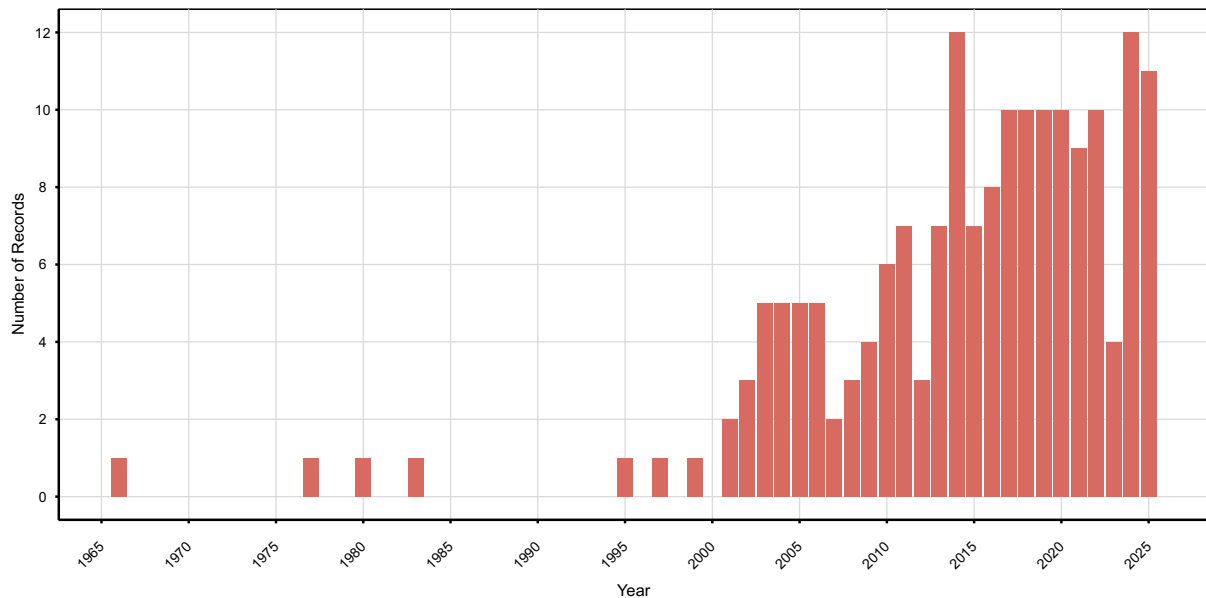


Figure 3: Records over Time (N = 177 Records).

Most research on serious games is published in teaching journals. Within those, the majority of records stem from political science or international studies outlets (with JPSE being the clear leader with 29 records). This is followed by teaching journals in the discipline of public administration (JPAE: 10, TPA: 8), and the generic S&G journal ($n = 7$). Individual studies can be found in specialized journals, such as crisis management (JCCM: 2), geography (JGHE: 2), and safety science.

Concerning the maturity of serious games in the records, most are running at the time of publication ($n = 153$, 83%). Approximately 7% of the games are in development ($n = 13$) or proposals ($n = 12$). A small fraction of the games is discontinued ($n = 6$, approx. 3%).

Simulation games dominate the game genres, accounting for 160 records. This suggests that the realistic modeling of complex ‘wicked problems’ is the primary focus of serious games in the public sector. Relatedly, strategy games represent the second most selected game genre ($n = 32$). Minority genres include board games ($n = 8$), interactives ($n = 5$), reality-testing games ($n = 4$), quizzes ($n = 3$), and puzzles ($n = 2$).

Most serious games are self-developed ($n = 133$), meaning that they were custom-built from scratch for a specific learning purpose. Commercially available “off-the-shelf” games were the

least represented ($n = 19$). In 22 records, commercial games were customized for learning purposes, mostly simulations (e.g., a city-building game) that were modified through custom scenarios.

Multiplayer game modes dominate ($n = 151$, 80%). 38 (20%) records were built based on a single-player experience.

Most of these multiplayer games are played in a co-located setting ($n = 116$, 71%), indicating a strong preference for face-to-face interaction. Online settings account for 19.5% of the records. Hybrid or blended modes, involving both co-located and online sessions, remain a niche area with 13 records (8%).

To investigate whether multiplayer modes are used to foster competitive or collaborative behavior, we analyzed the competitiveness required by the serious games. Most records integrate both collaborative and competitive elements (mostly collaboration within a group and competition between groups), accounting for 54% of the records. Collaboration ($n = 55$) is favored over competition ($n = 15$).

For the audience, 68% of serious games target individuals in training to become public sector personnel in the future (typically students but also apprentices). This may be related to a student sample bias, which is known in different areas of social sciences. Yet, a considerable number of games ($n = 64$) address professionals working in the public sector.

Given the large number of extracted game elements, we present them in a co-occurrence map (Figure 4). The size of each dot indicates how often the game element appears in serious games in a public sector context. Proximity between dots indicates elements that appear together in serious games. The elements show that serious games in this context are driven by high-fidelity simulation instead of the often-criticized points, badges, and leaderboards (PBL) approach (Chou, 2019). At the center of the map, the high frequency and central positioning of Roles, Scenario, and Documents suggest that the ‘core’ revolves around replicating bureaucratic environments and decision-making. The spatial distribution further reveals a functional split: the upper-right quadrant leans towards digital administrative tools (e.g., Spreadsheet, Email, Video conference), while the top-left quadrant maintains a cluster of analog tabletop mechanics (e.g., Dice, Tokens, Playboard, Cards). Interestingly, the peripheral placement of elements such as AR Goggles and QR Codes indicates that while cutting-edge technology and extrinsic rewards exist in the games, they remain secondary to the primary goal of modeling complex social and procedural systems within the public sector.

