Simulation-Oriented Training: Analysis and Modeling of Trainer Activity During Post-simulation Debriefing (D-STAM)

Valérie Duvivier, Université de Mons, Belgium
Emilie Carosin, Université de Mons, Belgium
Antoine Derobertmasure, Université de Mons, Belgium
Marc Demeuse, Université de Mons, Belgium

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Abstract
In post-simulation debriefing, the role of the trainer is increasingly recognised as an important asset for effective professional training. However, there are no specific models that focus on the trainer's activity during this fundamental phase of learning. Existing work often provides prescriptive insights and lacks a comprehensive theoretical framework from the trainer's perspective. To fill this gap, the paper presents the D-STAM (Debriefing Simulation Trainer Activity Model), an integrative model designed to understand and improve trainer activity during post-simulation debriefing. The D-STAM aims to answer the research question about the trainer's role in post-simulation debriefing and to identify the characteristics of the trainer's activity. It was developed on the basis of an integrative literature searches in nine French and English databases (Google Scholar, ERIC, ERUDIT, CAIRN, Pascal & Francis, OpenEdition, Springer, SCOPUS and Sudoc). The 33 articles selected were subjected to thematic analysis (according to Braun and Clark, 2006), supplemented by n-vivo 12 software. The D-STAM highlights the role of the trainer as a facilitator, guiding the learners' reflections and supporting the development of operational models. It emphasises the dual regulation of the trainer's activity, both by himself/herself and by the dynamic conditions of the debriefing. The model includes three levels of variables (input, process and effect) and provides a holistic understanding of the trainer's activity, including the use of technology. The model is applicable to the fields of medicine, risk management and education.

Keywords: Post-simulation Debriefing, Trainer, Facilitator, Professional Training, Dual Regulation, D-STAM

1. Introduction, Issue and Research Issue

Simulation for vocational training purposes is considered one of the "dominant models in education" (Horcik, 2014, p.1). It aims to reproduce the reality of a professional event or situation by reducing it to a simplified model (Duvivier & Demeuse, 2023). In this way, the learner interacts proactively with a real or virtual object, device or person and can modify the flow of decisions and actions throughout the interaction (Halamek et al., 2019).

Simulation for training purposes is generally organised into three successive interactive phases: the briefing phase, the simulation session and the debriefing phase (Fanning & Gaba, 2007; Samurçay, 2009; Vidal-Gomel, 2020). Each phase has a specific function (Dubois, 2017). Briefing allows each learner to mentally prepare for the simulated situation they are about to experience (Fanning & Gaba, 2007). The simulation session focuses on the simulated situation itself, where learners experience an environment that replicates real professional practice (Duvivier & Demeuse, 2023). Debriefing aims to explore mistakes, challenges and successes, identify key learning points (Oriot & Alinier, 2018) and encourage critical reflection on the skills developed (Duvivier & Demeuse, 2023). Often facilitated by a trainer (Sawyer, Eppich, et al., 2016), debriefing encourages learners to articulate actions and reflections on actions (Chinara & Pellerin, 2014; C. Pastré, 2006).

