

Article

From Theory to Action: The Power of Case-Based Learning and War Games in Military Training

De la Teoría a la Acción: El Poder del Aprendizaje Basado en Casos y los Juegos de Guerra en la Formación Militar

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Abstract

Contemporary operational environments require military personnel to interpret incomplete information, coordinate specialized knowledge, and make timely decisions under pressure, which calls into question training models focused exclusively on the transmission of doctrine. The objective was to identify case-based and game simulation learning methodologies used in military training through a literature review. A narrative review was conducted in Scopus and Web of Science, covering articles published between 2011 and 2026, of which 18 were included. The main results showed that these methodologies promote cognitive engagement, the analysis of alternatives, safe experimentation with error, team coordination, and reflective feedback. It is concluded that both methodologies form an experiential pedagogical continuum capable of transforming doctrine into informed decisions; future research should examine longitudinal effects, transfer of learning, and the responsible use of artificial intelligence.

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Sinergias educativas

October - December Vol. 11 - 4 - 2026
<http://sinergiaseducativas.mx/index.php/revista/>
eISSN: 2661-6661
revistasinergias@soyuo.mx
Page 54-75
Received: July 04 , 2026
Approved: September 12 , 2026

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Keywords: case-based learning; war games; professional military education; decision-making under uncertainty; experiential simulation

Resumen

Los entornos operacionales contemporáneos exigen que el personal militar interprete información incompleta, coordine conocimientos especializados y adopte decisiones oportunas bajo presión, lo que cuestiona los modelos formativos centrados exclusivamente en la transmisión doctrinaria. El objetivo fue identificar las metodologías de aprendizaje basado en casos y simulaciones de juego utilizadas en la formación militar mediante una revisión de literatura. Se realizó una revisión narrativa en Scopus y Web of Science con artículos publicados entre 2011 y 2026, de los cuales se incluyeron 18 artículos. Los resultados principales mostraron que estas metodologías favorecen la activación cognitiva, el análisis de alternativas, la práctica segura del error, la coordinación de equipos y la retroalimentación reflexiva. Se concluye que ambas metodologías conforman un continuo pedagógico experiencial capaz de transformar doctrina en decisiones fundamentadas; futuras investigaciones deberán examinar efectos longitudinales, transferencia y uso responsable de inteligencia artificial.

Palabras clave: aprendizaje basado en casos; juegos de guerra; educación militar profesional; toma de decisiones bajo incertidumbre; simulación experiencial

Introduction

The technological, political, and social transformation of conflict has expanded the cognitive demands of the military profession. The conduct of operations is no longer limited to applying predefined procedures; rather, it requires interpreting ambiguous signals, integrating information from multiple domains, and coordinating decisions with strategic, operational, and tactical implications. In this scenario, a rapid response is valuable only when accompanied by professional judgment, contextual understanding, and the ability to adapt. Evidence on military training through simulation shows that the most significant training outcomes are related to the integration of knowledge, skills, individual reasoning, and team coordination, while studies on immersion indicate that prior experience and adaptability substantially alter the way participants respond to simulated environments (Biggs et al., 2025; Niu et al.,

2022). In turn, the incorporation of artificial intelligence into military simulators promises more dynamic scenarios, although it also introduces issues of realism, explainability, documentation, and scalability that must be addressed as pedagogical—not merely technological—matters (Saastamoinen & Nuutinen, 2025).

This shift necessitates a reevaluation of professional military education models; while doctrinal instruction remains indispensable because it provides a common language, principles of action, and criteria for organizing planning, its declarative learning does not guarantee that an officer will be able to apply that knowledge when faced with an unprecedented problem. In other areas of higher education, case-based learning has been used precisely to bridge the gap between concepts and decisions (Sapeni & Said, 2020). Available reviews show that cases can stimulate reasoning, discussion, and problem-solving, although their effectiveness depends on how learning situations are selected, sequenced, and facilitated (Yao et al., 2023). Empirical evidence also suggests improvements in critical thinking when students analyze contextualized problems and must justify their answers, but these effects should not be generalized without considering the course design, the type of measurement, and the quality of the comparison used (Mu & Hatch, 2024).

Case-based learning can be defined as an active methodology in which an authentic or plausible situation serves as the organizing framework for the learning process; this is because, rather than receiving a ready-made answer, the participant identifies the problem, distinguishes relevant information, formulates alternatives, justifies a decision, and evaluates its consequences. This sequence is particularly relevant in professions where the solution is rarely unique and where judgment must integrate technical knowledge, institutional constraints, and ethical considerations. Yao et al. (2023) highlight that case studies promote active and reflective learning, but note significant variability in their design and implementation. Similarly, Mu and Hatch (2024), in their review of 112 empirical studies on the case method, found promising benefits, albeit accompanied by theoretical and methodological weaknesses. Pilz et al. (2024) point out a significant tension: although academic discourse attributes to case studies the ability to develop social and decision-making skills, in practice many instructors use them primarily to convey content, which reduces their transformative potential.