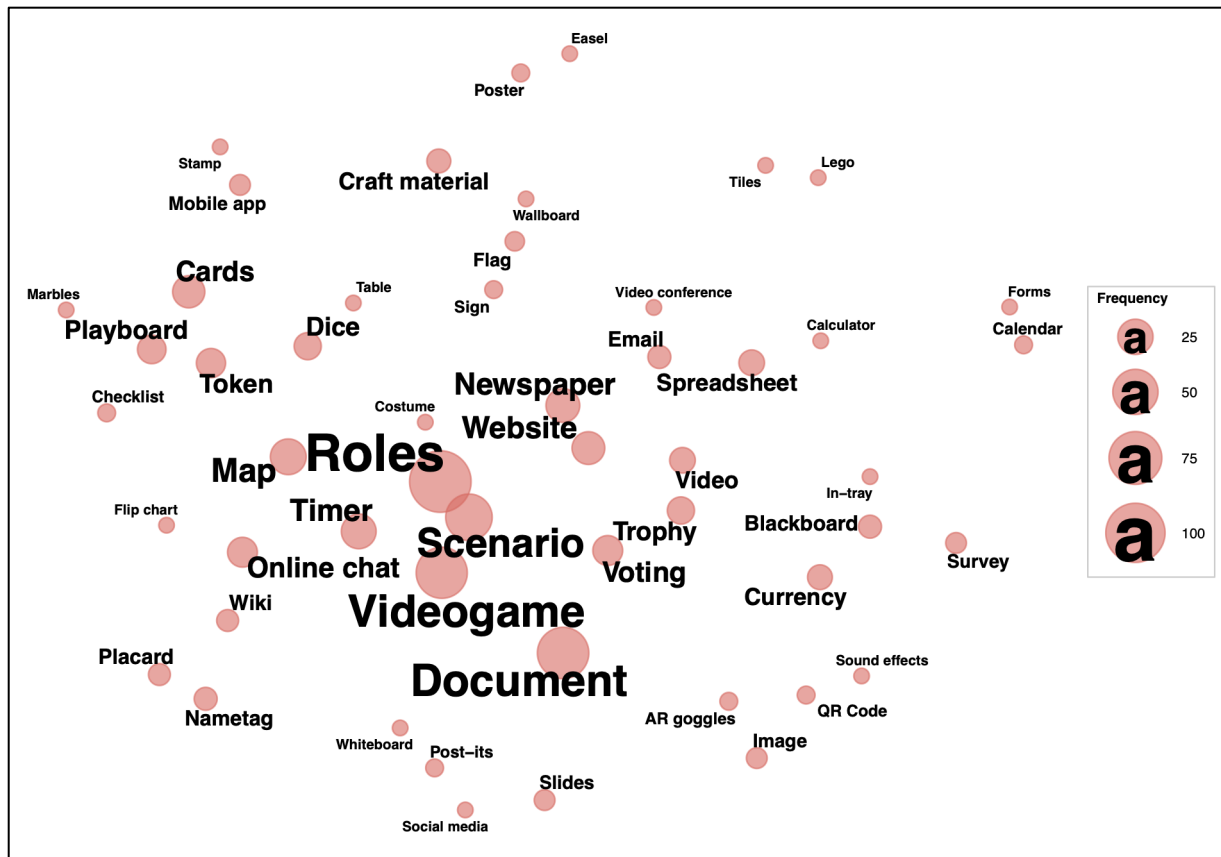


Figure 4: Game Elements in Records (N = 175 Games).

Note: The map represents a t-SNE projection of co-occurring game elements in records.

We display the game elements categorized in the taxonomy by Toda et al. (2019) as a polar chart (Figure 5). The chart shows the dominance of fictional and social dimensions, whereas performance elements are underutilized. Storytelling is the most frequent game element ($n = 76$), followed by competition ($n = 46$) and cooperation ($n = 16$). This suggests that serious games in this sector rely heavily on immersion in narratives and social dynamics to engage players.