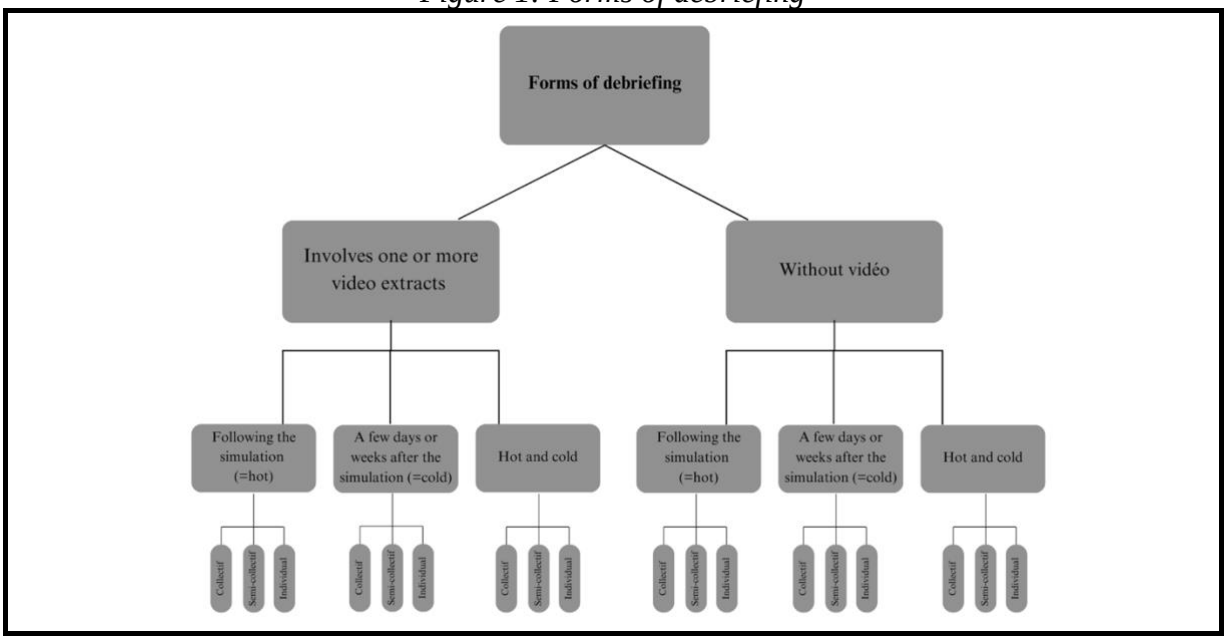
Considered to be one of the main pedagogical challenges of simulation (Oriot & Alinier, 2018; Savoldelli, 2011), debriefing is very regularly the subject of work in the military, civil security and education sectors, and especially in the health and medical sector. Some of this work (e.g. Oriot & Alinier, 2018; Bauchat & Seropian, 2020; Sawyer & al. 2016) has addressed debriefing methods and techniques, strategies for engaging learners during debriefing, the impact of this phase on learning, critical reflection and the importance of debriefing in skills development.

However, few have taken an interest in the trainers and even fewer in the way in which the trainer takes hold of the simulation object and uses it to train the learners, on the one hand, and the way in which the trainer supports the reflective activity of the learners during the debriefing, on the other, remains little studied. When it is, the elements reported are prescriptive in nature. Questions remain as to their generalisation or operationalisation. The way in which post-simulation contributes to the development of reflexivity has been less explored.

Yet a growing body of work suggests that debriefing cannot be considered without a skilled and trained professional trainer (Bauchat & Seropian, 2020; Oriot & Alinier, 2018; Sawyer et al., 2016). This interest can be explained for several reasons.

Firstly, there is also a wide variety of debriefing formats in figure 1 (see Sawyer & al. 2016 for a summary). This variety of formats highlights the richness and complexity of the pedagogical approach to debriefing as well as the multiple factors that come into play when choosing and conducting a debrief (Sawyer, Fleegler, et al., 2016). These factors may concern the level of the learner, the pedagogical objectives, the context (Eppich & Cheng, 2015; Sawyer & al., 2016; Oriot & Alinier, 2018; Bauchat & Seropian, 2020) and the content (Secheresse, 2020).

Figure 1: Forms of debriefing



This situation is made more complex by the abundance of methodologies (24 models identified by Duvivier & al. 2023) and debrieifng strategies, which forces trainers to skilfully combine different approaches, as a single method is often insufficient (Bauchat & Seropian, 2020). As Krogh et al., (2016) points, “although the literature describes different methods and approaches to debriefing that constitute effective debriefing, there are discrepancies in what is actually practised and how experts or experienced debriefers perceive and approach debriefing” (p.1).

However, trainers' pedagogical knowledge (Dubois, 2017) and their ability to improve their practices are limited by the lack of evaluation (Delmas & Delmas, 2021) and training opportunities (Cheng et al., 2016, 2017, 2020). Indeed, simulation training has historically focused on "basic" content (Cheng et al. 2020) and short formats (sessions of 3 to 5 days or up to 3 weeks) (Policard, 2018). According to Cheng et al. (2020), this limited access to basic debriefing skills hinders the development of a comprehensive conceptual framework and the progression of trainers' skills development.