Serious games and simulations extend this logic by introducing interaction, constraints, consequences, and feedback. Marsh (2011) proposes understanding them as a continuum between purpose-oriented games and purpose-designed experiential environments—a perspective that avoids the assumption that every effective activity must possess a high density of playful elements. This distinction is crucial for military education: the value of a simulation lies not in entertaining, but in representing meaningful decision-making relationships with a level of fidelity consistent with the learning objective. Guillén-Nieto and Aleson-Carbonell (2012) demonstrated that a serious game can bring about changes in complex competencies when it integrates narrative, practice, and explicit objectives; however, Stathakarou et al. (2026) found that the literature on military education regarding trauma rarely establishes an explicit relationship between each game element and a specific learning outcome. Therefore, gamification cannot be treated as a generic solution, but rather as an architecture that must be pedagogically justified.

Wargaming is a specific type of simulation focused on competitive or adversarial decision-making under conditions of uncertainty, where its structure may incorporate maps, game pieces, digital systems, teams, rules, exercise control, and adjudication mechanisms; however, its defining feature is the interaction among decisions that alter the initial problem. In the field of strategy, Schwarz (2013) argues that wargaming offers a sufficiently rigorous structure for examining courses of action and, at the same time, the flexibility necessary to represent dynamics, creativity, and debate. In military education, Lorusso et al. (2023) emphasize the importance of debriefing in translating actions into understandable consequences, while Hongisto and Saastamoinen (2023) demonstrate that even technologically simple tools can support tactical wargaming when they facilitate the pace, visualization, and coherence of the exercise. Technical sophistication, therefore, does not replace pedagogical design or the professional judgment of those leading the activity.

From a cognitive perspective, war games force participants to operate with incomplete information, limited time, finite resources, and adaptive opposition. These conditions encourage the comparison of alternatives and reveal the assumptions that normally remain implicit in a theoretical discussion. Schubert et al. (2015) demonstrated that simulation can be used to explore thousands of variations of an operational plan and identify particularly influential or risky actions. However, in an educational context, the purpose is

not merely to select an optimal option, but to understand why a decision seemed reasonable, what information was prioritized, how the adversary's response was interpreted, and what adjustments should be made. Lorusso et al. (2023) and Schwarz (2013) agree that the usefulness of wargaming depends on the decision-making process being observable and open to discussion, not on the exercise producing an exact prediction of the future.

The authenticity of the scenario is another central component, given that the activity can be visually realistic yet pedagogically poor if decisions have no meaningful consequences or if the participant does not understand the relationship between their actions and the outcomes. In shooting simulations, Biggs et al. (2025) found that the combat experience was associated with greater immersion and that this was related to performance, although adaptability emerged as a decisive factor. In virtual reality- -stress training, Vianez et al. (2025) identified favorable effects on stress and anxiety, but also noted the need for design criteria validated by specialists. In virtual patient simulations for military healthcare personnel, Stathakarou et al. (2024) observed that challenges, scoring, and feedback can sustain engagement and confidence, provided they do not shift attention away from clinical and tactical reasoning toward the superficial accumulation of points.

Safe error and repetition are decisive advantages of these methodologies. In real-world operations, a poor decision can have irreversible human, political, and material consequences; in a well-designed simulation, error can serve as evidence to review assumptions, practice new responses, and improve coordination. The study by Niu et al. (2022) found that simulation-based training strengthened knowledge, skills, individual thinking, communication, and teamwork in military nursing. Zhu et al. (2024) compared a serious game with audiovisual training in tactical casualty care and reported advantages of the game in terms of efficiency, acceptance, self-perception, and overall performance. These findings are consistent with the literature on case-based learning, which emphasizes the value of participation, but they also show that practice must culminate in feedback and reflection to prevent repetition from reinforcing inappropriate strategies (Li et al., 2019).

The collaborative dimension is equally relevant; complex military decisions are typically made in general staffs or multidisciplinary teams where each member contributes partial information and where the quality of the outcome depends on coordination, reasoning, and trust. War games allow us to observe how attention is distributed,

which voices dominate the discussion, how disagreements are resolved, and what information is left out of the process. Evidence on military simulation synthesized by Niu et al. (2022) points to improvements in communication and teamwork, while virtual patient designs studied by Stathakarou et al. (2024) show that learning can integrate technical and tactical decisions within the same scenario. However, Pilz et al. (2024) point out that the use of case studies does not automatically lead to social skills: it is necessary to assign roles, clarify rules of interaction, evaluate the quality of reasoning, and facilitate subsequent reflection on the team's performance.

In this regard, debriefing serves as the mechanism that transforms the activity into transferable learning. The experience, on its own, can be intense without leading to understanding; feedback must help reconstruct the sequence of decisions, identify biases, distinguish between outcome and process quality, and connect what happened with doctrinal principles (Sapeni & Said, 2020). Studies on serious games highlight that timely feedback and structured reflection improve the perception of learning and the acquisition of competencies (Guillén-Nieto & Aleson-Carbonell, 2012). At the same time, research by Stathakarou et al. (2026) shows that many studies describe game mechanics without explaining how they produce specific outcomes, which hinders the accumulation of knowledge. This problem is exacerbated when evaluation is limited to satisfaction or confidence—indicators that are useful but insufficient to demonstrate transfer to real-world decisions.