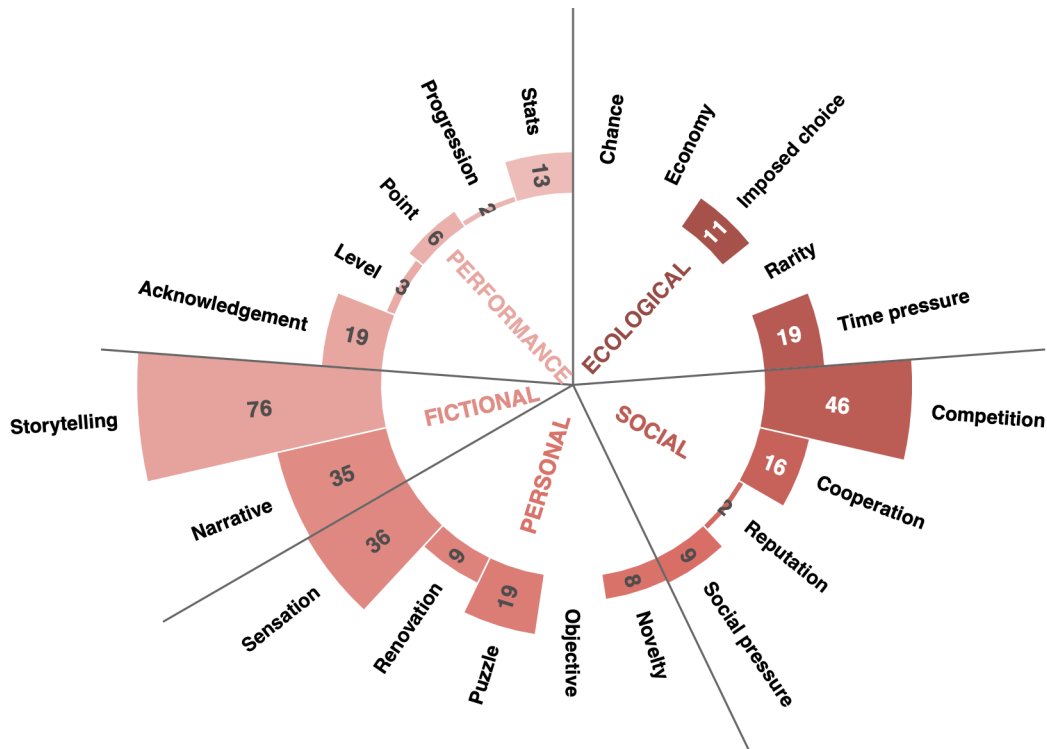


Figure 5: Game Elements in Records in the Taxonomy of Toda et al. (2019: 6) (N = 140 Games).
Note: Records lacking fun element details have been excluded.

Outcomes and Challenges

The second part of the analysis is conducted with the final sample of 35 cases. Most of the games reviewed were conceptual cases that represent preliminary prototypes tested with a small number of learners. The sample sizes ranged from twelve to approximately 300 participants (see A2: Sample of Serious Games). Of the 35 cases covered, 20 dealt with purely professional samples, four dealt with administrative graduate program students, and eleven were mixed samples, which included practitioners and graduate students alike.

Outcomes of Serious Games

Cognitive Outcomes: Strategic Knowledge

Among the 35 cases reviewed, 23 reported improvements in the shared *understanding of complexity*. For example, ‘3P Challenge’, a serious game aimed at public-private concessions, facilitated the reflection on overbudgeting from different angles and stimulated the experience of inherent conflicts (Benitez-Avila et al., 2022). The ‘Castlemount Simulation,’ a case for teaching pressure interest group activities, fostered a sense of government tasks and interdisciplinary work (Berridge and Clark, 1980). ‘Gaming the system,’ a game aimed at the dynamics of a hospital performance management system, provided attitudinal benefits like accepting the contingency of stakeholder conflicts (Douglas et al., 2019). A serious game designed to educate

personnel about open data shows significant promise in enhancing public employees' understanding of complex topics such as data management (Di Staso et al., 2021).

A relief camp design game according to the WHO guidelines not only improved the organizing strategies of participants, but also upgraded the guidelines themselves and led to *strategic reflections* by the WHO (Aslam et al., 2017). Similarly, P-Cube—a serious game platform that helps students learn about how decisions are made in the public sphere—enabled students to engage with content actively, fostering *critical thinking*, *problem-solving*, and again complexity (Kamkhaji et al., 2025).

Cognitive Outcomes: Procedural Knowledge

Procedural knowledge arises from the realism of the respective game and the preparation of the target group. The more *experienced* the target group, the higher their expectations with respect to the 'realness' of the presented scenario (Berridge and Clark, 1980). By contrast, inexperienced groups suffer from a lack of knowledge and need more preparation beforehand (Haferkamp et al., 2011). Emergency management games have shown significant differences between experienced and inexperienced groups in terms of their interactions and communication skills (Haferkamp et al., 2011; Correia Pereira et al., 2025). When comparing professional and graduate communication, experienced professionals communicated more efficiently, in a more structured manner, and more calmly. Yet, the learning outcomes of inexperienced groups are far-reaching, and they benefit from structured debriefings.

'Sim-MANA,' a roleplay on flooding science communication, improved the understanding of scientific modeling and *decision-making processes* (Taillandier et al., 2025). 'HurricaneLog,' a simulation of hurricane preparedness, triggered timely response strategies among the participants, elevating their *response time* during different stages of the game (Correia Pereira et al., 2025).

Cognitive Outcomes: Declarative Knowledge

Four studies provided pre- and post-test surveys in which declarative knowledge gains were tested. For example, a digital game to learn about the benefits and pitfalls of open data generated better knowledge and a greater willingness to practice *open data* in the government (Kleiman et al., 2022). Likewise, a multiplayer game about EU *climate policy* generated different climate governance maps among players before and after attending the game (Haug et al., 2011). A simulation of tax increment finance policies taught students about every aspect of *tax* increment finance district planning (Jolley and Klatt, 2018).