Secondly, the trainer's activity in post-simulation debriefing is not theorised by a model unlike the simulated exercise phase (cfr Vidal and Gomel, 2011 or Policard, 2018). This lack of theorization is particularly regrettable in the complex and dynamic context of debriefing, which can make the effects of the trainer's actions unpredictable or not immediately observable by the trainer.

Thirdly, the profiles of post-simulation debriefing trainers often involve individuals from operational departments or with dual roles between operational tasks and training (Dubois, 2017). These transitional positions may lead them back to their original functions or to new assignments (Dubois, 2017). Furthermore, while operational experience can be advantageous because it adds legitimacy in the eyes of the learners (Dubois, 2017), it seems to put a strain on the trainer's posture. The latter then oscillates between the posture of professional expert rather than trainer (Bastiani, 2017; Policard, 2018). This can create a challenge for trainers who have to strike a balance between maintaining cognitive control and allowing learners autonomy to explore and construct their understanding (Policard, 2018). Furthermore, trainers may downplay their educational role in relation to their fieldwork (Policard, 2018).

Fourthly, observing and integrating relevant data during the debriefing process is laborious and very demanding for trainers. Indeed, it requires them to constantly update and establish links between the pedagogical objectives of the simulation, those of the debrieifng as well as the elements that arrived in simulation and (Bastiani et al., 2017; Oriot & Alinier, 2018; Secheresse, 2020) and that arrive in debriefing. This situation is reinforced by the lack of tools enabling the trainer to analyse the learner's activity during the simulation or when the trainer is also involved in the simulated situation, as this can impair their overall perception and objective observation during the debriefing. Thus, it is not uncommon to read that conducting a post-simulation debrieifng can lead to mental overload among trainers (Oriot & Alinier, 2018).

Given these challenges, the aim of this paper is 1) to clarify the trainer's role in post-simulation debriefing and 2) to list and then model a set of components specific to the trainer's activity, while preserving the uniqueness of situations in a model. In light of the above challenges, this paper aims to answer two research questions:

1) What is the specific role of the trainer in post-simulation debriefing and how can this role be fully elucidated to improve understanding of its influence on learners' reflective processes?
2) How can we systematically identify and model the unique components of trainer activity during post-simulation debriefing, while ensuring the preservation of situational specificity within an overall model?

In order to answer these questions, this article presents our research methodology based on an integrative investigation. The results of the study are divided into two parts: first, we examine the role of the trainer during post-simulation debriefing. Second, we present the D-STAM model, which models the concrete manifestations of the trainer's activity during debriefing, based on Leplat and Cuny's (1974) five-box model adapted to simulation-based training systems. The D-STAM model articulates three levels of process (input conditions, activity performed and effect) and seven categories of factors (personal, contextual, technological, instrumental, regulatory, internal to the trainer and internal to the learner). We also explore the links between trainer determinants and feedback using a dual regulation perspective. Finally, we summarise the findings and discuss practical implications and future directions for research in this area.

2. Methodology and Selection of Sources

2.1. General Procedures

To answer these research questions, an integrative literature review was conducted. An integrative literature review "is a particular form of research that generates new knowledge about the subject under examination" (Torraco, 2005). The integrative approach involves synthesising and integrating knowledge from different research sources (Snyder, 2019; Torraco, 2005, 2016). Thus, unlike a traditional literature review which lists and describes previous work, the integrative literature review aims to go beyond simply describing previous work by identifying common themes, patterns or trends across the different studies included (Snyder, 2019; Torraco, 2016). It is built on comparative analysis and the search for links between different sources of research. For Snyder (2019), this method plays “an essential role in the construction of theoretical frameworks and the formulation of conceptual models” (p.133).

Our integrative review was based on 9 databases and 33 articles, both French- and English-speaking, in the fields of professional medical training, crisis management and teaching (see table 1).

