



Educational Wargaming in Higher Education: A Review of Empirical Studies

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ABSTRACT

Educational wargaming has gained increasing attention in higher education and professional military education as a form of experiential and game-based learning. Despite this growing interest, empirical research on educational wargaming remains fragmented. This article presents a semi-systematic review of empirical studies on educational wargaming published between 2014 and 2024. In addition to mapping empirical research, the review introduces a conceptual framework for analysing how learning is articulated, operationalized, and theoretically grounded.

Across fifteen peer-reviewed studies, the review examines three interrelated questions: what contexts, game formats, and learning objectives characterize educational wargaming; how learning is conceptualized, operationalized, and empirically examined; and how learning theory is integrated with wargaming theory and practice. The analysis draws on the Presage–Process–Product (3P) model to structure comparisons across research designs, educational settings, and game formats. The findings show variation in how educational wargaming is designed and studied. While many studies report positive learning outcomes, such as increased engagement, improved decision-making skills, and conceptual understanding, approaches to assessing learning are often inconsistent and limited. The review identifies gaps in the literature, including longitudinal research, insufficient attention to facilitation and debriefing processes, and weak integration between wargaming practices and learning theory.

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Educational wargaming has evolved from a well-established military training method into a growing area of academic inquiry that spans both military and civilian higher education. Despite renewed interest in wargaming as a professional practice, empirical research into the way it supports learning remains fragmented. In the context of wargaming's recent renaissance (Combe, 2021; Hirst, 2022, 2024), this article examines empirical evidence of the practice's pedagogical value through a semi-systematic review of peer-reviewed studies published between 2014 and 2024.

Although wargaming has a 200-year history as a tool for planning, analysis, and professional military education (PME), its pedagogical examination lags behind its practical use. Foundational works have articulated key principles of wargaming design and practice (Perla, 1990; Sabin, 2012; Van Creveld, 2013), and an active practitioner community continues to document experiences and insights. Yet empirical evaluation of learning in wargaming contexts remains limited. Demonstrating the specific learning contributions of wargaming is empirically challenging – not least because much of the field's knowledge base rests on practitioner expertise, experiential accounts, and iterative craft traditions rather than systematic study. This reliance on experiential epistemologies – often framed as the “art” of wargaming (Perla & McGrady, 2011) – has contributed to a gap between practice and research.

Recent scholarship has begun to address this gap by introducing new conceptual and pedagogical frameworks. For example, Fowler (2024) applies Bloom's taxonomy to clarify learning objectives in wargaming, while Hulterström (2024) advances a philosophical account of knowledge development in military educational settings. Even so, the field continues to face persistent challenges: limited theoretical consolidation, heterogeneous terminology, constrained access to empirical materials, and the absence of a clearly established academic forum dedicated to the full body of research on educational wargaming.

A further complication arises from the conceptual breadth of the term “wargame”. Educational interventions labelled as wargames vary widely in purpose, format, mechanics, and epistemic underpinnings, and often intersect with adjacent concepts such as simulation, serious games, or game-based learning. Authors use the term inconsistently, ranging from explicit engagement with wargaming scholarship to peripheral references framed through simulation or active learning. This conceptual variation complicates attempts to compare empirical findings across studies. Rather than imposing a fixed definition, this review adopts an inclusive analytical approach that examines how studies themselves conceptualize and operationalize wargaming in relation to learning. Included studies therefore engage with wargaming concepts or scholarship, even when the pedagogical activity is not explicitly framed as educational wargaming. This approach makes it possible to analyse conceptual variation within the field rather than prematurely narrowing the scope of relevant studies.

Against this background, this review examines how empirical studies of educational wargaming have been conducted and conceptualized, with particular attention to how learning is framed, investigated, and evidenced. The review addresses the following research questions:

RQ1: What educational contexts, game formats, and learning objectives characterize empirical studies of educational wargaming in higher education?

RQ2: How is learning conceptualized and operationalized in these studies, and how are learning claims empirically examined and supported?

RQ3: How are concepts from learning theory integrated with wargaming theory and practice in the reviewed literature?

By addressing these questions, the review not only maps empirical studies of educational wargaming but also introduces a conceptual framework for analysing how learning is articulated, operationalized, and theoretically grounded in this literature. In doing so, the article clarifies key analytical distinctions that structure current research and identifies areas where stronger theoretical integration and methodological transparency are needed.

A semi-systematic review is particularly relevant at this stage of the field's development. While empirical studies of educational wargaming have increased over the past decade, conceptualizations of learning and knowledge development remain uneven, particularly in how studies articulate learning objectives, operationalize learning processes and outcomes, and connect these to learning theory. By systematically mapping empirical contributions and analysing them through a shared conceptual framework, this review clarifies how learning is currently operationalized, where theoretical integration is strong, and where important analytical gaps remain.

EDUCATIONAL WARGAMING: FROM PRACTICE TO RESEARCH

Educational wargaming has received growing attention within professional military education and related academic fields over the past decade. This reflects both the longstanding role of wargaming in military training and a broader pedagogical turn toward experiential and game-based learning. At the same time, educational wargaming remains conceptually diverse, spanning different formats, purposes, and disciplinary traditions.

Educational wargaming in military contexts is rooted in traditions of experiential learning and professional development and is frequently described in professional wargaming literature as supporting operational planning, reflective problem-solving, and professional judgment (Bae & Brown, 2021; Combe, 2021). Foundational work has emphasized key design features of educational wargaming: Perla (1990) highlights the interaction between game systems, participants, and facilitation, while Sabin (2012) emphasizes balancing realism, abstraction, and playability.

Drawing on practice philosophy and Wittgensteinian perspectives, Enstad (2022) conceptualizes wargaming as contributing to situated professional understanding, enabling participants to interpret situations, coordinate action, and exercise context-sensitive judgment. The following sections, therefore, situate educational wargaming in relation to adjacent game and simulation practices, review early empirical research on educational wargaming, and examine how learning outcomes have been conceptualized in the literature.

DISTINGUISHING EDUCATIONAL WARGAMING FROM RELATED GAME AND SIMULATION PRACTICES

Although wargaming shares many characteristics with simulations and serious games, it is best understood as a family of pedagogical practices rather than a sharply bounded category. Educational wargaming typically involves human participants engaging in adversarial or competitive scenarios, role enactment, and facilitated decision-consequence cycles, but these features appear in varying configurations across different implementations (Perla, 1990; Sabin, 2012, 2015). Rather than drawing strict categorical distinctions, this review adopts a family resemblance perspective in which practices labeled as wargames overlap with simulation games and other experiential formats.¹

By contrast, the serious games field encompasses a wide range of designed instructional environments aimed at supporting predefined learning outcomes (Michael & Chen, 2006; Zyda, 2005). Research in game studies has highlighted the limitations of assuming that conceptual knowledge can be embedded directly into game mechanics. Linderoth (2010) shows that players often learn to navigate and exploit the functional affordances of games rather than internalizing the conceptual content designers intend. This insight underscores the importance of facilitation, framing, and social interaction in shaping how participants engage with the activity. Reviews of digital game-based learning research have likewise noted that many studies rely on weakly specified assumptions about how learning occurs, provide limited insight into the processes linking gameplay participation to knowledge development (Kebritchi & Hirumi, 2008). They also point to a broader tendency in the field to adopt an optimistic view of the educational potential of games without equally strong empirical support (Vandercruysse et al., 2012).