In contrast, ‘TeachLivE,’ a VR law enforcement training, did not produce significant knowledge gains in *comparison* with other direct teaching approaches (Kent and Hughes, 2022). Altogether, six games in the sample were compared with traditional training formats. Of this small group, four comparisons yielded motivational gains or skill improvements. Given the extraordinary effort of developing a serious game, the lack of comparison skews the scientific value of the prevailing empirical results.

Affective Outcomes

Another notable benefit of serious games is their effectiveness in improving *teamwork* in professional environments. Of the 35 cases reviewed, 17 provided evidence for social learning, such as understanding each other’s roles and struggles, facilitation of cooperation, consensus building, teamwork, trust building, learning from each other’s experiences, and cross-agency learning. The ‘3P Challenge’ stimulated reflections about overbudgeting of projects, engaging with private stakeholders, and group interactions (Benitez-Avila et al., 2022). Likewise, ‘gaming the system’ provided room for appreciating the complexity and diversity of performance management and the pathways taken by different players (Douglas et al., 2019). Communication training for crises and emergencies is perceived as beneficial in terms of group communication and communication strategies. Climate policy negotiation games were perceived as beneficial for realizing the different agendas of stakeholders, their resources, and power interests. In the case of urban land use planning, some scenarios were perceived as *time-consuming* and unnecessary because of additional negotiations and a *large group*.

Furthermore, the immersive nature of serious games can lead to significant psychological benefits, such as reduced anxiety regarding skill acquisition. Structured scenarios in which players must cooperate to achieve objectives allow users to practice the necessary skills in a *low-risk environment* before applying them in their actual work settings. Additionally, a playful environment encourages learners to take risks and mitigates performance-related anxiety (Fitzgerald et al., 2018). Simulated environments allow learners to experience situations that cannot be approached in the real world because of safety, cost, and time (Corti, 2006; Di Staso et al., 2022; Hendrix et al., 2016). ‘The regulation crash test’ is a particular example in which such a risk-free environment was adopted for policy design (Olejniczak et al., 2018). The game allowed learners to observe the full course of events triggered by regulation, demonstrating the consequences of participants’ decisions that, in real life, would occur with a long delay. ‘ANYCaRE,’ a role-playing game to investigate crisis decision-making, raises awareness of how decision makers interact with scientific and operational outputs to better anticipate and respond to extreme weather events (Terti et al., 2019). The game aroused the enthusiasm of

participants and offered a protected environment to try out emergency actions without facing true risks to human life.

Serious games also proved effective in changing learners' attitudes. For example, 'Databelt' and 'Winning Data,' two games about handling open data in governmental institutions, facilitated innovative risk-benefit approaches and shifted the overall attitude towards data transparency (Kleiman et al., 2022).

Skill-Based Outcomes

Skill-based improvements were explicitly mentioned in 19 out of 35 cases. Yet, these have seldom been systematically evaluated or compared with other teaching methods. The available evidence therefore points to several promising skill-based outcomes while remaining inconclusive about the relative effectiveness of serious games.

Several cases reported improvements in participants' skills to perform specific *professional tasks*. Serious games supported the development of relief-camp planning skills (Aslam et al., 2017), negotiation and management skills among technical experts (Berridge and Clark, 1980), and the ability to formulate tax increment finance district proposals (Jolley and Klatt, 2018). Disaster communication training also improved participants' communication skills by strengthening their ability to evaluate contextual information rapidly (Haferkamp et al., 2011).

Other cases demonstrated *performance improvements within the game environment*. Participants became more effective at balancing operational indicators such as response times, active demand ratios, operating costs, and preparedness investments during hurricane response exercises (Correia Pereira et al., 2025). Similarly, participants in a rural transportation simulation improved their in-game performance over time while exploring the consequences of regulatory changes under conditions of bounded rationality (Olejniczak et al., 2018). Such findings indicate learning during gameplay, although it often remains unclear whether these skill improvements transfer to real-world settings.

A further group of cases emphasized *interpersonal skills*. Crisis-management games supported the development of collective organizational memory by allowing participants to question established norms and strategies in a safe-to-fail environment (van Laere and Lindblom, 2019). Role-playing exercises also strengthened collaboration skills among meteorological services, civil-protection authorities, and private electricity providers (Terti et al., 2019).

A multiplayer law-enforcement simulation increased participants' awareness of autistic citizens' behavior (Kent and Hughes, 2022). This suggests that serious games may be particularly

suitable for experiential and perspective-taking skills that are difficult to achieve through direct teaching.

Despite the predominantly positive findings, evidence of superior skill development remains limited. Although the law-enforcement simulation increased awareness of autistic behavior, it did not produce significantly greater improvements in technical skills than direct teaching (Kent and Hughes, 2022). More generally, several studies assessed performance within the serious game instead of the transfer of skills to real-world settings. Others reported faster task completion, increased idea generation, or improved collaboration without establishing whether these outcomes persisted after the intervention.

Challenges to Serious Games

Despite the evident advantages, some studies acknowledge the challenges associated with incorporating serious games into VET in the public sector.