Table 1: Data from the integrative review

Database	1st phase	Retained for 2nd phase	Retained for 3rd phase
Open Edition	18	3	1
PubMed	86	10	5
ERUDIT	23	6	1
CAIRN	475	7	3
Pascal & Francis	34	6	0
Google Scholar	371	12	6
Springer	861	2	2
ERIC	156	14	1
SCOPUS	765	22	4
Addition to the margin			9
TOTAL	3439	87	33

The equations combined the keywords "Simulation" AND "Debriefing" AND "formateur/facilitateur/faculty/educator/teacher" AND "education" OR "Crisis NOT Interprofessional. We used titles, keywords and abstracts, and limited the query to the period 2012- 2022. Our review was conducted in three methodological steps: first, relevant references were identified by systematic searches of one or more databases. Second, the references were selected by evaluating the titles and abstracts of the articles, eliminating duplicates from multiple sources. The third step was to assess the eligibility of the articles by analysing their full text. In addition, we considered work on debriefing trainers with the use of video, in line with Levett-Jones & Lapkin (2014), who consider this debriefing format to be a 'reference standard'. The integration of video during debriefing leads to significant implications for the trainer's professional practices (Krogh et al., 2016) all of which are not necessary in debriefings that do not include videos. Furthermore, documents relating to virtual debriefings were not included, nor were interprofessional debriefings, which involve hierarchical teams and most often a co-debriefing of trainers.

2.2. Data Processing

To answer the research questions, we proceeded to define the manifestations of the trainer's activity on the basis of a coding carried out according to a pre-established general plan (Saubesty, 2006). This coding method is based on categories that serve as a guide for developing codes (Saubesty, 2006). Some authors suggest that the coding plan can be structured around the actors involved, the activities carried out and the elements of the context (Grenier & Josserand, 2014) or around context, content and process (Pettigrew, 1990). We opted for a coding approach guided by a pre-established general plan for two main reasons. Firstly, and like Saubestry (2006), our research is exploratory in nature, which means that we are seeking to explore and understand a relatively new field. By using a pre-established coding scheme, we were able to structure our analysis and focus our research in a more targeted way. In addition, given that our study focuses on activity, its role, its obstacles, and its levers, we were able to adapt the code categories to specifically reflect these 4 components of our research.

Once the general plan had been established around these four central themes, a thematic analysis was carried out following the six stages of Braun and Clark (2006) as recommended by Braun et al., (2019). In the first stage, we carefully read selected articles to gain an overall understanding of the content and identify key concepts related to the trainer's role in debriefing. Then, we assigned labels or categories to organize the information in the data (code generation). The third stage involved researching themes to group related codes, leading to exploratory connections and different perspectives. In the fourth stage, we conducted an in-depth analysis of the themes to highlight variations and similarities. For the fifth stage, we assigned descriptive names to each theme, considering their nuances. Finally, in the sixth stage, we synthesized the results into a model to better understand the different components of the trainer's activity in post-simulation debriefing.

Data analysis was facilitated with Nvivo 12 software, providing advanced functionalities for managing, organizing, and exploring qualitative data (Plard & Martineau, 2019). We imported, organized, and coded data, visualizing connections between codes and exploring relationships between themes to extract significant insights (Plard & Martineau, 2019). To ensure reliability, the data underwent double coding. The researcher initially coded the data based on the stabilized code grid. Two weeks later, the same researcher conducted a second coding to check consistency and reliability. According to Huberman and Miles' recommendations (1991) (cited by Pourtois, 1993), a concordance rate of 80% is considered satisfactory for reliability. Our analysis achieved a concordance rate of 87.1%, indicating high reliability.

3. Results: Role and Activity of the Trainer During a Post-simulation Debriefing

3.1. Trainer-Facilitator Perspective

In simulation-based vocational training, the term 'trainer' provokes debate and coexists with thirteen other terms such as 'teacher', 'mediator', 'instructor', 'mentor', 'professor' and 'facilitator' (Jones et al. 2014 cited by Policard, 2018; Simoneau et al., 2014). Although the term 'facilitator' is the most frequently used (in 15 out of 33 papers - table 2), it is used generically to describe the overall activity of the trainer during the three phases of a simulation-based training device, namely briefing, simulated exercise and debriefing.