¹ This use of “family resemblance” follows Wittgenstein’s (1953) account of how concepts are constituted through overlapping similarities rather than necessary and sufficient conditions.

Simulation-based education and training represent another adjacent domain, spanning fields such as healthcare, aviation, and emergency response. This research has evolved from early questions about effectiveness toward analyses of learning conditions, instructional design, scenario structure, fidelity, and debriefing practices (e.g., [Hallinger & Wang, 2020](#); [Lymer & Sjöblom, 2024](#); [Walsh et al., 2018](#)). While this literature offers robust insights into the conditions for learning in simulation-based education, educational wargaming is typically distinguished by its emphasis on adversarial learning activities in which uncertainty, opposition, and interpretive judgment play central pedagogical roles.

EMPIRICAL RESEARCH ON EDUCATIONAL WARGAMING: EARLY FINDINGS AND METHODOLOGICAL CHALLENGES

Early empirical research on educational wargaming, primarily conducted in military training contexts during the 2000s, documented both pedagogical promise and methodological limitations. Reviews of soldier training games have identified recurring methodological weaknesses and a limited use of systematic, peer-reviewed inquiry ([Whitney et al., 2014](#)). Research on feedback practices has yielded mixed results, with some studies reporting performance gains from specific tactical feedback ([Shebilske et al., 2009](#)), while others have found that traditional instruction matches or outperforms game-based training ([Proctor & Woodman, 2007](#); [Vogel-Walcutt et al., 2013](#)).

In higher education, wargaming has often been documented through practice-oriented or descriptive accounts rather than systematic empirical analysis. Studies in political science, international relations, and cybersecurity have adopted wargames or wargame-like exercises for teaching purposes (e.g., [Asal, 2005](#); [Asal & Blake, 2006](#); [Arnold, 2015](#); [Haggman, 2019](#); [Knight, 2019](#)), providing descriptions of pedagogical setups, role structures, and facilitation. However, learning is typically inferred from instructor observations, informal student feedback, or illustrative case descriptions rather than examined through systematic empirical analysis of how learning unfolds during the activity.

Across these early studies, engagement and immersion were frequently reported, but learning outcomes were operationalized and documented in heterogeneous and uneven ways. Differences in research design, data sources, and analytical approaches made it difficult to compare findings across studies or to draw cumulative conclusions about how learning unfolds in educational wargaming contexts.

OUTCOME CATEGORIES AND CONCEPTUAL TENSIONS IN EDUCATIONAL WARGAMING

The methodological challenges identified in early empirical studies are closely connected to how learning itself is conceptualized in the literature. In educational wargaming research, learning outcomes are often described through broad pedagogical categories rather than through explicitly theorized learning processes. Systematic reviews of game-based learning research generally report positive effects, while also highlighting substantial methodological variation. Reported outcomes span cognitive, behavioural, affective, and motivational dimensions, although some reviews organise these differently ([Connolly et al., 2012](#); [Sitzmann, 2011](#); [Vlachopoulos & Makri, 2017](#)). This categorical vocabulary is often implicitly reflected in how learning outcomes are described in wargaming research as well. Yet, these categories describe outcomes without explaining how learning is expected to occur.

Within the wargaming literature, learning is often treated as an implicit background assumption rather than an analytically specified object of inquiry. Practitioner-oriented accounts frequently foreground experiential engagement, professional judgment, and participation, without articulating the learning processes through which such activities are assumed to support competence development ([Bae & Brown, 2021](#); [Curry, 2020](#); [Hirst, 2024](#); [Sabin, 2015](#)). While some contributions draw on established educational frameworks to categorize intended outcomes or assessment aims – for example, through the use of Bloom’s taxonomy ([Fowler, 2024](#)) – they offer limited guidance for analysing how learning unfolds during wargaming or how professional competence develops through participation in complex, adversarial tasks.

Taken together, these studies illustrate a recurring pattern in which pedagogical intentions and outcome categories are invoked, but rarely connected through explicit theoretical reasoning that links learning conditions, learning processes, and learning outcomes.

Addressing this gap requires a framework that relates learning conditions, processes, and outcomes. The following section, therefore, outlines the conceptual framework used to analyse how empirical studies of educational wargaming articulate and connect these dimensions of learning.

THEORETICAL FRAMEWORK: CONCEPTUALIZING LEARNING IN EDUCATIONAL WARGAMING

Understanding learning in educational wargaming requires conceptual tools that account for how learning is shaped by design and facilitation, enacted through socially organized activity, and expressed as different forms of knowledge and competence. In these activities, participants interpret situations, make decisions under uncertainty, justify actions, and reflect on consequences.

To structure our analysis, we adapt the Presage–Process–Product (3P) model developed by Biggs (1993), drawing on Tynjälä (2013), to the context of educational learning. While the original model distinguishes between learning conditions, learning processes, and learning outcomes as sequentially related, we modify it to the context of educational wargaming by emphasizing the dynamic interaction between learning conditions and learning processes during gameplay. This framework aligns with the design- and facilitation-oriented character of educational wargaming and provides a common analytical language across diverse empirical studies.

Within this framework (see Figure 1), “presage” refers to learning conditions shaped by scenario design, task structure, facilitation and adjudication practices, institutional framing, and participants’ prior experience. “Process” denotes the situated activities through which learning unfolds during and around gameplay, including sensemaking, decision-making, justification, negotiation, coordinated action under uncertainty, and reflection. “Product” refers to learning outcomes understood as changes in participants’ capability to act, reason, and judge in relation to complex tasks. In the 3P model, learning outcomes are not treated as isolated results but as emerging from the interaction between learning conditions and learning processes. Changes in task design, facilitation, or institutional framing shape how participants engage in learning activities, which, in turn, influence the forms of knowledge or competence that become visible as outcomes.

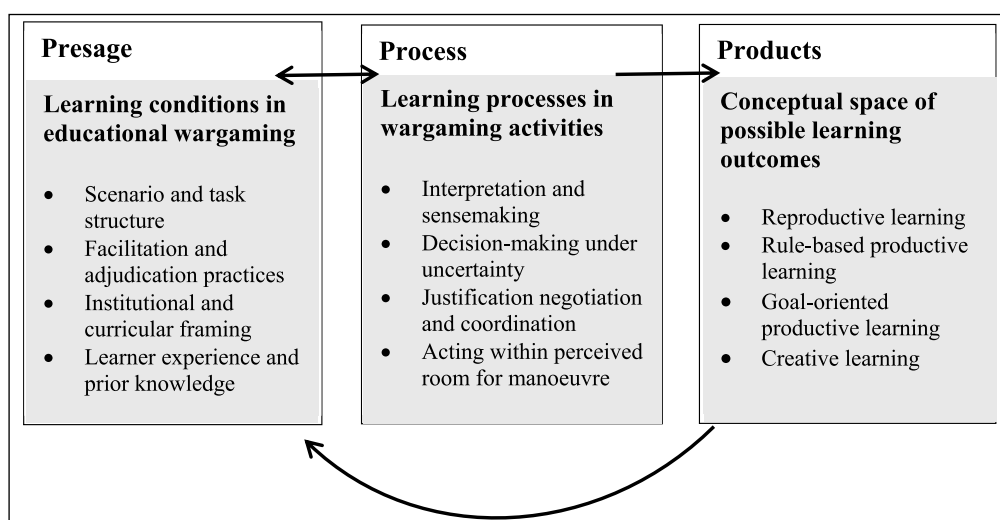


Figure 1 Modified Presage–Process–Product (3P) framework for analysing learning in educational wargaming.

