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Original Contribution

Enhancing perioperative care through decontextualized simulation: A game-changer for non-technical skills training

Paul Abraham [a,b,*], Nadège Dubois [c], Thomas Rimmelé [b,d], Marc Lilot [b,e,g], Baptiste Balança [b,f]

[a] Department of Anesthesiology, Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland
[b] Centre Lyonnais d'Enseignement par la Simulation en Santé (CLESS), SimuLyon. Claude Bernard University Lyon 1-Hospices Civils de Lyon, Lyon, France
[c] Medical Simulation Center, Public Health Department, Liège University, Liège, Belgium
[d] EA 7426, PI3 (Pathophysiology of Injury-Induced Immunosuppression), Claude Bernard University Lyon 1-Biomérieux-Hospices Civils de Lyon, Lyon, France
[e] Unit of Pediatric and Congenital Cardio-thoracic Anesthesia and Intensive Care, Medical-Surgical Department of Congenital Cardiology of the Fœtus, Child and Adult. Louis Pradel Hospital, Hospices Civils de Lyon, Lyon, France
[f] Neurologic Intensive care and Anesthesiology, Hospices Civils de Lyon, Pierre Wertheimer Hospital and Claude Bernard University Lyon 1 - Neuroscience Research Center, Lyon, France
[g] Claude Bernard University Lyon 1, Research on Healthcare Performance (RESHAPE), INSERM U1290, Lyon, France

HIGHLIGHTS

- Decontextualized simulation offers an innovative method for enhancing non technical skills (NTS) training in healthcare.
- Harness the gaming environnement to encourage sustained attention, engagement, knowledge retention and feedback.
- Integrate decontextualized simulation within educational programs and training to enhanced team performance.
- Versatility and easy implementation make decontextualized simulation a valuable tool for perioperative quality and safety.

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To the Editor,

Perioperative quality and safety encompass a range of processes, protocols, and guidelines implemented before, during, and after surgical procedures. These measures are designed to mitigate risks, minimize occurrence of complications, and enhance patient outcomes. The frequent occurrence of unanticipated events remains challenging for healthcare teams to perform safe and reliable actions in a dynamic and stressful environment. To ensure the optimal management of critical situations in healthcare, a team of experts needs to master both technical and non-technical skills (NTS) to deliver the highest quality of care in the safest environment [1,2]. NTS encompass a wide variety of individual and collective skills such as situation awareness, effective communication, stress management, appropriate clinical reasoning, leadership, and teamwork [3].

The undergraduate and postgraduate medical education often include extensive training focused on technical skills. Conversely, fewer

* Corresponding author at: Department of Anesthesiology, Centre Hospitalier Universitaire Vaudois, Lausanne, Switzerland.
E-mail address: paul.abraham@chuv.ch (P. Abraham).

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efforts are dedicated to NTS teaching while these skills are very much needed to efficiently manage critical situations, especially in the perioperative care [4]. For instance, in a large cohort of hospitals in the United States, the Risk Management Foundation of Harvard Medical Institutions Incorporated reported that communication errors were responsible for 30% of serious professional misconduct cases [5]. These led to the death of more than 1700 patients, with an associated cost of 1.7 billion dollars. Regular training on team communication to enhance collaborative work could therefore be the future of highly reliable healthcare systems, and it is of note that Neily et al. reported that such a training program significantly reduced medical errors, length of intensive care unit stay, and mortality rate [6]. The program, that was implemented nationwide by the Veterans Health Administration in all facilities conducting surgeries, involved a comprehensive day-long onsite learning session attended by the entire perioperative team, including surgeons, anesthesiologists, nurse anesthetists, nurses, and technicians; caregivers followed a specialized curriculum focusing on NTS, which encompassed lectures, group interactions, and educational videos. This is a foundational piece of NTS training literature, but the best strategy to implement teamwork training in clinical practice is still based on scarce data and needs to be determined [7].

Various models, such as Knowledge, Skills, Ability (KSA) as well as Input, Processes, Output (IPO), have been used to understand what makes people and teams work effectively. They do this by using specific action-related terms based on the Bloom taxonomy, a way of classifying different levels of thinking and learning [8]. To enhance team performance, it is crucial to facilitate teams in leveraging their experiences and translating them into practical applications in real-world scenarios. By doing so, we can broaden the positive impact of experiential learning, as outlined in the Kolb circle of experiential learning [9,10]. Numerous resources and tools have been created to bolster teamwork, particularly through the use of interprofessional simulation programs [11].