Design-Related Challenges

Different *administrative cultures* were considered in the games, such as Weberian bureaucracy in Germany (Becker et al., 2020; Fuchs and Kirstein, 2024), PPP in the Dutch context (Benitez-Avila et al., 2022), federalism (Ogonek et al., 2020), and lower hierarchy in Swedish municipalities (van Laere and Lindblom, 2019). The institutional context is a frequently mentioned real-world problem that is portrayed in the games, including aspects such as risk aversion (Di Staso et al., 2021), EU country interests (Haug et al., 2011), legalism (Kleiman et al., 2020), silos (Klievink and Janssen, 2010), accountability (Little et al., 2015), or city rivalry (Mayer et al., 2004).

Throughout the review, the *realism of the content* was perceived as crucial for the success of serious games. For example, a simulation on performance management had to transfer research insights into binary algorithms (Douglas et al., 2019). Because of the game's character, many external factors (e.g., from politics or economics) are often neglected in the simulation but cannot be disregarded in practice. Contrary to the fun elements of gaming, public service ethos prioritizes integrity, accountability, and fairness over personal gain and satisfaction (Horton, 2006). Some games like 'DREAD-ED' were challenged because the scenario was too far from reality and not capable of displaying the diversity of responsibilities in real-life disaster communication (Haferkamp et al., 2011). Yet, adding more details (realism) can make the results less generalizable. In a regulation crash test game, realism and playability were difficult to balance (Olejniczak et al., 2018). Professionals were unlikely to participate in game sessions longer

than 1.5 days. This also limited the number of scenarios to be tested before the game frustrated the players.

In some simulations, the data for the game could be estimated because *real data were too sensitive or not available* owing to confidentiality reasons. Therefore, designers had to rely on artificial data. Similarly, gaming platforms must be tailored to meet the public sector demands. For some topics, such as flooding, it was difficult to acquire test participants because of the *low perceived relevance*.

An essential part of designing a serious game is paying close attention to the target group. For ‘relief camp manager,’ the researchers had to recognize the learners’ lack of familiarity with relief camp design training (Aslam et al., 2017). In contrast, ‘the Castlemount simulation’ dealt with a group of skilled technicians who were skeptical towards the given information and its accuracy (Berridge and Clark, 1980). The choice of serious games to be offered must be appropriate to the *level of knowledge and skills of the learners*, and to stimulate their interest in the subject and type of reasoning. In one hazard-related game, the meteorological information presented was difficult to analyze without expertise (Kamkhaji et al., 2025). Yet, recruiting experts to participate in a serious game reduces the sample size and may contradict the original purpose.

Some challenges are also related to the *instructors and their points of view*. Particularly in the public sector, teams suffered from perfectionism or time pressure, data gaps, and a lack of definition of ‘good enough’ for the serious game. Instructors also need to be clear about a set of learning objectives. In addition, public service objectives are often ambiguous and conflict-ridden (Rainey et al., 2021). In some cases, instructors struggle with the compression of complexity or modeling of wicked problems (Meier and Duke, 1966). In role-playing games, role definitions need to be detailed, which takes time to prepare.

Action-Related Challenges

Although fun/enjoyment during the gameplay is important for learning outcomes, related *experiences were barely measured* in the records. 13 of the reviewed cases reported motivational benefits, high involvement, or strong engagement with the respective games. For example, gaming simulations for urban planning in the city of Bottrop stimulated creative thinking among participants regarding innovative indices for climate adaptation (Fuchs and Kirstein, 2024). A serious game on EU climate policy was positively evaluated in terms of the experience and design of the exercise, which, according to the interviewees, had brought about a different kind of interaction (Haug et al., 2011). P-Cube was judged as enjoyable, complex, realistic, and

helpful by 75% of 241 participants (Kamkhaji et al., 2025). VR law enforcement training generated more positive participant responses than traditional methods (Kent and Hughes, 2022).

Some challenges are related to players' *skepticism*. Top civil servants are often characterized as risk-averse and powerful elites who prioritize expertise and seriousness (Van der Wal, 2014). In the public sector context, instructors must pay close attention to certain status groups and their elite dynamics. During a crisis management game, top civil servants thought they did not need any training, or they were reluctant to participate in gaming in general because they felt that it did not fit their serious job descriptions (van de Ven et al., 2014).

Some agency representatives were also *difficult to recruit* in the first place. Some in-game challenges had to do with the artificial situation, such as losing the learning focus because of too much fun or unrealistic risk behavior (Ogonek et al., 2020). In collaboration games, participants spent too much time finding perfect solutions instead of moving forward, and many discussions led to *disagreements* or *fear of more work after the game*. Some games suffer from a *lack of digital literacy, role ambiguities, privacy issues, and negative attitudes*. For example, 'HurricaneLog' had to exclude some learners because of inactivity or because they did not understand the functionalities (Correia Pereira et al., 2025). Land-use planning games have led to unconventional findings because of their non-binding character. For 'DREAD-ED,' crisis managers and the student sample evaluated the assignment of specific roles to the players negatively (Haferkamp et al., 2011). It was too difficult to remember the specific function of each role. In addition, the participants stressed the focal role of the instructor in assisting the team and communication process. 'P-Cube' also emphasizes the specific role of the instructor who selects the games according to both the interests and competency levels of the students attending (Kamkhaji et al., 2025).

Some challenges are also related to in-group behavior. Some serious games suffered from unfamiliar roles or *dominant participants*. For example, the scientific communication roleplay suffered from single participants who dominated the discussion, went off-topic, or had personal opinions (McEwen et al., 2014). A simulation of an emergency response system lacked creativity because of a narrow scenario and *language barriers* among the participants (Mendonça et al., 2006).