To further specify learning outcomes, we draw on Ellström’s (1992, 2001) action-theoretical perspective, in which learning is conceptualized as the development of action capability under varying task structures and degrees of room for manoeuvre. In this review, these distinctions serve to clarify the conceptual space of possible learning outcomes and to illuminate why some forms of learning are more readily articulated and assessed than others. In line with

the 3P model, the feedback loop denotes pedagogical feedback over time, whereby learning outcomes may inform revisions of learning conditions, facilitation practices, and assessment strategies across iterations.

Finally, within this framework we draw selectively on experiential and game-based learning theories, pedagogical psychology, and sociocultural perspectives to illuminate specific dimensions of learning in wargaming. These perspectives primarily inform the interpretation of learning processes, particularly the situated, collaborative, and interpretive character of decision-making and reflection during gameplay.

INDIVIDUAL PERSPECTIVES: EXPERIENTIAL ENGAGEMENT AND INSTRUCTIONAL CONDITIONS

Educational wargaming is frequently situated within broader traditions of experiential and game-based learning, both of which emphasize the pedagogical value of active involvement, iterative problem-solving, and feedback. Kolb's (1984) experiential learning cycle – moving from concrete experience to reflection, conceptualization, and experimentation – provides a familiar vocabulary for describing how learners engage with wargaming activities. In the game-based learning tradition, digital or analogue games are similarly assumed to support learning through feedback loops, challenge, and motivational engagement (de Freitas & Neumann, 2009; Garris, Ahlers & Driskell, 2002; Hays, 2005). Together, these perspectives help explain why wargaming is often perceived as an attractive pedagogical method and why many implementations emphasize active participation and experiential immersion. Within the 3P framework, experiential and game-based traditions primarily inform the process dimension, illuminating what *individual* learners do in wargaming activities – engage, experiment, decide, reflect – while offering less analytical precision regarding how such processes are related to changes in competence.

Pedagogical psychology introduces a critical qualification by emphasizing the cognitive conditions under which individual engagement is likely – or unlikely – to produce learning. Research on guided instruction demonstrates that novices benefit most from structured guidance, modeling, and scaffolding, whereas minimally guided approaches often produce shallow or misleading understandings (Kirschner et al., 2006). Relatedly, Kirschner et al. (2025) discuss illusions of learning, where high engagement or perceived success is not matched by corresponding improvements in understanding or judgment. Within the 3P model, pedagogical psychology primarily informs the presage dimension, clarifying how specific instructional decisions condition both the processes that unfold during gameplay and the outcomes that can be demonstrated afterwards.

SOCIOCULTURAL PERSPECTIVES ON LEARNING PROCESSES IN EDUCATIONAL WARGAMING

Sociocultural perspectives foreground participation, interaction, and the relationship between actors and their environment as the primary sites of learning in socially organized and materially structured activities. Learning is understood as participation in shared practices where meaning is negotiated through interaction, language, and the use of cultural tools (see Lave & Wenger, 1991; Säljö, 2009), developing through coordinated action, role-taking, and communicative practices embedded in institutional and material contexts. Applied to educational wargaming, this perspective highlights how learning emerges as players assume roles, coordinate actions, justify decisions, and engage in collective sensemaking during and around gameplay.

These perspectives thus contribute to understanding *how* learning unfolds during wargaming activities, shifting attention from individual cognition to collective interpretive practices and knowing-in-action. Within the 3P framework, sociocultural perspectives primarily inform the process dimension, complementing the individual-focused accounts of experiential and game-based learning by foregrounding the interactional and collaborative character of learning in wargaming.

AN ACTION-THEORETICAL PERSPECTIVE ON LEARNING OUTCOMES

To specify what kinds of learning outcomes educational wargaming can plausibly support, we draw on Ellström's action-theoretical perspective on learning and competence (Ellström, 1992, 2001). Learning is conceptualized as the development of action capability, understood as an individual's potential to act competently in relation to task demands and situational constraints.

A central distinction in Ellström's framework is between objective and subjective room for manoeuvre. "Objective room for manoeuvre" refers to the openness inherent in the task, shaped by rules, goals, constraints, and available resources. "Subjective room for manoeuvre" is a matter of how participants perceive and interpret what actions are possible, legitimate, or meaningful within a given situation. In educational wargaming, this distinction is particularly relevant, as scenario design, facilitation, and institutional norms may afford considerable objective freedom while simultaneously constraining participants' perceived scope for action.

Building on this distinction, Ellström differentiates between four qualitatively different forms of learning. Reproductive learning involves carrying out given tasks through given methods. Productive rule-based learning still presupposes given tasks and methods, but allows participants to evaluate whether their actions lead to the intended result. Productive goal-oriented learning involves situations in which the task may be defined, but the means are not given in advance, requiring participants to interpret the situation and weigh alternative courses of action. Creative learning involves questioning or redefining the task itself, and thus generating new approaches, problem framings, or criteria for action.

These learning modes do not represent a developmental sequence, nor are they used here as an empirical classification scheme. Rather, they clarify how different task structures and conditions afford different forms of action capability, without implying that more open-ended learning is inherently preferable. Within the 3P framework adopted in this review, Ellström's action-theoretical perspective specifies the product dimension of learning by clarifying how different learning conditions and task structures afford different forms of action capability.

METHOD

We conducted a semi-systematic review (Snyder, 2019) informed by principles from critical review methodology (Grant & Booth, 2009). A fully systematic review would be less appropriate due to the limited number of empirical studies and the heterogeneity of learning conceptualizations in the field. The semi-systematic approach enables systematic mapping while retaining flexibility to analyse conceptual variation. The approach is particularly suited to emerging research areas where empirical studies remain limited.

DATA RETRIEVAL AND STUDY SELECTION

A systematic database search was conducted in collaboration with librarians from the Anna Lindh library at the Swedish Defence University across three databases: Web of Science, Military Database, and ERIC. The search strategy combined variants of "wargame" with learning-related terms using Boolean operators and excluded studies on machine learning and related computational approaches (see Table 1). Additional searches included targeted journal searches known to publish wargaming research (e.g., *Simulation & Gaming*, *Journal of Advanced Military Studies*) and snowballing via Google Scholar and Keenious, with forward and backward snowballing. Searches were applied to titles, abstracts, and keywords.

Search #1:

wargam* OR "war gam*" OR "war-gam*"

and

(learning OR assessment OR education OR skill* OR pedagogic* OR "learning outcome" OR "learning process"
OR "learning condition*" OR knowledge)

NOT

("reinforcement learning" OR "machine learning" OR "deep learning" OR "contrastive learning" OR
"data mining")

Search #2:

Additional searches: journals with special issues on wargaming, Google Scholar, and Keenious.

Table 1 Search Concepts Used for Study Selection.