Simulation programs have now integrated NTS as a fundamental component of team-based educational curricula. This integration is particularly apt as full-scale simulations align seamlessly with the previously described methodology and learning objectives [12]. In addition to full-scale and *in situ* simulations, decontextualized simulation (DCS) may be based on accessible and efficient tools with fewer required resources. Herein, we propose a definition of DCS, describe its relevance in NTS education or team training, and give some examples of how and why its implementation for better and safer perioperative care is of interest.

1. Defining decontextualized simulation

The concept of DCS in healthcare education, while well-articulated in terms of its separation from the healthcare context, lacks a clear and precise definition within the framework of simulation-based training modalities. The term is predominantly used during debriefings, specifically within the Contextualization, Decontextualization, and Recontextualization (CDR) cycle. The latter aims to enhance learning transfer by dissecting an experienced situation within its simulated context, abstracting the situation from its original context, and then reapplying it in a novel context [13].

In the field of healthcare simulation, the overarching aim is to meticulously recreate real-life contextualized scenarios, thereby establishing a conducive environment for healthcare professionals to exhibit and refine their competencies across a spectrum of technical and NTS. These competencies are multifaceted, encompassing knowledge, performance, and attitude. To enhance engagement and promote the cultivation of these skills, an array of simulation tools has been deployed, ranging from simple tools to intricate and interactive modules [12]. Notably, these tools often incorporate playful and immersive elements, even in traditional simulation settings, to create a more engaging and effective learning experience.

By synthesizing these concepts, we can redefine DCS as a distinct educational approach. In this approach, professionals are trained in NTS through engaging and playful methodologies that diverge significantly from traditional healthcare settings. This redefinition not only clarifies the role of DCS within the training spectrum but also highlights its potential as a unique and effective learning modality.

2. The decontextualized simulation, “it's in the game”

Drummond et al. report that gaming methodologies significantly increase the efficacy of health education, capitalizing on essential pedagogical principles such as prolonged concentration, proactive participation, retention of knowledge, and provision of feedback [14]. Additionally, gaming mechanisms enhance participants' compliance with established guidelines, encourage repetitive practice, and amplify their motivation to elevate performance levels [15]. In this context, DCS presents a broad spectrum of potential applications.

Predominantly, the implementation of multiplayer gaming scenarios facilitates collaborative interactions among participants, fostering the development of NTS [14]. Serious games, which are designed with educational objectives in mind, provide an engaging platform that can be adapted to various simulation modalities, contingent on the educational goals, target demographic, and available resources. Despite the limited prevalence of serious games specifically tailored to the healthcare sector, there is a substantial repertoire of games with potential applicability. These games can be instrumental in cultivating NTS, such as effective teamwork and clear communication, while maintaining an entertaining user experience. To ensure the effective use of existing public games as tools for delineating, training, and endorsing NTS and teamwork, we suggest in the present manuscript that using DCS as the guiding framework could be beneficial. This approach would involve adopting specific game rules, inspired by the Kolb circle of experiential learning, to enhance and optimize the learning experience [10].

Several gaming environments are particularly adapted to DCS, and a non-exhaustive list of these games is provided in Table 1, presenting the game types, examples, and the skills they address. Most of the games proposed herein are applicable to DCS out of the box, while others can be used for DCS but require adaptation. Predominantly, these games are designed for group learning rather than individual instruction, with a significant emphasis on cultivating communication and teamwork competencies. To enhance the targeted communication skills within DCS gaming environments, integrating the TeamSTEPPS™ framework

Table 1
Decontextualized simulation game examples.

Game type	Targeted skills	Examples
Real-time, cooperative game with multiple actions	Team competencies: leadership, task distribution, situational awareness, adaptability	Magic Maze® Supplying war 1415® Zombie TeenZ®
Real-time, competition between teams with pre-defined role playing	Communication skills: closed loop communication, efficiency, decision-making	Captain Sonar®
Wargames	Team competencies and decision-making, efficiency	Hold the Line® Kartenspiel®
Bluffing, deduction game	Finding consensus under uncertainty, cognitive bias, hierarchical conflict, Transmission of limited crucial information	Avalon® Supplying war 1415® The Mind® Hanabi®
Role playing game	Team competencies and communication skills	Online or in person multiplayer such as: Escaping A Sinking Ship® MMORPG* Pandemic® The Crew®

* MMORPG massively multiplayer online role-playing games.

offers a structured and effective approach [11]. This framework not only promotes essential team-based skills but also specific communication strategies such as closed-loop communication, call-outs, huddles, and structured communication such as the Situation, Background, Assessment, Recommendation (SBAR) checklist. Additionally, it fosters shared decision-making, consensus-building, hierarchical conflict management, and personal skill development, including awareness of cognitive biases and cognitive load [16]. By combining these elements, TeamSTEPPS™ may serve as a comprehensive tool to improve communication and teamwork in a variety of gaming scenarios or modality, outlined in Table 1.