Recent research also highlights the role of artificial intelligence as part of generative systems and adaptive agents that can diversify scenarios, represent less predictable adversaries, automate part of the scoring process, and provide individualized feedback, according to Saastamoinen and Nuutinen (2025). They also believe that these capabilities can improve military preparedness, although they emphasize the limitations regarding realism, scalability, and documentation. Schubert et al. (2015) show that computational models are useful for exploring alternatives and conducting sensitivity analyses, but such analytical capability does not equate to pedagogical authority. A model's opacity, data biases, or a plausible yet doctrinally incorrect response can lead to flawed learning; therefore, artificial intelligence must be integrated with expert oversight, decision traceability, scenario validation, and clear protocols regarding when the system makes recommendations, makes decisions, or simply generates inputs (Saastamoinen and Nuutinen, 2025).

From another perspective, evaluation constitutes another critical point: in a complex exercise, a favorable outcome may be due to a well-founded decision, chance, asymmetric information, or lenient adjudication; similarly, an unfavorable outcome does not necessarily prove that the reasoning was deficient. Therefore, evaluation criteria must distinguish between the outcome and the process and consider problem identification, the use of evidence, the formulation of assumptions, the quality of reasoning, adaptation, and coordination. Mu and Hatch (2024) caution that case study research loses its strength when it uses ambiguous indicators or weak designs, while Stathakarou et al. (2026) point out that the absence of relationships between elements and outcomes prevents an understanding of the educational mechanism. Lorusso et al. (2023) add that a coherent evaluation is necessary for the outcome to be interpreted and discussed. Thus, evaluating a war game requires examining how decisions were made, not merely who won the exercise.

The facilitator's role spans all phases: before the exercise, they must set objectives, prepare the case, adjust the level of complexity, and ensure that participants understand their roles and the rules. During the activity, they need to maintain participants' decision-making autonomy without allowing technical errors or design ambiguities to derail the learning process. Afterward, they lead the reflection and link the experience to the theory. Pilz et al. (2024) show that teaching practices can reduce the case method to mere content delivery; Yao et al. (2023) highlight the variability in implementation methods; and Zhu et al. (2024) demonstrate that acceptance and performance improve when the environment provides meaningful feedback. The facilitator is not a peripheral observer but rather a component of the design whose competence influences the quality of the experience and the possibility of transferring it.

For Latin American military education, these issues hold additional relevance, as institutions often combine doctrinal traditions, uneven technological resources, and specific operational needs; therefore, the adoption of external models cannot be reduced to simply replicating platforms or formats. The findings of Hongisto and Saastamoinen (2023) indicate that simple tools can be effective when they serve their purpose, while Saastamoinen and Nuutinen (2025) show that advanced solutions require infrastructure, documentation, and validation. Evidence on case-based learning also confirms that the implementation context influences outcomes (Pilz et al., 2024). Consequently, the challenge is not to choose between low-tech and high-tech approaches, but rather to develop a

sustainable, doctrinally relevant, and assessable methodology within each military education system.

Despite the growth of this literature, a knowledge gap persists. Studies are scattered across military education, tactical healthcare, computer simulation, management, and higher education; they employ heterogeneous designs, populations, and outcomes, making it difficult to determine which components actually account for effectiveness. Mu and Hatch (2024) identify methodological weaknesses in case-method research, while Stathakarou et al. (2026) point out the absence of explicit links between game elements and learning outcomes. In military studies, measurements of knowledge, perception, immersion, or immediate performance predominate, with little longitudinal evidence on transfer to professional practice. Furthermore, the available Latin American scientific literature on these topics is limited, making it difficult to determine how doctrine, organizational culture, technological resources, and the characteristics of each country's military education system influence outcomes.

In light of this gap, the following research question was formulated: How do case-based learning, wargames, and decision-making simulations contribute to military training? The objective of this manuscript was to identify the case-based learning and game simulation methodologies used in military training through a literature review.

Materials and methods

A narrative literature review with a critical and integrative orientation was conducted; this approach was selected because the research problem brings together research traditions on case-based learning, serious games, military simulation, virtual reality, computational decision support, and professional education. The narrative review allowed us to examine conceptual relationships, compare designs, and organize pedagogical mechanisms without reducing incomparable results to a single effect. To ensure transparency, the information sources, time period, search terms, eligibility criteria, data extraction categories, and synthesis procedure were defined in advance.

The search was conducted in databases such as Scopus and Web of Science on July 20, 2026, and included publications from January 2011 through July 2026. These databases were selected due to the

restrictions established for the manuscript and because of their coverage of journals and scientific series related to education, simulation, human factors, computer science, and high-responsibility professions. Search terms were entered in English, as the majority of the literature was in that language.

The search queries were: (“wargaming” OR “war game” OR “military simulation” OR “serious game”) AND (“military education” OR “military training” OR “decision making” OR “critical thinking”); and (“case-based learning” OR “case method”) AND (“critical thinking” OR “problem solving” OR “decision making”). Supplementary searches were also conducted using “virtual patient,” “combat casualty care,” “operational plans,” “adjudication,” “immersion,” and “artificial intelligence.” A total of 385 articles were retrieved.