We included peer-reviewed journal articles published in English between January 2014 and December 2024, focusing on empirical studies in higher and professional education, including PME. Grey literature, conference proceedings, dissertations, and reports were excluded. Inclusion was based on the authors' own positioning of their work as empirical investigations of learning in relation to educational wargaming or closely related practices, combined with the articulation of an identifiable empirical basis, including some specification of data sources or materials, whether based on primary data collection or systematic engagement with secondary material. Table 2 summarizes the inclusion and exclusion criteria.

INCLUSION	EXCLUSION
Mentions <i>Wargaming</i> (synonyms: wargame, "war game")	Languages other than English
Addresses learning (including synonyms)	Reports and grey literature
Context in Higher education or professional education (including PME)	Posters, workshop papers, and conference presentations
Published in English	Dissertations and theses
Publication date 2014–October 2024	Studies focusing on primary or secondary education
Article includes an abstract	Practice-oriented accounts lacking specification of data sources or empirical material
Peer-reviewed journal article	
Empirical study with an articulated empirical basis (qualitative, quantitative, mixed methods, or systematic use of secondary material)	

Table 2 Criteria Applied in Study Selection.

The initial database search yielded 88 articles. After removing duplicates, 76 articles remained for screening. Snowballing and targeted searches yielded 28 articles, totaling 104 records. The search was last updated on 20 December, 2024.

Screening proceeded in two stages (see Figure 2). Titles and abstracts were first screened against the inclusion criteria, yielding 30 articles. Full-text screening by both authors resulted in 17 articles. During analysis, two articles were excluded as practice-oriented documentation lacking an articulated empirical basis or specification of data sources, resulting in a final sample of 15 studies. Two included studies constitute methodological boundary cases. Curry et al. (2016) synthesize practitioner reports rather than presenting original empirical material, while Martinson (2024) relies primarily on secondary materials and policy discourse. Both were retained because they engage systematically with their source material, though they illustrate the blurred boundary between empirical research and practitioner documentation, which informed our inclusion decisions.

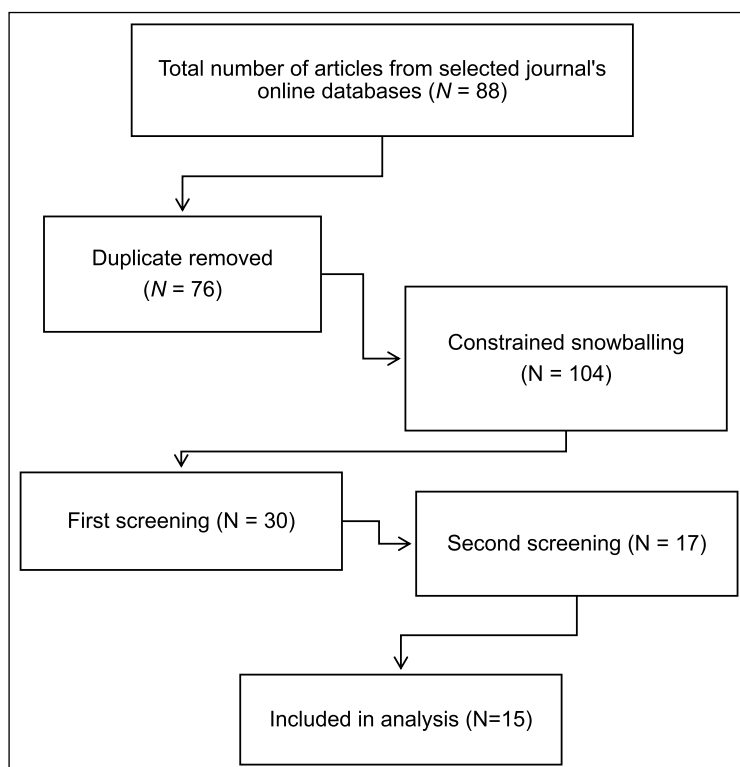


Figure 2 Flow chart of the literature search.

Our inclusion criteria for learning were deliberately broad at the screening stage, encompassing explicit references to learning as well as related educational constructs. This ensured that the review did not pre-emptively narrow the field to specific learning outcomes. Any disagreements during screening were resolved through discussion.

ANALYTICAL APPROACH AND ANALYSIS OF LEARNING

To address the three research questions, we combined systematic mapping with critical, theory-informed synthesis.

First, studies were mapped according to educational context, game format, and learning objectives (RQ1).

Second, learning was analysed in terms of learning conditions, processes, and outcomes using the Presage–Process–Product framework, alongside an assessment of methodological transparency (RQ2). This analysis examined how learning was operationalized and how learning claims were supported empirically. Methodological transparency was assessed at this step using a three-level grading scheme (high, moderate, low), informed by established reporting standards such as PRISMA and adapted to the characteristics of wargaming research. As such, our analysis was context-sensitive, considering disciplinary norms, publication venues, and research purposes when assessing methodological transparency and interpretability. We aimed to evaluate whether reported procedures provided sufficient information for understanding, interpretability, and critical appraisal.

Third, we examined how wargaming concepts were theoretically integrated with learning theory (RQ3). This step allowed us to assess the depth and nature of theoretical engagement, as well as the degree of integration between wargaming theory and learning theory. Overall, the analysis was conducted reflexively and context-sensitively, taking disciplinary norms and research purposes into account.

The extracted information underlying these analyses is summarized in three supplementary tables: Appendix 1 presents characteristics and stated learning objectives of the reviewed studies; Appendix 2 summarizes the operationalization of learning and methodological transparency; and Appendix 3 provides an overview of theoretical frameworks and their integration with wargaming concepts.

Together, the systematic mapping and theory-informed synthesis provide the analytical basis for the results and discussion that follow.

RESULTS

This section presents the findings of the fifteen empirical studies included in the review. The studies span military, civilian, and mixed educational settings and employ diverse research designs and analytical approaches. The results are organized into three sections corresponding to the research questions.

MAPPING AND DESCRIPTIVE CODING OF ARTICLES (RQ1)

The core characteristics of the fifteen studies included in this review are summarized in a structured table (Appendix 1), detailing educational contexts, game mechanics, technological formats, scenario themes, and stated learning objectives.

The reviewed studies show a strong representation of military and professional educational contexts, including officer training academies, advanced military programs, and operational exercises, complemented by cases from civilian higher education (e.g., international relations and law). The cases cover learner groups from cadets and students to experienced officers and faculty.

The studies also display considerable diversity in core mechanics and the use of technology. Most employ adversarial, team-based setups in two-sided (Red/Blue) formats (e.g., [Harris & Freeman, 2023](#); [Martinson, 2024](#); [Reynaud & Northcote, 2015](#); [Rosen & Kerr, 2024](#); [Smith et al., 2024](#)). Others make use of matrix games or multi-stakeholder negotiation formats in both military ([Hagen, 2022](#); [Roennfeldt et al., 2022](#)) and civilian contexts ([Chalecki, 2021](#)), with Bell

and Bollfrass (2022) offering hybrid military–civilian examples. While some studies incorporate decentralised grey-zone mechanics (Bell & Bollfrass, 2022), others focus on the design of specific negotiation mechanics (Glasgow, 2014). A smaller subset employs computer-based or digitally mediated formats (Curry et al., 2016; Minai, 2020; Harris & Freeman, 2023; Smith et al., 2024), including adaptations to online environments during COVID-19 (Hagen, 2022; Harris & Freeman, 2023). Within the reviewed sample, analogue and tabletop formats remain the most common overall, featuring in eight of the fifteen studies.