Virtual simulation can also serve as an effective instrument for DCS, using advanced video game technologies and design methodologies akin to traditional gaming (*e.g.*, real-time 3D, object and environment simulation). However, it transcends mere entertainment, integrating educational objectives within a playful environment. Engaging healthcare professionals in activities outside their routine practice not only fosters collaboration but also contributes to team building [17]. The incorporation of virtual simulation in healthcare education is becoming more frequent, propelled by innovative game-based learning environments that significantly boost learner engagement, motivation, commitment, adherence to guidelines, and the development of both technical and NTS [15,18].

Massively multiplayer online video games have demonstrated their capacity as a platform for assessing and honing leadership skills [19]. Additionally, certain multiplayer board games facilitate both collaborative and competitive group dynamics. These versatile tools enable individuals to engage in decontextualized scenarios, such as navigating a group through a maze or preventing a ship from sinking, to develop NTS such as communication, cooperation, and situational awareness. Moreover, some games have been used to explore various facets of communication and organizational strategies in the context of military conflicts, including diverse communication methods and resource constraints [20].

Within medical education programs, the competencies frequently linked to resource crisis management include leadership, assigning tasks, maintaining situational awareness, strategizing for resource use, as well as forecasting and preparation. We argue that the intricacy and profundity of these competencies ought to align with the educational goals set forth. Furthermore, the learner's level of competence should dictate the complexity of the gameplay. It is crucial that, even in a decontextualized environment, the simulation experience reflects authentic professional situations, which can subsequently be reinterpreted and applied to real-world contexts in the post-simulation debriefing. For instance, in real-time cooperative games, scenarios resembling a critical situation in the OR can be recreated, with each participant assuming a specific role and cooperating. The inherent challenges and constraints, such as time limits (using an hourglass), communication restrictions, can be adjusted to align with pedagogical goals, leading to the creation of diverse scenarios. This dynamic approach allows for the same board games to be played with different organizational structures and communication modalities, such as the absence of rules, imposed leadership, or mandated closed-loop communication. Each organizational structure and communication modality will induce specific dynamics within the teams. The playful environment allows focusing the debriefing on NTS without discussing the technical aspects, while providing some contextualized examples. Moreover, by applying the principles and rules detailed in Table 2, given the wide choice of games (board games, card games, or advanced virtual simulation tools) and their multiple configurations, many teaching opportunities can be developed. Despite the gaming environment being promoted in DCS, the learners should not be infantilized by being placed in a childish game, but rather in a situation where their skills are socially valued, and where they can find their role [21].

Table 2
Decontextualized simulation principles.

A) Conceptualization
- Define the pedagogical objectives *a priori.*
- Transform game rules accordingly to create opportunities for experiential learning.
- Consider individuals and teams of gamers respectfully as partners who will have to behave accordingly.
- Anticipate the next pedagogical objectives to be proposed (with that game or another) to the team after the first pedagogical objective has been correctly achieved.
B) Active experimentation
- Gather the instructors to share the same experience background with the game.
- Test the game in real pedagogical settings before using it with learning teams.
- Keep constantly in mind that the game shall be a tool for serving the pedagogical objectives and not the contrary.
- Explore the debriefing learning opportunities arising from the active experimentation.
- Reflect all game experiences with recontextualization in real clinical experiences related to the pedagogical objectives.
- Identify the pitfalls the game could present to the detriment of educational objectives.
- Prioritize the learning opportunities and the learning objectives.
- Retest the game.
C) Concrete experience
- Clarify to the teams the time dedicated to the decontextualized simulation and announce the estimated duration of the game
- Explain to individuals and teams the pedagogical objectives of the session in terms of learning skills as healthcare providers.
- Remember to all that this remains only a game offering learning opportunities with collective entertainment, team building that are as much important as skill improvement opportunities of individuals.
- Check that everyone has understood the pedagogical objectives, the game rules (and adaptation if any), and the role of each participant.
- Lead a structured debriefing immediately after the game experience.
- Help learners to regularly recontextualized observed experience in real healthcare situations.
- Help learners identify the healthcare provider learning objectives resulting from the game experience.
- Offer the opportunity to learners to play again or to move toward the next pedagogical objective.
D) Reflective observation
- Note the implementation options resulting from the observation of the game play.
- Debrief the whole session with learners, keeping in mind the pedagogical objectives.
- Collect feedback from learners (with anonymous evaluation questionnaires).
- Debrief the whole session with instructors to share optimization of the session and of the curriculum based in decontextualization simulation game.
- Identify the pitfalls or near pitfalls the game has elicited and how instructors have managed/avoided those pitfalls.
- Link the decontextualized simulation experience into the existing training curriculum.
- Communicate on the experience and objectives.
- Evaluate healthcare team competence modification in real setting.
- Plan the next session with an appropriate pretest.