Original articles, systematic reviews, scoping reviews, and works published in peer-reviewed scientific journals were included if they met at least one of the following conditions: directly addressing military education or training; examining wargames, simulations, or serious games applied to high-stakes decision-making; or providing transferable evidence on case-based learning, critical thinking, and problem-solving in higher education. Excluded were doctrinal manuals, books, editorials, abstracts without full text, unpublished institutional documents, studies focused on entertainment without an educational purpose, and works that described technology without analyzing its educational or decision-making use.

The selection process took place in three stages. First, titles and abstracts were reviewed to identify their relevance to the research question. Second, the available text was read to verify that each study provided information on the population, intervention or setting, outcomes, implementation conditions, or limitations. Third, a complementary theoretical sampling approach was applied: when a military article presented a pedagogical mechanism that was insufficiently explained, case-based learning studies or serious games were incorporated to help interpret that mechanism. This decision was not intended to equate different professions but rather to distinguish between direct evidence and transferable evidence. The final result consisted of 18 articles: 10 directly related to military or operational contexts and 8 from higher education or simulation with conceptual utility for military training.

To ensure bibliographic traceability, the following were recorded: title, authors, year, journal or series, volume, page numbers or article

number, DOI identifier, and access URL. The rigor of the review was maintained through four decisions. First, direct evidence from military contexts was separated from transferable evidence. Second, inferring causality was avoided when studies were descriptive, qualitative, or based on self-reports. Third, positive findings were cross-checked against reviews reporting heterogeneity, design weaknesses, or the absence of explicit relationships between mechanisms and outcomes. Fourth, only claims supported by the selected sources were retained.

Since this was a literature review based on publicly available documents, neither informed consent nor the involvement of a human research ethics committee was required.

Results

Table 1. *Summary of the articles included in the narrative review*

Authors and year	Objective	Methodology	Key Findings
Marsh (2011)	To propose a conceptual continuum for distinguishing serious games from purpose-driven experiential environments.	Conceptual article based on an analysis of approaches to computer-based entertainment, learning, and experience design.	The study argues that serious games and experiential environments should be understood as part of a continuum, rather than as completely separate categories. Educational effectiveness does not depend on incorporating a large number of playful components, but rather on establishing a clear correspondence between the educational purpose, the actions performed by the participant, and the context in which the experience takes place. This perspective is relevant to military training because it allows for prioritizing the pedagogical functionality of the scenario over its technological or recreational appeal.

Authors and year	Objective	Methodology	Key Findings
Guillén-Nieto and Aleson-Carbonell (2012)	Evaluating the effectiveness of a serious game for the development of intercultural competence.	An empirical study in higher education, involving the use of a serious game and the assessment of various learning outcomes.	The results showed differentiated improvements in the components of intercultural competence, indicating that a serious game can foster complex learning when it integrates a coherent narrative, contextualized decisions, and opportunities for practice. The study also showed that not all outcomes develop at the same rate; therefore, assessment must distinguish between knowledge, attitudes, and performance. From a pedagogical perspective, it is emphasized that the value of the game stems from the integration of objectives, feedback, and experience—and not solely from interaction with the platform.
Schwarz (2013)	Examining business wargaming as a methodology for teaching strategic formulation.	Applied analysis of the use of wargames in strategic education and organizational decision-making processes.	The study identifies wargaming as a methodology capable of structuring the exploration of uncertain scenarios and forcing participants to consider the responses of actors with conflicting interests. Its application fosters strategic creativity, reasoned debate, and the comparison of courses of action before a decision is made. Furthermore, it allows for the questioning of assumptions that often remain implicit in conventional planning exercises. The author cautions, however, that its usefulness depends on proper scenario preparation, active participation, and subsequent reflection that transforms the experience into learning.
Schubert et al. (2015)	Developing a simulation-based decision support system to evaluate operational plans.	Event modeling and simulation, supplemented by sensitivity analysis and regression trees to compare operational alternatives.	The simulation made it possible to examine a large number of plan variants and identify actions that had a significant influence on overall results. The procedure facilitated the identification of critical decisions, risks, and relationships between variables that might go unnoticed in an exclusively qualitative assessment. The authors show that these types of tools can expand the analytical capabilities of planners; however, their results should be interpreted as supporting professional judgment and not as automatic substitutes for human decision-making.