Scenario themes reflect the disciplinary orientation of each intervention, ranging from tactical military operations and naval warfare (Martinson, 2024; Rosen & Kerr, 2024) to ground operations (Smith et al., 2024) and combined arms or strategic-level dilemmas (Bell & Bollfrass, 2022). In civilian contexts, scenarios tend to support conceptual or strategic understanding, such as international relations theory (Mattlin, 2021) or policy challenges (Chalecki, 2021). None of the reviewed studies focuses exclusively on air operations, although a few incorporate multi-domain elements.

Learning objectives vary substantially. Some studies target tactical or operational proficiency (Rosen & Kerr, 2024; Smith et al., 2024), while others aim for conceptual, reflective, communicative, or metacognitive skills (Alme & Hvidsten, 2022; Bell & Bollfrass, 2022). Certain implementations align learning objectives tightly with game mechanics, as in Mattlin's (2021) adaptation of Diplomacy to teach Wendt's cultures of anarchy, while others treat scenario themes primarily as platforms for broader educational goals. For example, both Hagen (2022) and Roennfeldt et al. (2022) examine peacekeeping through the United Nations Organization Stabilization Mission in the Democratic Republic of the Congo (MONUSCO) matrix game but pursue different aims: Hagen focuses on narrative and rhetorical complexity, while Roennfeldt et al. evaluate operational and strategic decision-making. Glasgow (2014) takes a different approach altogether, using wargame design rather than gameplay as the primary educational activity.

The mapping shows recurring patterns, such as adversarial mechanics and team-based negotiation, and variation in context, format, and educational intent. These variations form an important backdrop for the following analysis of learning conditions, processes, and outcomes across the reviewed studies.

CONCEPTUALIZATIONS OF LEARNING IN EDUCATIONAL WARGAMING (RQ2)

Learning Conditions

The reviewed studies describe learning in educational wargaming as shaped by a set of conditions that enable, structure, or constrain what participants can do and learn. In line with our analytical framework, “conditions for learning” are defined as the contextual, structural, facilitative, and procedural features that permit or constrain particular forms of learning. Across the 15 studies, these conditions cluster around 4 recurring domains: (1) instructional design and scenario structure; (2) facilitation and adjudication practices; (3) reflection and debriefing arrangements; and (4) format-specific technological and material affordances.

Instructional design and scenario structure emerged as central to establishing meaningful learning conditions. Studies such as Alme and Hvidsten (2022), Bell and Bollfrass (2022), Minai (2020), and Reynaud and Northcote (2015) emphasize the importance of careful scenario preparation, explicit role definitions, and the integration of wargaming activities with lectures and course objectives. In some cases, learning objectives are directly embedded into game mechanics, as in Mattlin's (2021) adaptation of Diplomacy to teach theoretical concepts or Rosen and Kerr's (2024) focus on eliciting decision-making aligned with predefined doctrinal criteria through tightly structured scenarios. When the scenario is complex, unclear, or misaligned with curricular aims, the learning conditions become less clearly structured. Under such circumstances, the educational significance of the activity depends more heavily on facilitator intervention and on how participants interpret and enact their roles within the scenario.

Facilitation and adjudication practices constitute another major condition for learning. Across the studies, the facilitator shapes not only the conduct of the game but also the pedagogical environment. Facilitators adjudicate outcomes, manage time, support negotiation, and guide participants' attention toward relevant cues. Kuehn's (2021) discussion of challenges – gamesmanship, loss of control, faculty workload, fairness, and difficulties in assessing individual

learning – illustrates how facilitation forms a structural condition with direct implications for what learning is possible. In matrix games (Hagen, 2022; Roennfeldt et al., 2022), expert facilitation combined with adjudication mechanisms (such as randomized modifiers) enables open-ended argumentation and creative reasoning. By contrast, Bell and Bollfrass (2022) adopt a distributed-agency approach, decentralizing decision authority in ways that broaden participation but complicate standardization and comparison across groups.

Reflection and debriefing arrangements are widely cited as critical learning conditions, though their structure and implementation vary substantially. Some studies integrate reflection continuously during gameplay, particularly in remote or hybrid settings (Harris & Freeman, 2023), while others rely primarily on post-game debriefing to consolidate understanding (Reynaud & Northcote, 2015; Roennfeldt et al., 2022). Alme and Hvidsten (2022) explicitly analyse the transition between immersion and reflection as a learning process. Although reflection is universally treated as pedagogically valuable, no study systematically isolates its impact from other elements of the wargaming activity.

Technological formats and material affordances associated with different game formats shape learning conditions in distinct ways. Analogue and tabletop formats (e.g., Reynaud & Northcote, 2015) enable embodied interaction, shared spatial reasoning, and immediate social cues. Digital formats (Harris & Freeman, 2023; Smith et al., 2024) necessitate explicit communication protocols, introducing mediated interaction that can limit spontaneity but enhance scalability and flexibility. Hybrid configurations (Hagen, 2022) combine the advantages and challenges of both formats, requiring additional facilitation strategies to maintain coherence across physical and virtual environments.

A further distinction, largely implicit in the reviewed studies, concerns the difference between digital formats that function as computer-based training environments and those that aim to mediate human-human interaction. Studies such as Curry et al. (2016) and Minai (2020) examine systems in which participants primarily interact with a digital game engine, placing learning closer to a serious games-style approach to individual cognition. By contrast, studies such as Smith et al. (2024) and Harris and Freeman (2023) use digital interfaces to connect players who engage in adversarial, collaborative, or role-based interactions. In these cases, the platform shapes communication and affordances but does not replace human judgment or social reasoning. This distinction is pedagogically significant, as digital mediation may alter the subjective room for manoeuvre and communication ecology without fundamentally altering the social character of wargaming.

These findings show that instructional design, facilitation, reflective structure, and technological format interact as interdependent conditions for learning in educational wargaming. They shape both the *objective* room for manoeuvre available to participants (what can be done within the scenario) and the *subjective* room for manoeuvre (what participants perceive as possible or legitimate), thereby influencing whether activities invite more reproductive, rule-based, or exploratory forms of learning. Many of these conditions are double-edged: high facilitator involvement can enhance learning opportunities but reduce scalability; open-ended or decentralized scenarios may promote creativity but undermine comparability; digital platforms may increase flexibility in participation and delivery, while also reshaping the interactional formats through which learning processes unfold. These variations form the backdrop for analysing the learning processes and outcomes reported across the reviewed studies.

Learning Processes

Overall, learning processes are often described in considerably more detail than learning outcomes. Many authors provide descriptive accounts of what participants do in and around wargaming activities, highlighting interaction, argumentation, coordination, reflection, and iterative decision-making. These descriptions portray learning as emerging through participation in structured activities, including gameplay, discussion, and debriefing, rather than as an internal or purely individual cognitive change.