Evaluation-Related Challenges

Evaluation-related challenges focus on the evaluation methodology for the serious game, its acquired data, and its limitations. Most studies have used qualitative evaluations of a single

conceptual case. In 34 of 35 records, the results were captured by a survey. Four records compared the test scores before and after attending the game sessions.

Observational measures such as in-game behavior and scores were captured in ten games. Three out of the 35 games used experimental groups to compare the different teaching methods. The theoretical approaches, experimental designs, and thorough evaluation methods rarely overlap. Many studies lack data on either user judgements (e.g., motivation, fun) or cognitive or behavioral outcomes. For instance, a mobile augmented reality study in Oman captured motivational differences (Al-Amri et al., 2023), but did not examine learning outcomes. ‘Road to settlement’ lacked any transparent evaluation criteria (Asgary et al., 2024). ‘Relief camp manager’ was analyzed by competitive test results and a qualitative survey evaluation (Aslam et al., 2017). Yet, the sample size was small ($n = 30$), lacked a theoretical approach, and did not include a control group. ‘3P Challenge’ accounts for 39 participants in two rounds, and was qualitatively evaluated, accompanied by a review of the gaming results (Benitez-Avila et al., 2022). Yet, researchers admit that the evaluation lacks external validity because of the controlled setting, small sample, and simulation of risks. For ‘the Castlemount simulation,’ outcome data were qualitatively reported (Berridge and Clark, 1980). ‘Gaming the system’ was focused entirely on the strategies and reflections of the participants (Douglas et al., 2019).

One notable exception is ‘HurricaneLog,’ which thoroughly reported in-game performances and actions (Correia Pereira et al., 2025). In addition, players had to complete a survey assessing their educational level, background expertise in humanitarian logistics, and prior gaming experience. ‘HurricaneLog’ is the only case that distinguishes between player types like hardcore, midcore, and casual gamers. Yet, data on learners’ in-game motivations were missing, and there was no control group.

In contrast, ‘Winning data’ relies on survey responses and a thorough theoretical approach concerning attitudinal changes towards using open data (Kleiman et al., 2022). The quasi-experimental design captures ex-ante and ex-post survey measures (without a control group), making it difficult to isolate bias from researchers and supporting organizations. The evaluation method did not account for the effectiveness of the KPIs or behavioral effects.

The study by Haug et al. (2011) evaluated 12 participants’ learning of EU climate policy based on ex-ante and ex-post surveys, leading them to conclude that no learning had taken place. Yet, this finding is not generalizable, and the lack of a control group prevents them from controlling for the learning effect exerted by evaluation instruments. ‘P-Cube’ was qualitatively evaluated by both instructors and students (Kamkhaji et al., 2025). Nevertheless, the results are merely

descriptive, and they are not methodologically robust because the game has been used in various teaching environments. The evaluation of law enforcement training in Mount Dora distinguishes between several groups that participated in different training methods and a common survey (Kent and Hughes, 2022). The differences in training methods did not result in significant differences in training effectiveness.

Further evaluation challenges included *fear of assessment, lack of resource support, time pressure, researcher bias, short-term assessments, low survey participation rates, and perception instead of behavioral measures*. None of the studies met the criteria for each of the four stages of the Kirkpatrick model (Smidt et al., 2009). Most game evaluations focused on reactions and learning outcomes without further analyses on real-world transfer.

Discussion

The public sector is often characterized as a change-reluctant, law-dominated, bureaucratic environment with a strong focus on accountability, stability, and expertise (Rainey et al., 2021). Shifting political environments, ambiguous objectives, and conflicting stakeholder demands lead to specific training requirements (e.g., communication, negotiation, crisis management) that cannot be met by traditional teaching methods. Serious games and simulations offer risk-free environments to practice timely problem-solving, negotiation, and communication under stress.

The purpose of this article was to review the current state of serious games in the public sector. This article began by asking: “What are the outcomes and challenges of the purposeful use of serious games in the vocational training of public employees and students?” In contrast to specialized reviews in healthcare or military studies, we explicitly focused on public management games, screening a corpus of 5,023 records.

Since the 2010s, and owing to its practical relevance, the number of publications on this issue has been increasing steadily. Clustering serious games by the most dominant genres, characteristics, modes, and elements within this field, this review demonstrates the adaptability of serious games for various domains within the public sector, including environmental policy, emergency management, crisis communication, and general administration. In terms of trends, cooperative simulations with elements of competition and storytelling are dominant, often as co-located or blended models. Owing to the specific public sector context with multiple stakeholders and the prevalence of conflicting demands, most games are multiplayer and self-developed.

Structured by the input-process-outcome model (Garris et al., 2002) expanded with challenges, the in-depth analysis highlighted the cognitive, affective, and skill-based outcomes of serious games for learners and institutions. The final set of records suggests that serious games generate outcomes in terms of enhanced engagement, skill acquisition, cognitive development, and provision of risk-free learning environments. Yet, the lack of comparative benchmarks puts these outcomes into question.