Authors and year	Objective	Methodology	Key Findings
Li et al. (2019)	To compare the effect of a course based on case-based learning on students' critical thinking.	A comparative study with nursing students, aimed at assessing changes in critical thinking and academic engagement.	The case-based course was associated with improved critical thinking and more active participation in the analysis of the problems presented. Participants had to identify relevant information, formulate explanations, and justify possible answers, which shifted learning from the reception of content toward the development of arguments. The findings suggest that case studies are particularly useful when they present ambiguous situations and require reasoned decisions; however, their effect depends on the quality of the questions, the facilitation, and the way in which reasoning is assessed.
Sapeni and Said (2020)	To synthesize the available evidence on the relationship between case-based learning and critical thinking.	A literature review focused on nursing education and outcomes associated with critical reasoning.	The review concluded that case-based learning has the potential to strengthen critical thinking, as it exposes students to contextualized problems and requires them to relate prior knowledge to new evidence. Benefits were also identified regarding discussion, problem-solving, and decision-making. However, the available empirical evidence had limitations related to the diversity of study designs, instruments, and sample sizes. Therefore, the authors recommended more rigorous research to more precisely establish the conditions under which these outcomes occur.
Niu et al. (2022)	To evaluate the effectiveness of simulation-based training on military nursing competencies.	A systematic review of 10 studies that examined simulation interventions in military healthcare training contexts.	The synthesis showed favorable effects on knowledge, technical skills, individual thinking, communication, teamwork, and professional competence. Simulation allowed for the practice of procedures and decision-making in a controlled environment, with the possibility of repetition and correction without exposing patients or staff to real risks. The results also showed that the interventions varied in duration, modality, and evaluation, making it difficult to determine which components account for the benefits. Consequently, the need for more standardized protocols and indicators that measure transfer to professional performance is emphasized.

Authors and year	Objective	Methodology	Key Findings
Yao et al. (2023)	To review the design, implementation, and outcomes of case-based learning in theoretical courses.	A review of interventions developed with university nursing students, including an analysis of design characteristics and educational outcomes.	The reviewed studies indicated that case studies promoted active learning, reflection, the integration of theory and practice, and problem-solving. However, considerable variability was identified in how cases were selected, discussions organized, time allocated, and outcomes assessed. This heterogeneity prevents case-based learning from being considered a uniform intervention. The review concludes that its effectiveness depends on the authenticity of the situations, the degree of student participation, and the provision of systematic guidance and feedback.
Hongisto and Saastamoinen (2023)	Evaluating an Excel-based simulator to support the development of tactical wargames.	Development of a computer tool and analysis of its use to support manual wargaming exercises.	The tool facilitated the representation of tactical variables and streamlined certain calculations that, when performed manually, could slow down the exercise. Its incorporation helped maintain the pace of the game and presented the consequences of the decisions made more clearly. The authors demonstrated that a technologically simple solution can add value when it addresses specific needs of the scenario and is understandable to users. This finding challenges the notion that the quality of wargaming necessarily depends on complex simulators or significant technological investment.
Lorusso et al. (2023)	To analyze the adjudication of wargames in Air Force education and other military training settings.	Study of the design and implementation of a tool aimed at supporting resolution processes during wargames.	The research highlights that adjudication is the mechanism through which participants' decisions translate into effects and changes within the scenario. Consistent and understandable adjudication increases the exercise's credibility, allows actions to be linked to their consequences, and provides material for subsequent discussion. The study also notes that arbitrary adjudication reduces participants' trust, while overly predictable rules diminish uncertainty. Therefore, it proposes striking a balance between transparency, consistency, and professional flexibility.

Authors and year	Objective	Methodology	Key Findings
Zhu et al. (2024)	To develop and evaluate a serious game focused on tactical decision-making regarding combat casualties.	A randomized controlled trial with 148 participants, in which the serious game was compared with an audiovisual training modality.	Serious games demonstrated advantages over audiovisual resources in terms of knowledge acquisition, self-perceived competence, acceptance of the training strategy, and overall performance. Interaction with tactical scenarios allowed participants to practice decision-making and relate medical procedures to changing operational conditions. The results suggest that active participation and immediate feedback promote a more applied understanding than passive observation. However, the interpretation must take into account that several indicators corresponded to immediate results and that retention and transfer must be evaluated at later time points.
Pilz et al. (2024)	To compare faculty expectations with the practical application of the case method in higher education.	A survey was administered to 214 faculty members in the field of management to assess their objectives, methods of use, and perceptions regarding the case method.	Faculty members widely recognized the value of case studies in connecting theory and practice and in developing analytical skills. However, the research revealed a gap between expectations and implementation: in many courses, case studies were used primarily as examples to explain content, rather than assigning students the responsibility to analyze, debate, and make decisions. This discrepancy limits the development of social, argumentative, and decision-making skills. The study demonstrates that the method's potential depends less on its nominal presence in the curriculum than on the specific way in which the activity is organized.
Mu and Hatch (2024)	To examine the effectiveness of the case method in higher-level business education.	A scoping review of 112 empirical studies published between 2000 and 2022.	The review found generally promising results in learning, engagement, critical thinking, and knowledge application, although the conclusions were mixed and not always comparable. Recurring weaknesses were identified, such as designs lacking comparison groups, inconsistent measurement instruments, incomplete descriptions of the intervention, and insufficient theoretical frameworks. These limitations make it difficult to attribute the results exclusively to the case method. The authors recommend research with greater conceptual clarity, better performance measures, and a precise description of how cases are implemented and facilitated.