Several studies describe learning processes consistent with sociocultural perspectives, emphasizing participation, dialogue, negotiation, and collective interpretation of evolving situations during gameplay and reflection. For example, Bell and Bollfrass (2022) analyse how participants coordinate, negotiate, and justify decisions in decentralized wargaming

environments, highlighting how understanding emerges in social contexts rather than individual optimization. Similarly, Roennfeldt et al. (2022) describe how participants collectively interpret scenarios and articulate strategic considerations through facilitated discussion, framing learning as a socially organized process of sensemaking.

Iterative cycles of action and reflection constitute another recurring feature across the corpus. Participants are commonly described as making decisions, observing consequences, and revising subsequent actions in light of emerging information and feedback from the game system, peers, or facilitators. Studies such as Minai (2020) and Reynaud and Northcote (2015) describe how repeated decision–consequence cycles create opportunities for learners to test assumptions, explore alternative courses of action, and refine their reasoning. Reflection, whether embedded during gameplay or structured in post-game debriefings, is frequently highlighted as an important learning process. Harris and Freeman (2023) incorporate ongoing reflection moments into their remote format, whereas Reynaud and Northcote (2015) and Roennfeldt et al. (2022) treat facilitated debriefings as central to consolidating learning. Alme and Hvidsten (2022) further show how transitions between immersion and reflection shape participants' understanding of unfolding situations. Interestingly, one empirical assessment study suggests that students often attribute learning primarily to gameplay itself rather than to post-game reflection (Rosen & Kerr, 2024). Despite this emphasis, reflection is rarely operationalized in ways that allow systematic analysis of how particular forms of iteration or debriefing contribute to specific learning outcomes.

Facilitation plays a role in shaping learning processes across some of the reviewed studies. Instructors, educators, or facilitators are described as framing tasks, guiding attention, moderating discussion, and supporting transitions between gameplay, interruption, and structured reflection. Through questioning, feedback, and selective emphasis, facilitators help participants articulate reasoning, connect in-game experiences to broader professional concepts, and negotiate shared understandings of what occurred during the activity (e.g., Alme & Hvidsten, 2022; Kuehn, 2021). Despite this emphasis, facilitation is most often treated descriptively rather than analytically, and few studies examine in detail how specific facilitation practices shape learning processes as they unfold in interaction.

Several studies also point to tensions between competitive gameplay and learning-oriented participation. Martinson (2024) observes that tournament-style wargaming competitions in the Chinese Navy risk emphasizing winning over reflective learning. Similarly, Kuehn (2021) identifies “gamesmanship” as a recurrent challenge in educational wargaming, where players optimize strategies for success within the game rather than for the intended learning objectives. From a different perspective, Alme and Hvidsten (2022) note that highly immersive or competitive “gamer modes” may orient participants toward performance and engagement rather than reflective learning, highlighting the importance of structured transitions between gameplay and reflection. These studies suggest that competitive dynamics can both stimulate engagement and potentially redirect attention away from learning goals. In some cases, gameplay also challenges students' prior assumptions about warfare and historical events. For example, Reynaud and Northcote (2015) report that students' misconceptions about campaigns and military capabilities were revised through repeated gameplay and reflection.

Taken together, the reviewed studies portray learning processes as socially organized, interactionally accomplished, and deeply embedded in the structure of wargaming activities and their surrounding reflective practices. While individual studies legitimately focus on specific dimensions of learning, process descriptions are seldom accompanied by explicit theoretical reasoning about how conditions shape those processes or what outcomes they plausibly afford, limiting the potential for cumulative comparison across studies. The 3P framework does not require that every study empirically investigate all three dimensions, but it does provide a conceptual vocabulary for reasoning across them.

Learning Outcomes

In the reviewed corpus, learning outcomes are operationalized through a heterogeneous set of indicators, most commonly framed in cognitive, behavioural, or affective terms, often reflecting categories familiar from adjacent fields such as game-based learning.

Cognitive outcomes are the most explicitly articulated and empirically evidenced. Several studies report gains in domain-specific knowledge or improvements in the application of concepts through pre-/post-tests or analyses of decision rationales (see, for example, [Rosen & Kerr, 2024](#); [Minai, 2020](#)). Conceptual learning, such as increased historical understanding or theoretical comprehension, is also reported in political science and international relations contexts ([Reynaud & Northcote, 2015](#); [Mattlin, 2021](#)).

Behavioural outcomes are often inferred from observed or reported performance during gameplay. Studies describe improved coordination, communication, or decision-making under conditions of uncertainty, but typically without clearly specified criteria for what constitutes behavioural improvement. For example, [Bell and Bollfrass \(2022\)](#) infer behavioural competence from participants' ability to negotiate and coordinate in decentralized wargaming environments, while [Roennfeldt et al. \(2022\)](#) argue that their exercise supports the development of a strategic mindset primarily through participants' reflections.

Affective and experiential outcomes are the most commonly reported across the corpus. Engagement, motivation, perceived relevance, and enjoyment are frequently measured through self-reported learning gains or post-activity reflections (e.g., [Harris & Freeman, 2023](#); [Smith et al., 2024](#); [Curry et al., 2016](#)). These outcomes are often treated as indicators of educational value, even when their relationship to more clearly defined forms of learning remains analytically underspecified.

Viewed through [Ellström's \(1992, 2001\)](#) distinction between different modes of learning, the reviewed studies differ not only in the outcomes they report but also in the kinds of learning their research designs make analytically visible. When tasks, performance criteria, and assessment criteria are tightly specified, assessment can focus on outcomes that are definable in advance and measurable against relatively fixed benchmarks, as in [Rosen and Kerr \(2024\)](#). Such designs make reproductive and rule-based productive forms of learning more readily assessable, but they also narrow the range of competence that can be demonstrated empirically. By contrast, studies that aim to address goal-oriented, productive, or creative forms of learning typically rely on less standardized forms of evidence, such as participant reflections, narratives, or post-activity discussions. In these cases, the issue is not necessarily that such forms of learning are absent, but that they are rarely defined or assessed with equivalent precision.

Across the reviewed corpus, systematic alignment between learning objectives, process design, and assessment strategies appears limited. This does not suggest the absence of more complex forms of learning; rather, it indicates that current research designs most readily capture outcomes linked to predefined tasks or assessment proxies, whereas goal-oriented, productive, and creative forms of learning are more often addressed through indirect or self-reported measures.

Methodological Transparency and Assessment Practices

To address the second part of the research question, we examined how the reviewed studies report research design, data collection, analytical procedures, and assessment strategies. Methodological transparency is treated here as a prerequisite for interpreting claims about learning in educational wargaming and is assessed using a three-level grading scheme (high, moderate, low), adapted to the field's heterogeneity. A complete overview of transparency levels across all fifteen studies is provided in Appendix 2.

A cluster of studies provides relatively high transparency by offering detailed accounts of research procedures and clear links between data and findings. [Harris and Freeman \(2023\)](#), [Minai \(2020\)](#), and [Reynaud and Northcote \(2015\)](#) describe their sampling strategies, data sources, and analytic steps in sufficient detail to enable critical appraisal. [Harris and Freeman \(2023\)](#), in particular, combine survey data, observational insights, and qualitative reflections, documenting both quantitative and qualitative procedures. Their outcome measures rely on self-report, which poses limitations, but the transparency of their methodological reporting is notable.