Table 2: Works describing the role of facilitator

Themes	Sub-themes	Authors
Role of the Trainer	Trainer-Facilitator	- Savoldelli, G., & Boet, S. (2013). - Secheresse, T., Mampe-Armstrong, H., Usseglio, P., et al. (2016). - Dury, C. (2017). - Secheresse, T., Pansu, P., & Lima, L. (2021). - Oriot, D., & Alinier, G. (2019). - Amor, B., Hentati, J., Gargouri (2018). - Galland, J., Jaffrelot, M., Sanges, S., Fournier, J. P., Jouquan, J., Chiniara, G., & Rivière, É. (2020). - Roulin, V. (2014). - Tutticci, N., Ryan, M., Coyer, F., and Lewis, A. (2018). - Jones, A. L., Reese, C. E., & Shelton, D. P. (2014). - Bastiani, B., Calmettes, B., Minville, V., & Marhar, F. (2017). - Dubrous, V., Eymard, C. (2022). - Cheng, et al. (2020). - Dubois, L-A. (2017). - Sondag, (2018).

In debriefing, the concept of facilitator corresponds more to "a pedagogical attitude related to a way of promoting learning in the general context of active pedagogy" (Policard, 2018; p.12). Specifically, the trainer-facilitator plays the role of mediator between the learners, the knowledge to be acquired (Simoneau & Pilote, 2017), the pedagogical objectives and the trainer himself/herself (Duvivier et al., 2023). This mediation, reminiscent of Houssaye's pedagogical triangle (1988 cited by Houssaye, 2000), gives the trainer a pedagogical intention at the time of the debriefing.

The aim is to improve their future performance by developing operational models that can be transferred to similar real-life situations (Rudolph et al., 2008; Secheresse, 2020; Pastré, 2011). To achieve this goal, the trainer-facilitator will encourage learners to develop reflective thinking by encouraging them to critically examine the actions and decisions taken during the simulated exercise and during the debriefing. This reflection allows learners to become aware of their skills, strengths and areas for improvement (Oriot & Alinier, 2018). To do this, the facilitator encourages the group to speak and discuss (Policard, 2018). He or she asks questions and guides the exchange (Simoneau & Pilote, 2017) to explore everyone's different perspectives on the simulated situations. To encourage the active participation of the learners, the trainer-facilitator adopts the position of a co-learner rather than that of an authority or expert (Horczik, 2014; Fanning & Gaba, 2007). In this way, the facilitator differs from a more transmissive approach by creating a more collaborative and open learning environment.

In conclusion, the trainer-facilitator plays an essential role in debriefing as a pedagogical mediator, encouraging reflection, active participation, speaking out and adopting a co-learner stance. This facilitative approach contributes to the exploration, learning and development of learners' skills and reflexivity in the context of simulation-based training.

3.2. Activity Modeling of the Trainer in Post-Simulation Debriefing: D-STAM

Understanding and capturing the activity of trainers in simulation and debriefing is a complex task (Bastiani, 2018). To achieve this we have opted for an approach based on activity analysis, like Bastiani (2017, 2018) and Dubois (2017). This analysis of activity is based on various theories, including the course of action (Clot, 2004), the clinic of activity (Clot, 1999), the professional didactics (Mayen, 2012; Pastré, 2006; Pastré et al., 2006) which pays particular attention to the debriefing of real-life situations, especially in dynamic environments (Bastiani, 2018) with dual regulation (Rogalski & Colin, 2018).