Cognitively, serious games facilitated deeper engagement with educational content by fostering active learning. Engaging interactively with complex and ambivalent matters enhanced the participants' understanding of the underlying issues and interrelationships. These simulations stimulated awareness of stakeholder conflicts, decision-making processes, and contingencies (Benitez-Avila et al., 2022). In terms of procedural knowledge gains, emergency management games were successful in triggering timely preparedness initiatives, effective communication styles, and emergency response strategies among the participants (Correia Pereira et al., 2025). Declarative knowledge gains were dependent on the introduction of educational content and debriefing by instructors after the game.

Affectively, serious games fostered an understanding of interdependencies in decision-making, professional identities and skills, sensitivity for role conflicts, styles of interaction, and collaboration techniques. Some games mention attitudinal changes and decreased anxiety towards issues (e.g., climate awareness, open data, and e-government). Competencies such as emotional intelligence, active listening, problem solving, self-control, and the ability to evaluate context could also be taught effectively during collaborative games.

Depending on the scenario, serious games supported various skill-based outcomes. These outcomes include contract design, efficient emergency communication, negotiation skills, cost calculation, climate awareness, crisis management, land use, and urban planning.

Nevertheless, this review identified some weak spots in the design, action, and evaluation of serious games in the public sector. By clarifying the blank spots today, we promote a more rigorous research agenda to substantiate the educational benefits of serious gaming in the public sector.

Spot 1: Technological Embeddedness and Data Awareness

The design and development process of serious games can be resource-intensive, leading to reluctance to adopt these tools because of concerns over cost and return on investment (Di Staso et al., 2022). Other constraints include the necessity for adequate infrastructure and technology access, which may not be uniformly available across all public employee training programs

(Göbel et al., 2024). As many serious games involve individual data, instructors must ensure that player data is protected and safely stored when necessary.

Predominantly digital formats may involve substantial development costs but lower marginal delivery costs when a serious game is reused with a larger or geographically dispersed group. Analog formats may involve lower development costs but create recurring demands for preparing materials, providing rooms, coordinating participants, and facilitating each session. Multi-player games can be particularly resource-intensive because they require careful briefing, observation, pacing, and moderation. Hybrid formats combine these requirements and may introduce additional coordination and integration costs.

Different formats provide different learning affordances. Digital simulations can support standardized repetition, immediate feedback, customization, and the measurement of in-game performance. Analog and co-located serious games may be especially appropriate for affective and social learning, including negotiation, perspective-taking, collective sensemaking, and inter-professional collaboration. Hybrid formats can combine the procedural and feedback capabilities of digital games with the social interaction and reflection enabled by co-located sessions. Yet, the reviewed literature rarely compares otherwise similar digital and analog versions of the same intervention. Comparative studies are needed to determine whether observed outcomes result from the technological format itself or from related characteristics such as multi-player interaction, facilitation, or feedback.

Spot 2: Content Validity and Learning Objectives

Hummel et al. (2016) emphasized the importance of content validity and the necessity of aligning serious games with learners' perceptions (i.e., the public service ethos (Horton, 2006)) to ensure that they genuinely enhance desired skills instead of providing mere entertainment. Although each design has limitations, the realism of the content was perceived as crucial for the success of the serious games that we reviewed. To achieve this, serious games are often grounded in real cases (e.g., Malawi resettlement (Asgary et al., 2024), Bottrop land-use planning (Fuchs and Kirstein, 2024), Port of Rotterdam emergency cases (Mendonça et al., 2006)), and are co-developed with practitioner/expert feedback (Berridge and Clark, 1980; Correia Pereira et al., 2025; Haferkamp et al., 2011; Kent and Hughes, 2022). Yet, there is consensus among the cases that serious games are not fully representative of the public sphere they are situated in—and should not be. Simplified dilemmas (Stubbé et al., 2014; van de Ven et al., 2014), reduced institutional size (Haug et al., 2011), and non-binding decisions (Fuchs and Kirstein, 2024; Mayer et al., 2005) are means through which a safe-to-fail environment,

understandability, and reflection are enabled. In turn, this cautions instructors not to mistake serious games for decision-support, and to include a debriefing (Garris et al., 2002) to make players aware of the games' limitations and allow for real-world transfer.

Some challenges are also related to the instructors and their point of view. In this regard, the dominance of self-developed games may be interpreted as the desire of the researchers to build (and publish) something unique. Sometimes researchers and instructors suffered from perfectionism or time pressure, data gaps, and a lack of definition of 'good enough' for the simulation.

Spot 3: Target Group Alignment

In terms of a motivating game cycle, the interplay of fun, challenge, and social interaction in serious games decreased barriers, enhancing participants' willingness to engage with educational content. This is important, as in VET, a lack of motivation presents a problem (Kyndt and Baert, 2013). Serious games encourage a self-directed approach that promotes persistence and commitment to mastering the subject matter (Breuer and Bente, 2010). Some games even stimulated creative thinking among participants, leading to new and innovative solutions (Fuchs and Kirstein, 2024).

Some serious games may not adequately cater to the diverse learning styles and capabilities of user groups, leading to exclusion or disengagement among certain users (Grossard et al., 2017). The artificial nature of a game might lead to a loss of learning focus, skepticism, or unrealistic behavior (Ogonek et al., 2020).

Yet only one record mentioned player types (i.e., hardcore gamers) in the development process. Future studies might take a closer look at how the available player types and their needs can be recognized in the design and evaluation process of the game (see, for example, Gießmann et al. (In Press) for prevailing player types among public sector employees and recommended game elements).