[Rosen and Kerr \(2024\)](#) represent a high-to-moderate transparency case with an unusually rigorous empirical design. Their study addresses several well-known challenges in educational gaming research, including small sample sizes, the need for both objective and subjective data, risks of instructor bias, and difficulties in constructing control groups. They also separate

teaching and research roles and report effect sizes using standard benchmarks, enhancing interpretability. Nevertheless, the absence of publicly available test instruments and survey questions limits replicability and secondary analysis, illustrating how even methodologically ambitious studies face practical constraints.

By contrast, several studies demonstrate only moderate or low transparency. Smith et al. (2024) report statistical procedures in detail but provide limited information about interactional dynamics and material constraints in the digital environment. Hagen (2022) offers extensive empirical material from matrix game sessions but is less explicit about analytic procedures.

Assessment strategies also vary widely across the reviewed studies. Objective measures, such as knowledge tests (e.g., Rosen & Kerr, 2024), may support comparability. Subjective measures – including participant reflections, surveys, or process-based assessments (Reynaud & Northcote, 2015; Harris & Freeman, 2023; Roennfeldt et al., 2022) – capture experiential and affective dimensions but raise concerns about validity, generalizability, and alignment with stated learning objectives.

Overall, methodological transparency remains uneven across the literature. While some studies clearly document their procedures, others provide only limited information about data collection, analysis, or assessment. More generally, limited reporting of how learning objectives, activity design, and assessment strategies are connected constrains both the interpretation of reported outcomes and the potential for cumulative knowledge-building across studies.

INTEGRATION OF WARGAMING AND LEARNING THEORIES (RQ3)

The reviewed studies engage with and integrate theoretical frameworks related to wargaming and learning in markedly different ways. To examine this variation systematically, the analysis mapped how each study engages with wargaming concepts, learning theory, and the extent to which these frameworks are integrated into research design and interpretation. An overview of the theoretical underpinnings and levels of integration across the included studies is presented in Appendix 3. The results reveal substantial variation: while some studies explicitly mobilize pedagogical frameworks to structure both design and analysis, others rely on implicit assumptions about experiential learning or refer only loosely to learning concepts. Overall, theoretical integration ranges from explicit and analytically productive to implicit and loosely articulated.

A small group of studies offers strong theoretical integration by combining wargaming concepts with established learning theories in a coherent analytical framework. Reynaud and Northcote (2015), for example, draw on reflective practice, authentic learning, and productive failure to illuminate how iterative role-play supports historical understanding. Glasgow (2014) situates simulation design within a constructivist pedagogical framework, emphasizing collaborative knowledge construction and problem-based learning. These studies treat theory not as a decorative element but as an analytic tool that structures the interpretation of observed learning processes.

A larger group of studies exhibits partial integration. These works often reference classic wargaming theory – such as Perla's (1990) focus on structured experience or Sabin's (2012) principles of abstraction and adjudication – but incorporate learning theory in a more limited or ad hoc manner. Bell and Bollfrass (2022) present one of the most explicit articulations of design assumptions in the reviewed literature, drawing on complexity theory and negotiation research to justify a dynamic and decentralized design. However, these frameworks primarily describe system behaviour and interaction patterns rather than how learning occurs. Their relevance for learning lies primarily in how they frame interaction, uncertainty, and coordination, rather than specifying the processes through which learning develops. Yet the study does not connect these design logics to explicit learning processes or outcome trajectories, leaving the relationship between pedagogical assumptions and actual learning analytically open. Other examples of partial integration include Kuehn (2021), who links facilitation and adjudication to assessment theory, and Roennfeldt et al. (2022), who draw on interaction and systems thinking to frame their analysis. However, connections to contemporary learning theory remain brief.

Finally, several studies demonstrate minimal or implicit theoretical engagement. In some cases, learning is discussed primarily through practitioner-oriented assumptions embedded within wargaming tradition – for example, the belief that immersion, competition, or realism naturally

translate into learning – rather than through explicit theoretical constructs. While Rosen and Kerr (2024) provide a methodologically rigorous study of engagement and knowledge gain, they do not articulate a theoretical explanation of how learning unfolds during wargaming. Martinson (2024) similarly discusses learning primarily through professional-military discourse rather than through explicit pedagogical theory. Smith et al. (2024) focus on affective and experiential responses without connecting these outcomes to cognitive or social learning processes. Such studies offer valuable descriptive insights but risk reverting to folk theories of learning (see Bennerstedt, Ivarsson & Linderöth, 2012; Säljö, 2009), where learning is treated as self-evident rather than analytically specified.

Patterns of theoretical integration cut across educational contexts rather than mapping neatly onto civilian–military distinctions. Yet there are noteworthy exceptions. Kuehn (2021) bridges these approaches by integrating wargaming practice with assessment theory, while studies such as Alme and Hvidsten (2022) and Minai (2020) illustrate how experiential learning concepts can be explicitly connected to empirical analysis. These examples demonstrate the potential for productive theoretical pluralism when concepts are clearly articulated and explicitly linked to empirical claims.

Overall, the field exhibits uneven theoretical development. While some studies articulate clear conceptual links between wargaming practices and learning theory, many rely on implicit assumptions about how participation in gameplay leads to learning. As the overview in Appendix 3 illustrates, theoretical integration ranges from explicit and analytically productive to implicit and loosely articulated. This unevenness complicates cross-study comparisons and constrains the cumulative knowledge-building process. A more consistent articulation of theoretical assumptions – both regarding wargaming as a pedagogical practice and the nature of learning – would strengthen the field’s evidentiary basis and support a more rigorous integration of empirical findings.

DISCUSSION

This review shows that contemporary empirical research on educational wargaming conceptualizes learning in markedly different ways and supports these conceptualizations through heterogeneous methodological practices. The field is characterized less by conceptual consensus than by fragmentation in how learning is defined, operationalized, and evidenced. This fragmentation is not merely a methodological issue. Still, it reflects deeper theoretical differences in how learning in wargaming is understood – as cognitive change, as social and interactional accomplishment, or as the development of situated professional judgment mediated through facilitation and reflection.

CONCEPTUAL AMBIGUITIES IN DEFINING LEARNING

Across the reviewed studies, learning is conceptualized in highly variable ways – sometimes defined explicitly, but often inferred indirectly from participant behaviour, engagement, or self-report. This conceptual ambiguity reflects a broader challenge in educational wargaming research: learning is frequently treated as self-evidently following from participation in well-designed or engaging wargames, rather than as something to be theorized, operationalized, and empirically unpacked. Many studies rely on short-term indicators such as enjoyment, perceived relevance, or in-game success, without examining the underlying processes through which professional judgment, interpretive skill, or domain-specific understanding are expected to develop.

From an analytical perspective, such approaches may risk conflating engagement, participation, or in-game performance with learning, a concern echoed in pedagogical psychology through the notion of illusions of learning (Kirschner et al., 2025). Studies of gameplay interaction similarly show that learning cannot be assumed simply from participation in games, while also demonstrating that players may develop forms of understanding that differ from the intended learning outcomes (Bennerstedt, Ivarsson & Linderöth, 2012). A related tension concerns the competitive dynamics inherent in many wargames. Several reviewed studies indicate that participants may orient their actions toward winning the game rather than toward the intended learning objectives, a phenomenon previously described in educational wargaming

as “gamer mode” (Frank, 2012). Such dynamics illustrate how engagement and competitive gameplay can simultaneously stimulate participation while redirecting participants’ attention toward optimizing in-game success rather than toward interpreting the professional problems the wargame is intended to represent. From a 3P perspective, this can be understood as a shift in learning processes arising from particular design and facilitation conditions.