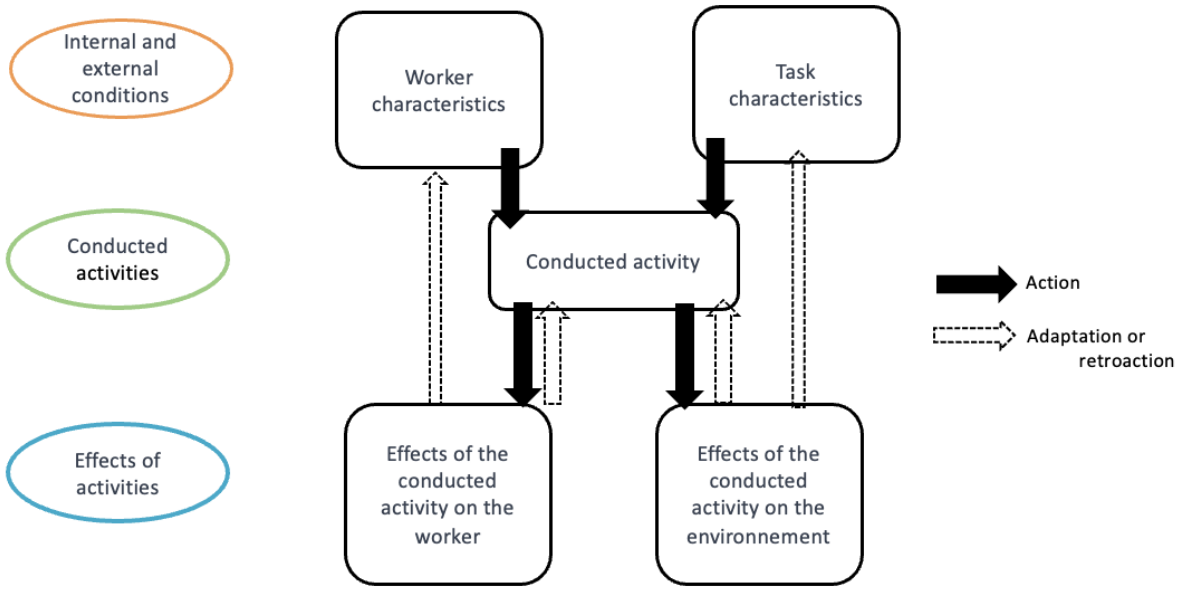
Dynamic environment refers to the debriefing contexts that draw from situations, interactions and reactions of the learners that evolve in real time, and thus require continuous adaptation on the part of the trainer. Double regulation of activity refers to the dynamic process by which an individual adjusts and regulates his or her activity according to both the external constraints of the work situation and his or her own internal characteristics (Saubesty, 2006). As a result, the trainer's activity is influenced by external contextual factors such as task requirements, tools and resources available, as well as internal factors such as skills, knowledge, motivations and emotions. In post-simulation debriefing, the trainer performs a double regulation of his activity due to the complex and dynamic nature of his role. Firstly, the trainer must regulate his activity according to the external conditions of the simulation, such as the pedagogical objectives, the simulation scenarios, the resources available and the expectations of the learners. He must adapt and adjust his approach to create an environment conducive to learning and facilitate learners' critical reflection on their actions and performance during the simulation. Secondly, the trainer must also regulate his activity according to his internal characteristics, such as his specialist knowledge, his professional experience, his teaching skills, and his ability to facilitate learners' learning. He must consider his own emotional reactions, judgements and beliefs in order to guide learners effectively through the debriefing process. The trainer must be able to adapt to learners' needs and reactions, while maintaining a balance between facilitating learning and regulating the reflection process. By ensuring this dual management, the trainer aims a) to modify the relationship between the learner and the content taught (Samurçay & Rogalski, 1998) and b) to maintain the learner in a zone of proximal development (Vidal-Gomel et al., 2011).

Moreover, trainers' activities are closely linked to their motivation and interest in practice. Indeed, it should be noted that trainers do not necessarily engage in the debriefing activity for the same reasons (Policard, 2018). The manifestations of their engagement may vary and correspond to different profiles (Policard, 2018), with an intensity and strength of involvement that lie on a continuum from low investment (mere consent) to a high degree of involvement Klein et al. (2012). A trainer's engagement profile can influence their pedagogical posture, in particular their propensity to adopt a controlling posture rather than a letting go attitude (Policard, 2018). Furthermore, the trainer's commitent is closely linked to his or her motivation. Trainers are not motivated solely by the desire to pass on knowledge, but above all perceive this activity as a professional opportunity (Bastiani, 2017). It is therefore possible, according to Bastiani (2017), that some trainers underestimate the importance of their teaching role in relation to their previous experience in the field, for which they provide training.