3. The place of decontextualized simulation in the future of healthcare education and team training

The first strength of DCS is its ease of implementation. While virtual and full-scale simulation requires programming resources to recreate a healthcare workspace, users can also easily practice technical skills and NTS with basic games, accessible from the non-medical world, as detailed in Table 1. These games can be used in simulation centers or/and in clinical environments as an attractive way for healthcare professionals to better acquire NTS and debrief around their performance as individuals and as a team. Due to their decontextualized nature, these simulation sessions provide an opportunity to emphasize the debriefing process on NTS while setting aside the technical aspects, which tend to take precedence in full-scale simulations. This also enables the implementation of specific teaching programs that require a lower level of resources (material, fewer supervisors or actors).

The second strength of DCS is its possibility to be used as a complement to the usual simulation program or quality improvement processes. Fig. 1 depicts how contextualized and DCS programs can be strategically integrated within Kolb's cycle of experiential learning and Deming's wheel of continuous improvement for educational and professional development purposes [10,22]. Contextualized simulations offer real-world, field-specific experiences, whereas DCS provides diverse, often game-based scenarios. The cycles encompass key stages of experiential learning (within Kolb's cycle) and continuous improvement (as outlined in Deming's wheel), emphasizing the effective use of these simulation programs. The choice between contextualized and DCS, including the timing of exposure as either a concrete experience or active experimentation, should be tailored to specific learning objectives and desired outcomes.

Some educational objectives might be complex to address when the team experience is conflictual, the DCS, during the briefing, could become an attractive lever, acting as an icebreaker. Moreover, the entertaining decontextualized experience might also reinforce the "ego" and the sense of belonging to a team and participate in the development of a collective history and experience. This may improve the efficiency of individuals and teams, the quality and safety of care they might deliver. It will also surely foster the enthusiasm of individuals to participate to DCS or further simulation sessions and educational programs to improve their skills as a team.

The use of the DCS before the usual simulation session can emphasize specific skills or competencies that will be developed during a succeeding contextualized simulation (Fig. 1). For instance, helping teams and individuals to be fully convinced during the game debriefing that the use of a checklist or a team preparation plan might have helped them more easily to successfully manage the situation. An example of using DCS prior to a contextualized simulation session is engaging learners in games such as Pandemic®, Magic Maze®, Zombie teenz®, The Crew®,