Authors and year	Objective	Methodology	Key Findings
Stathakarou et al. (2024)	To analyze the use of gamification elements in virtual patients designed for the training of military healthcare personnel.	Interaction analysis and semi-structured interviews on the use of virtual patients in military trauma scenarios.	Challenges, scoring, and feedback helped maintain engagement and strengthen users' confidence during practice. Virtual patients allowed for the integration of clinical and tactical decisions, providing a safe space to rehearse responses without real-world consequences. However, participants noted that game elements should remain subordinate to the professional objective, as an excessive emphasis on scoring could divert attention from reasoning. The study highlights the importance of designing gamification to support decision-making rather than as an end in itself.
Saastamoinen and Nuutinen (2025)	To explore the potential applications of artificial intelligence in military simulators and war games.	Analysis applied to the Finnish context, accompanied by recommendations for the development of next-generation training systems.	Artificial intelligence was identified as a technology capable of generating variable scenarios, representing adaptive adversaries, and supporting feedback and debriefing. These functions could increase the diversity of situations and reduce reliance on completely predetermined scripts. However, the authors point out challenges related to realism, scalability, documentation, traceability, and confidence in the results. Therefore, they recommend that AI be incorporated under expert supervision, with validation criteria, and without replacing the responsibility of the instructor or military decision-maker.
Biggs et al. (2025)	To examine the relationship between combat experience, immersion, and performance in shooting simulations.	A study involving 169 male military participants in advanced training, designed to analyze variables related to immersion, adaptability, and performance.	Combat experience was associated with higher levels of immersion in the simulation, and immersion was associated with observed performance. However, adaptability emerged as one of the most relevant factors, indicating that training effectiveness does not depend solely on the sense of realism. The findings suggest that participants interpret and make use of the scenario based on their prior experience and their ability to adapt to changing conditions. This justifies designing exercises with progressive difficulty and considering individual differences when evaluating results.

Authors and year	Objective	Methodology	Key Findings
Vianez et al. (2025)	To evaluate military stress management training using virtual reality and establish design principles.	Systematic review of 13 studies, supplemented by a Delphi method applied to specialists.	The reviewed evidence showed favorable results in reducing stress and anxiety associated with training situations, although the studies differed in terms of devices, duration, intensity, and variables assessed. Through the Delphi process, a 97% consensus was reached on principles relevant to the design of these experiences. The authors emphasize the need to gradually increase exposure, ensure the relevance of stimuli, and provide professional guidance during the training. Virtual reality can support psychological preparation, but it requires validated protocols and careful control of the emotional load.
Stathakarou et al. (2026)	To synthesize the use of game elements in military education focused on trauma care.	A systematic review of 42 studies published between 1986 and 2025.	The review identified widespread use of simulations, challenges, feedback, scoring, and other game elements in military trauma training. However, none of the studies explicitly established which individual element produced a specific educational outcome. This lack of traceability makes it difficult to identify the mechanisms responsible for improvements and limits the ability to replicate effective designs. The authors conclude that future interventions should be grounded in theory, precisely describe their components, and evaluate distinct outcomes, such as knowledge, performance, collaboration, retention, and transfer.

Discussion

The results suggest that case-based learning and war games contribute to military training when they transform doctrinal knowledge into an activity involving interpretation, choice, action, and reflection; this paper should not be interpreted as establishing an automatic link between the use of simulation and improved performance. The reviewed studies show that the relevant mechanism is the requirement to justify decisions in the face of incomplete information and observable consequences. In this regard, the findings of Li et al. (2019), Yao et al. (2023), and Sapeni and Said (2020) agree in attributing to the case a role in stimulating critical thinking. The works of Schwarz (2013), Schubert et al.

(2015), and Lorusso et al. (2023) expand on this mechanism by incorporating opposition, dynamism, and adjudication. Wargaming can therefore be understood as an adversarial extension of case-based learning: it retains the contextualized problem but adds time, interaction, uncertainty, and responses from other actors.

This interpretation helps distinguish between two levels that are often conflated: just as case-based learning organizes the analysis of a situation, wargaming organizes a system of interdependent decisions. A case study may stop at formulating a course of action, whereas a wargame forces participants to confront it with constraints and emerging responses; this is where their complementarity proves pedagogically valuable: the case study can be used to build foundations, vocabulary, and criteria prior to the simulation, and the wargame can test the soundness of those criteria. Subsequently, the debriefing allows participants to revisit the case using evidence generated by the participants themselves; this sequence explains why the activity gains greater value when integrated into a curriculum rather than when presented as a standalone event.

The findings also align with the literature that conceives of serious games as purpose-driven experiential environments. As described by Marsh (2011)—who questions the equation of effectiveness with the number of game-like elements—and by Guillén-Nieto and Aleson-Carbonell (2012), who show that learning depends on the integration of narrative, practice, and objectives; in the military context, Stathakarou et al. (2024) observed that scoring and challenges could sustain engagement but must be subordinate to clinical and tactical reasoning. The consistency among these studies suggests that an understandable and functional design may be more useful than a spectacular simulation if it represents key decisions, provides sufficient information to act, and generates comprehensible feedback.