Epistemological variation across the reviewed studies further shapes what counts as evidence and what forms of comparison are considered meaningful. Studies such as Rosen and Kerr (2024) implicitly adopt a more positivist logic, treating learning as an outcome measurable through predefined indicators, while studies such as Bell and Bollfrass (2022) draw on constructivist and sociocultural assumptions, emphasizing meaning-making and situated understanding as the primary expressions of learning. As Säljö (2009) argues, theoretical plurality is a productive condition for intellectual development – but only when epistemological assumptions are made explicit rather than left implicit. Making these assumptions visible is therefore essential for more cumulative and analytically precise research on learning in educational wargaming.

From an action-theoretical perspective (Ellström, 1992, 2001), what the studies’ format-based categories – such as digital versus analogue, or discussion-based versus map-based – leave analytically underspecified is how tasks, constraints, and room for manoeuvre structure participants’ opportunities for interpretation, decision-making, and professional judgment. This is not a criticism of individual studies for failing to investigate all dimensions of learning simultaneously, but a field-level observation: across the reviewed studies, wargames are typically justified with reference to anticipated forms of competence development, even when these expectations are not explicitly theorized or connected to design and facilitation decisions. What matters for learning, from this perspective, is not the formal category of the game but how design and facilitation structure conditions for action and reflection – a question that often remains implicit in the reviewed literature.

This tension between pedagogical rationale and assessment design is analytically productive rather than merely a limitation. Rosen and Kerr (2024) assess whether students can apply predefined operational art criteria to a historical case – a coherent design that yields statistically significant learning gains among wargaming students. From an action-theoretical perspective, however, the tightly structured scenario and predefined assessment criteria constrain participants’ room for manoeuvre in ways that make rule-based productive learning visible while leaving the broader forms of judgment and professional reasoning invoked in the pedagogical rationale analytically inaccessible. By contrast, Reynaud and Northcote (2015) create conditions – iterative productive failure, misconception-challenging scenarios, and sustained semester-long engagement – that plausibly afford more goal-oriented forms of learning, even though their qualitative methods cannot confirm this with equivalent precision. The difference between these studies is not one of methodological quality but of what different presage conditions make visible as outcomes – a pattern that recurs across the reviewed literature and remains largely unarticulated as a field-level observation.

OPENING THE PEDAGOGICAL BLACK BOX

A recurring limitation in much of the reviewed literature is the reliance on relatively coarse indicators of learning, such as self-reports, aggregate performance measures, or post-hoc reflections. While such indicators may be sufficient to support claims that learning has occurred, they provide limited insight into how learning processes unfold in practice. Several studies describe interaction, coordination, and discussion in relatively rich descriptive terms, but few examine learning processes through fine-grained analysis of interaction as it unfolds moment by moment.

This mirrors a broader challenge identified in simulation research: the need to “open the pedagogical black box” by examining how learners and instructors jointly construct meaning during learning activities (Lymer & Sjöblom, 2024). Recent work within educational wargaming has begun to address this gap by adopting micro-analytic approaches that examine interaction during debriefing (e.g., Sjöblom & Lymer, 2025), showing how professional understanding is shaped through situated discourse rather than assumed as an automatic consequence of participation.

While much of the wargaming literature foregrounds game design, participant experience, or post-hoc outcomes, facilitation is often discussed only normatively or generically. By analysing how facilitators frame tasks, guide attention, and make professional norms relevant in wargaming activities, micro-analytic studies render visible a dimension of pedagogical work that remains largely implicit in the broader empirical literature.

METHODOLOGICAL TRANSPARENCY AND THE CHALLENGE OF ASSESSING COMPETENCE

Methodological transparency varies across the reviewed studies (see Appendix 2), with some providing detailed accounts of facilitation practices, role definitions, scenario design, and data analysis, while others omit information crucial for interpretability and comparison – particularly consequential given that facilitation, adjudication, and scenario structure are constitutive elements of learning conditions rather than neutral backdrops. Assessment strategies similarly reflect different assumptions about what learning in educational wargaming is and how it can be made empirically visible: predefined tests foreground outcomes specifiable in advance, whereas process-oriented approaches better capture situated judgment and professional reasoning as they unfold in practice.

CONCLUSIONS

This review examined fifteen empirical studies of educational wargaming published between 2014 and 2024 and provides a systematic mapping of how learning is conceptualized, operationalized, and theoretically grounded in this emerging field. The analysis identifies a field marked by both pedagogical ambition and considerable conceptual fragmentation. While recent studies demonstrate increasing sophistication in scenario design, facilitation practices, and educational intent, they vary considerably in how they define, theorize, and empirically assess learning. As a result, it remains difficult to compare findings across studies or to articulate clearly what kinds of learning educational wargaming supports.

A central finding of the review is that learning in wargaming cannot be adequately inferred from engagement, in-game performance, or self-reported experience alone. Understanding learning as the development of professional competence necessitates attention to how learning conditions, interactional processes, and learning outcomes are interrelated. Few studies analyse how facilitation and scenario design shape learners' room for manoeuvre, and even fewer document in detail how meaning is constructed during gameplay or debriefing. Longer-term outcomes, such as retention, transfer, or the development of professional judgment, are not systematically examined in any of the reviewed studies and are suggested as areas of future research.

Taken together, the review highlights the importance of greater theoretical and epistemological explicitness in research on educational wargaming. Different research traditions conceptualize learning outcomes in fundamentally different ways – ranging from measurable effects and participation in practice to situated competence-in-action and action capability. Rather than requiring reconciliation into a single framework, making these assumptions explicit enables more productive comparisons, cumulative knowledge building, and analytically precise claims about learning.

Future research would benefit from designs that more explicitly link pedagogical intent, game design, facilitation, and empirical analysis. Process-oriented studies that open the pedagogical “black box” can clarify how learning unfolds in interaction, while assessment strategies that move beyond short-term indicators can support more robust claims about the development of professional competence. By approaching educational wargaming as a pedagogical practice shaped by design choices, facilitation, and explicit epistemic commitments, future research can move toward a more cumulative and empirically grounded understanding of how, and under what conditions, wargaming supports professional learning in complex and uncertain environments.

All data analysed in this study consist of publicly available published literature and supplementary appendices, all of which are cited and available within the manuscript and reference list.

ADDITIONAL FILES

The additional files for this article can be found as follows:

- **Appendix 1.** Study characteristics and stated learning objectives of the reviewed educational wargaming studies (2014–2024). DOI: <https://doi.org/10.31374/sjms.451.s1>
- **Appendix 2.** Operationalization of learning and methodological transparency in the reviewed studies. DOI: <https://doi.org/10.31374/sjms.451.s2>
- **Appendix 3.** Theoretical frameworks and levels of integration in the reviewed studies. DOI: <https://doi.org/10.31374/sjms.451.s3>

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COMPETING INTERESTS


The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

Ulrika Bennerstedt led the conceptualization of the study and the development of the analytical framework. Ulrika Bennerstedt and Björn Sjöblom jointly conducted the screening and analysis of the included studies. Both authors approved the final version.

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