To better understand the dynamic and doubly regulated activity of the trainer in post-simulation debriefing, we have adapted Leplat and Cuny's five-square model (1974). The model is derived from the double regulation model of activity and has been widely discussed within the French study group RESACT. It serves as a conceptual framework for understanding the different

components and interactions involved in professional activity, without providing a specific analysis process. This framework allows us to explore complex relationships between conditions, activity, and consequences, as well as question the analysis of the trainer's concrete activity in the specific context of post-simulation debriefing.

Figure 2: Leplat and Cuny model (1974)
(free translation from French into English)



The five-square model (Leplat and Cuny, 1974) represents different aspects of occupational activity. The first two squares (at the top) encompass the internal and external conditions of the worker that influence his or her activity. These include individual characteristics and environmental factors such as the physical environment, tools and resources available. The middle box represents the activity itself, which includes the actions and processes used by the worker, including different stages and strategies. The last two boxes (at the bottom) focus on the consequences of the activity. The fourth box looks at the impact on organisational objectives, overall performance and productivity. The fifth box looks at individual outcomes such as job satisfaction, cognitive costs and personal development.

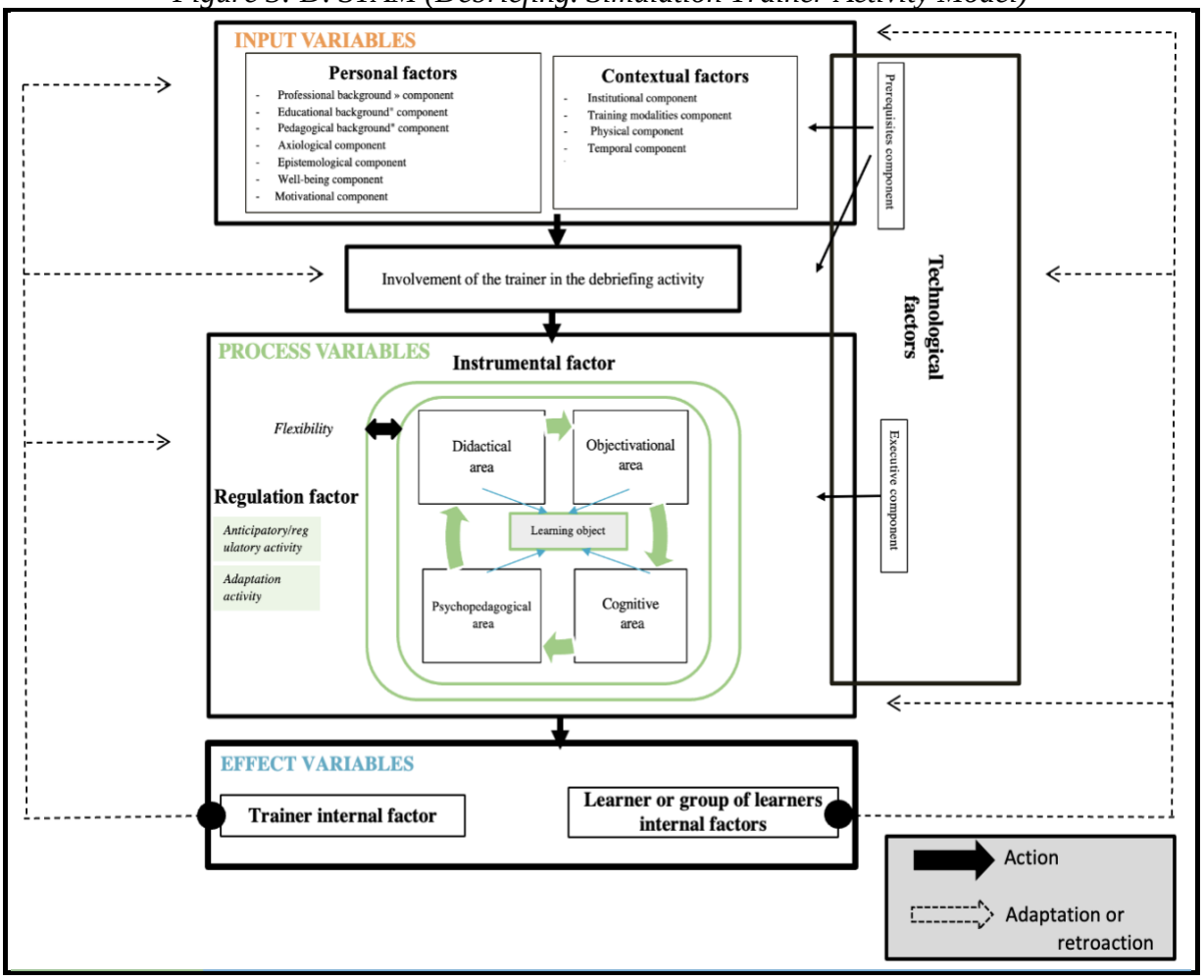
In the context of a debriefing after a simulation, Leplat and Cuny ‘s model (1974) provides us with a relevant conceptual framework for understanding and analysing the trainer's role and interactions in the context of training and post-simulation debriefing. It serves to support the analysis of professional situations by identifying the characteristics of a concrete activity, in our case the trainer's activity in post-simulation debriefing. This framework was mobilised on the basis of the work of our literature review and the presence of elements related to the 3 levels of variables of the Leplat and Cuny (1974) model (Table 3 - X : Variable covered in the work; - Variable not covered in the paper).