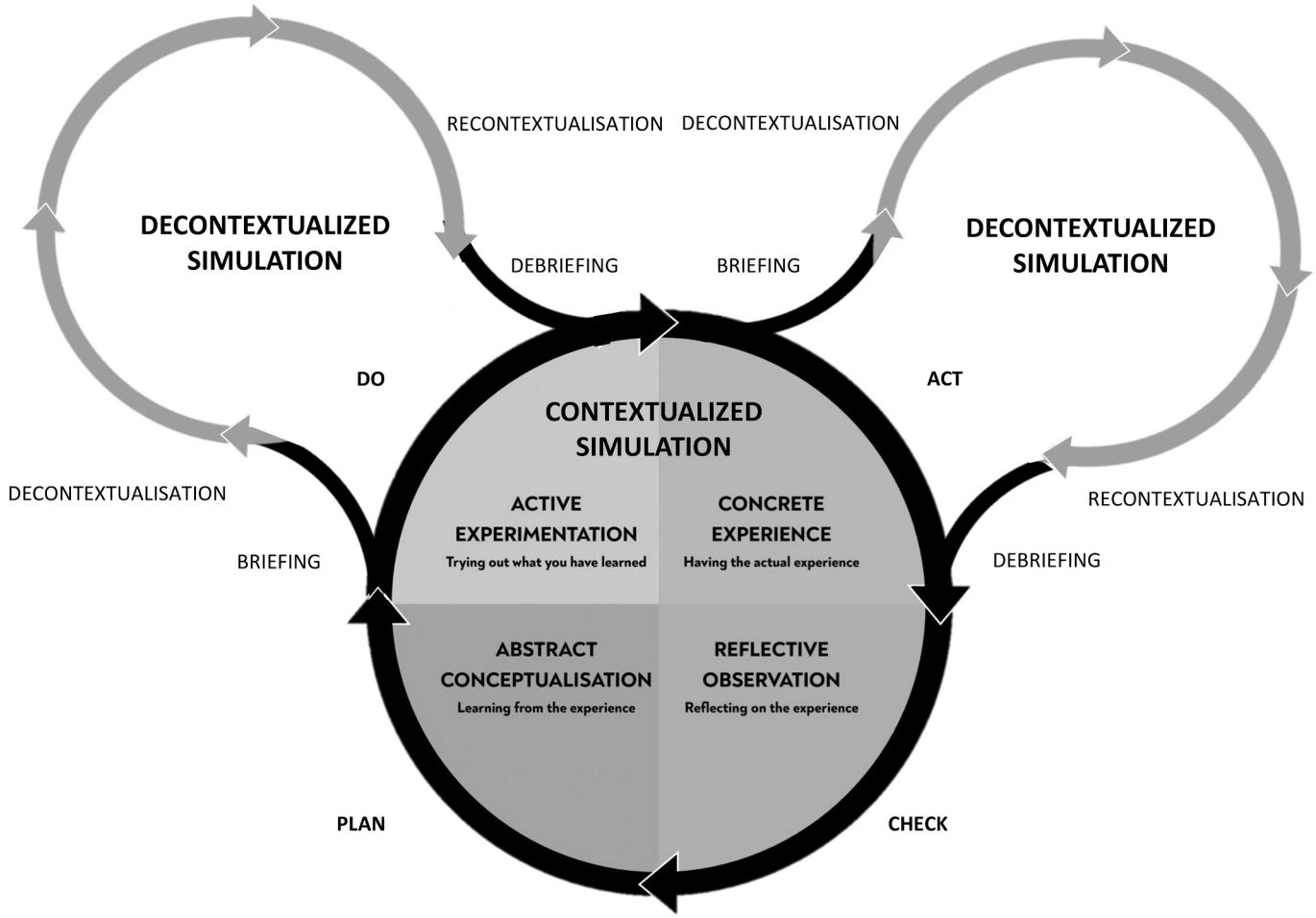

Fig 1. Integration of Decontextualized Simulation in Kolb's Cycle and Deming's Wheel.
The figure illustrates the integration of Decontextualized Simulation (DCS) within Kolb's experiential learning cycle and Deming's Plan-Do-Check-Act (PDCA) wheel, for enhanced NTS learning and professional development. DCS might acts as a precursor to contextualized simulations, where non-technical skills homed in a non-clinical environment are briefed and debriefed. Subsequently, these skills undergo recontextualization for application in clinically simulated scenarios. This process is cyclic, with the aim of refining and applying these essential skills in actual clinical practice, thereby creating a loop of perpetual learning and quality enhancement in healthcare training.

etc. The debriefing of this DCS would focus on highlighting the significance of non-technical skills in scenarios where effective teamwork is crucial for enhancing individual abilities and achieving superior team outcomes. Emphasis would be placed on the importance of communication, leadership, and team management, both during the games and in clinical practice. Learners would then be encouraged to refine these skills and competencies, preparing them as a multi-professional team for a subsequent, contextualized simulation scenario.

The use of the DCS after the usual simulation session is also of interest when some skills or competencies have been targeted to work on during the debriefing (Fig. 1). As such, DCS would highlight the applicability of general tips, tricks and successful strategies developed during games that could also be applied in a healthcare environment. Then, their experience in the game might be recontextualized, and could be helpful to convince everyone of the strength to systematically translate these strategies whatever the clinical context they are used to: trauma teams, interprofessional surgical teams, teams preparing for complex procedures, *etc*.