Evidence regarding critical thinking should be interpreted with caution; positive results were found here in the studies by Li et al. (2019), as well as by Sapeni and Said (2020) and Yao et al. (2023), who support the usefulness of case studies; however, Mu and Hatch (2024) caution that many studies feature limited samples, weak comparisons, or insufficient theoretical frameworks. Pilz et al. (2024) also show that the stated pedagogical intent does not always align with practice: case studies can become lengthy examples used to explain content, without students making decisions or discussing alternatives; this discrepancy helps explain why similar studies produce different results.

Regarding decision-making, the literature provides evidence that simulation allows for the exploration of alternatives and sensitivity analysis, as demonstrated by Schubert et al. (2015). However, the criterion for educational success cannot be reduced to the closeness of a student's response to a computational solution, given that military decisions involve doctrinal assumptions, political constraints, human coordination, and risk acceptance. Therefore, the scoring described by Lorusso et al. (2023) must be transparent and sufficiently explainable to support further discussion; if the participant perceives the result as arbitrary, the simulation loses legitimacy; if the rules are entirely predictable, it ceases to represent uncertainty, and the design must balance consistency and surprise.

Immersion emerges as a relevant condition, though not necessarily linear; this is why Biggs et al. (2025) show that prior experience influences immersion and that adaptability is strongly related to performance, implying that the same scenario can be challenging for one participant and routine or confusing for another. Vianez et al. (2025) found favorable results in stress training using virtual reality and consensus on design principles, but exposure to pressure must be calibrated to avoid saturation, superficial habituation, or responses unrelated to the objective. Pedagogical authenticity requires that difficulty be progressive and that the scenario represent relevant stresses, not that it indiscriminately reproduce all stimuli from the real environment.

Debriefing emerges as the primary mediator between experience and learning. The findings of Zhu et al. (2024) and Stathakarou et al. (2024) demonstrate the value of feedback, while Stathakarou et al. (2026) highlight a persistent weakness: the literature describes game elements without specifying which outcome each is intended to produce. A structured debriefing can partially compensate for this weakness by reconstructing the sequence of events, comparing intention and effect, and linking decisions to concepts. However, its quality depends on facilitators capable of asking questions, managing disagreements, distinguishing chance from decision-making quality, and preventing the game's outcome from being interpreted as an absolute verdict. Trainer training should be considered part of the intervention.

Regarding technology, the findings reject both optimistic determinism and indiscriminate resistance. Hongisto and Saastamoinen (2023) show that an Excel-based solution may be sufficient to support a tactical game, while Saastamoinen and Nuutinen (2025) describe opportunities for artificial intelligence in

terms of adaptability and scenario generation. The choice of technology must follow the objective: to automate calculations, represent consequences, manage information, or generate adversaries. AI can expand variability and feedback, but it can also produce opacity, bias, and dependency. In military education, where traceability and accountability are essential, any automated adjudication function must be auditable and remain under human control.

The integrative contribution of this review is to propose a pedagogical continuum consisting of six stages: doctrinal contextualization, case analysis, formulation of alternatives, simulated or adversarial interaction, assignment of consequences, and reflective debriefing. This continuum allows for the placement of activities with varying levels of complexity without reducing them to a dichotomy between traditional classroom instruction and games. It also offers an assessment framework: each stage must be linked to observable evidence, such as problem identification, quality of arguments, use of information, coordination, adaptation, and subsequent learning. The novelty lies not in asserting that war games are useful, but in specifying that their effect depends on a chain of mechanisms that can be designed, observed, and evaluated.

The review has limitations. The search was restricted to ScienceDirect, which may have excluded relevant studies published on other platforms, in specialized military journals, and in doctrinal documents. The corpus combined direct and transferable evidence, particularly from nursing, management, and simulation, which enhances understanding of mechanisms but limits generalizability. The studies employed heterogeneous designs and— frequently measured satisfaction, self-perception, or immediate performance; longitudinal designs and measures of transfer to real-world work were scarce. There were also potential biases related to publication, language, and text availability. Finally, the limited representation of Latin American studies prevented an in-depth analysis of institutional and cultural variables specific to the region.

Based on these limitations, four questions are posed for future research. What combination of authenticity, opposition, time pressure, adjudication, and debriefing produces the greatest transfer to operational performance? To what extent does structured debriefing mediate the relationship between participation in a war game and improvements in critical thinking or decision-making quality? How do prior experience, team composition, and leadership style moderate learning outcomes? Can artificial intelligence used as

an adversary, scenario generator, or adjudication support increase realism without introducing opacity, bias, or a loss of professional accountability? These questions require mixed-methods designs, repeated measures, behavioral indicators, and longitudinal follow-up.