Spot 4: Small Sample Sizes and Incomprehensive Evaluations

Because of the many conceptual cases, analyses often rely on focus groups and their reflections. As already mentioned in the results section, the reported sample sizes are small, which carries problems with statistical evaluation. Hence, the results often rely on qualitative insights, continuing the trend in educational research (Hsu, 2005). Yet, for newly emerged teaching artifacts such as serious games, experimental studies are needed to provide statistical relevance and rigor to the subject. A few studies have used experimental designs with pre- and post-test surveys

and reliable item batteries. In-game behavior and scores were captured in ten games. Three out of 35 games used control groups to compare the outcomes of different teaching methods.

Because of the small sample sizes, even these methodologically advanced studies have statistical insufficiencies. None of the studies captured intermediate and final outcomes alongside game features as proposed by the input-process-outcome model of serious games. Although many studies apply theoretical approaches, they are seldom evaluated using a sufficient statistical model.

Future studies may benefit from larger sample sizes, a thorough research method (e.g., experimental design with control groups), and the inclusion of cognitive, affective, and behavioral outcomes. A comparison of different teaching approaches towards the same topic might accentuate the expected outcomes of serious games.

Spot 5: Long-Term Effects and ‘Real World Transfer’

Studies rarely refer to long-term effects, such as job satisfaction, real-world motivational gains, or decision improvements. While debriefing and real-world transfer are essential parts of the process, most studies rely on short-term perceptions or in-game behavior. Yet, the long-term transfer towards real-world behavior is often missing from the analysis. Future studies might take a closer look at the real-world outcomes of gaming by carrying out panels or longitudinal studies.

Implications for Instructors, Curriculum Designers, Training Providers, and Institutions

The article reveals several implications for educational practice. *Instructors* can use serious games to introduce topics of greater complexity such as refugee resettlement, public budgeting, or disaster management. Serious games might also be a favorable tool for bridging the gap between theory and practical application. They have the potential to deeply engage with difficult content by means of identification and self-efficacy. When teaching communication skills or crisis management under time pressure, cooperative and team-oriented gaming seems to be effective, especially regarding roles and communication procedures. Nevertheless, instructors must be deeply involved in the introduction and debriefing of the topics, bridging the gap between gaming and real-world transfer. To make serious games effective, learners need additional support, discussion, and reflection upon their gaming experiences with the instructors. When roleplays are professionally supported by the instructors, they offer enough room to put someone into another position and empathize with others’ objectives, dilemmas, and resources. In contrast, singleplayer simulations for managing budgets, hospital stakeholders, the

introduction of open data technology or even camp relief logistics can be effective because learners are offered room to practice their decisions and actions firsthand in a risk-free environment. Before gameplay, instructors should assess learners' prior knowledge and provide essential terminology, conceptual material, and role guidance, because insufficient preparation can lead to confusion, superficial decisions, or attention being directed toward game mechanics rather than the subject matter.

Curriculum designers might benefit from educational gaming platforms and a variety of serious games to choose from. Yet, serious games should not be misunderstood as entertainment breaks. They must be introduced and embedded consistently into the curriculum by means of clear learning objectives, professional introduction, and moderated learning transfer.

Professional training providers should pay attention to the institutional context, especially the relevance of the content provided to the user group. They must be aware of a greater reluctance and skepticism towards gaming, especially with respect to experienced professionals (Berridge and Clark, 1980) and higher age groups (Gießmann et al., In Press). Designers need to bring public sector specialists into their teams to understand educational objectives and the real-world problems they are tackling.

Institutions ought to pay close attention to the game initiative and its long-term evaluation. They should rely on a team of professional game designers, psychologists, and instructors when designing or contracting for a serious game. In addition, they should pay attention to the user group and its needs. To benefit long-term, public sector organizations must define clear educational objectives and a reasoned evaluation strategy.

Conclusion

Serious games present a multifaceted approach to improving VET outcomes in the public sector, notably through enhanced engagement, skill acquisition, cognitive development, and provision of risk-free learning environments. Yet, the implementation of serious games should be approached with caution, ensuring alignment with educational goals and addressing challenges in content validity and empirical support.

Reflecting on our notion of 'Gaming for the Public Good,' the areas of application show a focus on societal problems such as disaster resettlement (Asgary et al., 2024), humanitarian logistics (Rahim et al., 2020), flood-risk management (McEwen et al., 2014), crisis management (Stubbé et al., 2014), open data (Di Staso et al., 2021), e-government service delivery (Ogonek et al., 2019), urban planning (Fuchs and Kirstein, 2024), and crime (Sydelko et al., 2024). Further,

affected communities (Asgary et al., 2024) and legitimacy (Berridge and Clark, 1980) are addressed.

Future research should continue to explore the nuanced effects of serious games on various public sector training fields by incorporating experimental and statistically rigorous research designs, to allow for informed and effective integration into training programs. On the one hand, the evolving nature of work and rapid technological advancements mean that training programs must continuously adapt, complicating the integration of serious games into established curricula (Vigoroso et al., 2021; Tazouti et al., 2019). On the other hand, the use of AI-assisted programming or image generation could help lower the development costs and time of serious games, allowing for faster prototyping and iterative refinements.

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