Another strength of DCS is its ability to act on the cognitive flexibility, which reflects the ability of an individual who is focused on one task to instantly disengage from that task, to focus on another, and then to reconfigure a new set of responses and apply them to the current task. The DCS enhances the cognitive flexibility of the healthcare professionals, which is by itself a specific facilitating ability and an educational objective of such simulation. Therefore, DCS relies on the ability to create a robust and long-lasting bridges between different experiences and mutually reinforcing. Decontextualization may be seen here as a lever of improvement. Pr. Mavre, from the Institute of Applied Arts in Paris (France), explained that decontextualization "is all about putting the learner inside a context in which his professional reflexes will be neutralized, allowing reaching for a deeper level of the brain mechanism of an individual" [23]. The DCS might be seen as a translational learning tool complementary to existing ones. It is interesting to note that many cognitive abilities are applied by an individual in some areas of activity, but not in others, only because of the lack of cognitive links between these areas of activity. Perhaps DCS would help bridge these general cognitive gaps resulting in more cognitive flexibility and general heuristic mental consistency. The challenge with decontextualization is to always recontextualize the experiences of the learners regarding their past performance, those they will have to do in simulation session, or during healthcare.

The effectiveness of DCS was first demonstrated outside of the healthcare context in 2016 by Fauquet-Alekhine et al. [24] who studied an innovative training in a highly technical and complex field (nuclear power plant) and who found that, prior to a physical mock-up exercise, DCS led to a significant reduction in mishandling and failures [24].

The Institute of Medicine report entitled "Health Professions Education: A Bridge to Quality" identified that physicians and other healthcare professionals lacked an adequate training in providing high-quality healthcare when it comes to communication, leadership and working as an interprofessional team [25]. The ease of implementation of DCS and its accessibility as well as its potent strength described above might help to fill this gap. It is of note that we are currently conducting a randomized controlled trial with the hypothesis that exposure to DCS, using the Captain Sonar™ board game, would have an impact on trauma team performance on a subsequent full scale contextualized *in situ* simulated patient [26]. However, it remains to be demonstrated whether DCS facilitates the memorization and the acquisition of skills by the healthcare professionals and whether these new skills will be transferred to the field and improve quality and safety of care.

4. Conclusion

Perioperative care thrives on active professional interactions, pivotal information exchanges, key effective communication, essential leadership, and the daily challenges of teamwork. Integrating DCS into undergraduate and postgraduate healthcare education, along with team training, actively advances these NTS, which are paramount for safe and high-quality perioperative care. Our recommendations are therefore to emphasize the following key points:

- Promote interprofessional simulation scenarios can specifically enhance collaborative interactions, fostering a culture of effective teamwork.
- Embrace the potential of gaming methodologies with DCS in healthcare education and team training to offer engaging and diverse simulation tools to cultivate NTS.
- Tailor DCS to the learners' competence levels, ensuring that the simulation experience reflects authentic professional situations or could be adequately recontextualized.
- Strategically integrate DCS within the overall simulation program and quality improvement processes as an educational tool and a complement to contextualized simulations, emphasizing its role in enhancing specific skills before or after traditional simulation sessions.
- Implement TeamSTEPPS™ framework into DCS to provide a structured approach to team-based skills development.

One should recognize the potential of DCS with its ease of implementation and accessibility in addressing educational gaps or training deficiencies related to communication, leadership, and interprofessional teamwork. DCS represents therefore a practical and effective approach to improve the quality and safety of perioperative healthcare. By incorporating these recommendations, healthcare education can move toward well-trained expert teams that are not only well-versed in technical skills but also excel in the crucial non-technical aspects of patient care. The game rules in healthcare education are evolving, and DCS represents a potent strategy to shape the future of competent and collaborative healthcare professionals for better perioperative care.

CRediT authorship contribution statement

Paul Abraham: Conceptualization, Validation, Visualization, Writing – original draft, Writing – review & editing. **Nadège Dubois:** Conceptualization, Validation, Writing – original draft, Writing – review & editing. **Thomas Rimmelé:** Validation, Writing – original draft, Writing – review & editing, Supervision. **Marc Lilot:** Conceptualization, Supervision, Validation, Writing – original draft, Writing – review & editing. **Baptiste Balança:** Conceptualization, Supervision, Validation, Writing – original draft, Writing – review & editing.

Declaration of competing interest

None.

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