References

- Air War College. (2026). Historical Basis of War Games and Integrated Joint Staff Work in the Joint Staff Course (1996–2026). Unpublished institutional document. Ecuadorian Air Force.
- Biggs, A. T., Ives, B., Hickmann, S., Turori, D., & Kelly, K. R. (2025). Immersion in shooting simulations following real-world combat experience. *International Journal of Industrial Ergonomics*, 110, 103846. <https://doi.org/10.1016/j.ergon.2025.103846>
- Ecuadorian Air Force. (2024). Institutional Strategic Plan 2024–2033. General Command of the Ecuadorian Air Force.
- Ecuadorian Air Force. (2025). Aerospace Doctrine of the Ecuadorian Air Force. General Command of the Ecuadorian Air Force.
- Guillén-Nieto, V., & Aleson-Carbonell, M. (2012). Serious games and learning effectiveness: The case of It's a Deal!. *Computers & Education*, 58(1), 435–448. <https://doi.org/10.1016/j.compedu.2011.07.015>
- Hongisto, T., & Saastamoinen, K. (2023). Using an Excel-based war simulator to support tactical wargaming. *Procedia Computer Science*, 225, 912–921. <https://doi.org/10.1016/j.procs.2023.10.078>
- Li, S., Ye, X., & Chen, W. (2019). Practice and effectiveness of the “nursing case-based learning” course on nursing students’ critical thinking ability: A comparative study. *Nurse Education in Practice*, 36, 91–96. <https://doi.org/10.1016/j.nepr.2019.03.007>
- Lorusso, L., Gernhardt, D., & Novak, D. (2023). Wargaming adjudication in the Air Force and other military areas of education. *Transportation Research Procedia*, 73, 203–211. <https://doi.org/10.1016/j.trpro.2023.11.909>
- Marsh, T. (2011). The serious games continuum: Between games for purpose and experiential environments for purpose. *Entertainment Computing*, 2(2), 61–68. <https://doi.org/10.1016/j.entcom.2010.12.004>
- Mu, F., & Hatch, J. E. (2024). The efficacy of the case method in tertiary business education: A scoping review: 2000–2022. *The International*

- Journal of Management Education, 22(2), 100983.
<https://doi.org/10.1016/j.ijme.2024.100983>
- Niu, A., Ma, H., Zhang, S., Zhu, X., Deng, J., & Luo, Y. (2022). The effectiveness of simulation-based training on the competency of military nurses: A systematic review. *Nurse Education Today*, 119, 105536. <https://doi.org/10.1016/j.nedt.2022.105536>
- Pilz, M., Tögel, J., Albers, S., van den Oord, S., Cramer, T., & Vítečková, K. (2024). Teaching with business cases in higher education: Expectations and practical implementation by management instructors. *The International Journal of Management Education*, 22(3), 101068. <https://doi.org/10.1016/j.ijme.2024.101068>
- Saastamoinen, K., & Nuutinen, J. (2025). Next-generation readiness: Applying AI to military simulators and wargaming in Finland. *Procedia Computer Science*, 270, 3479–3487. <https://doi.org/10.1016/j.procs.2025.09.473>
- Sapeni, M. A.-A. R., & Said, S. (2020). The effectiveness of case-based learning in increasing critical thinking among nursing students: A literature review. *Clinical Nursing*, 30(Suppl. 2), 182–185. <https://doi.org/10.1016/j.enfcli.2019.07.073>
- Schubert, J., Moradi, F., Asadi, H., Luotsinen, L., Sjöberg, E., Hörling, P., Linderhed, A., & Oskarsson, D. (2015). Simulation-based decision support for evaluating operational plans. *Operations Research Perspectives*, 2, 36–56. <https://doi.org/10.1016/j.orp.2015.02.002>
- Schwarz, J. O. (2013). Business wargaming for teaching strategy making. *Futures*, 51, 59–66. <https://doi.org/10.1016/j.futures.2013.06.002>
- Sathakarou, N., Kononowicz, A. A., Mattsson, E., & Karlgren, K. (2024). Gamification in the design of virtual patients for Swedish military medics to support trauma training: Interaction analysis and semistructured interview study. *JMIR Serious Games*, 12, e63390. <https://doi.org/10.2196/63390>
- Sathakarou, N., Kononowicz, A. A., Harjani, M. G., Swain, C., & Karlgren, K. (2026). Game elements in military trauma care education: Systematic review. *JMIR Serious Games*, 14, e79163. <https://doi.org/10.2196/79163>
- U.S. Army. (2022). Field Manual (FM) 3-0: Operations. Department of the Army.
- U.S. Naval War College. (2023). Educational philosophy and curriculum. U.S. Naval War College.
- Vianez, A., Marques, A., Loureiro, J., & Gomes, P. V. (2025). Military stress management training using virtual reality: A systematic review

and Delphi method. *Computers in Human Behavior Reports*, 19, 100734. <https://doi.org/10.1016/j.chbr.2025.100734>

Yao, J., Fu, R., Zhu, M., Jia, L., Dong, X., Shi, Y., Zhang, X., & Yuan, H. (2023). Case-based learning interventions for undergraduate nursing students in a theoretical course: A review of design, implementation, and outcomes. *Journal of Professional Nursing*, 46, 119–133. <https://doi.org/10.1016/j.profnurs.2023.03.007>

Zhu, S., Li, Z., Sun, Y., Kong, L., Yin, M., Yong, Q., & Gao, Y. (2024). A serious game for enhancing rescue reasoning skills in tactical combat casualty care: Development and deployment study. *JMIR Formative Research*, 8, e50817. <https://doi.org/10.2196/50817>