Table 3: Elements related to the 3 levels of variables and included in the D-STAM model

Research	Internal and external conditions	Conducted activities	Effects on activities
Savoldelli, G. & Boet, S. (2013)	-	X	X
Secheresse, T., Mampe-Armstrong, H., Usseglio, P. et al. (2016)	X	-	-
Dury, C. (2017)	X	X	-
Secheresse, T., Pansu, P., & Lima, L. (2021)	-	X	X
Oriot, D., & Alinier, G. (2018)	X	X	-
Amor, B., Hentati, j.,Gargouri, (2018)	X	X	-
Galland, J., Jaffrelot, M., Sanges, S., Fournier, J. P., Jouquan, J., Chiniara, G., & Rivière, É. (2020)	X	X	X
Roulin, V. (2014)	-	X	X
Jones, A. L., Reese, C. E., & Shelton, D. P. (2014)	X	X	-
White, M. (2017)	-	X	X
Hallmark, BF, Thomas, CM, & Gantt, L. (2014)	X	X	-
Poinçon, B. (2015)		X	X
Secheresse, T. (2020)	X	X	X
Lilot, M. (2019)	X	-	
Bastiani, B. (2017)	X	X	X
Renou, J. (2012)	X	X	-
Bastiani et al. (2021)	X	X	X
Tutticci, N,. Ryan,M., Coyer, F., and Lewis, A. (2018)	X	X	-
Dubois, L., Bocquillon, M., Romanus, C. & Derobertmasure, A. (2019)	X	-	X
Dubrous,V., Eymard, C., (2022)	X	X	X
Heng, A., Eppich, W., Kolbe, M., Meguerdichian, M., Bajaj, K., & Grant, V. (2020)	X	X	X
Dubois, L. A. (2017)	X	-	X
Dubois, L-A., & Van Daele. (2018)	X	-	-
Sondag (2018)	X	X	X
Cheng, A., Kolbe, Grant, V., et al. (2020)		X	X

Figure 3, and his legend, gives an overview of the D. STAM (Debriefing Simulation Trainer Activity Model). The first level relates to the internal and external conditions, i.e. the input variables. The variables concern the trainer's personal factors on the one hand, and the contextual factors specific to the environment in which the trainer operates on the other (figure 3). Each level of variable is described below.

Figure 3: D. STAM (Debriefing. Simulation Trainer Activity Model)



3.3. Description of the D-STAM Model by Levels

3.3.1. Level 1: Input Variables

a) Personal Factors

In terms of personal factors, six components are listed. These components are interconnected and mutually reinforcing.

- The "trainer's professional experience" components refers to the trainer's practical and concrete experience in the field of activity concerned by the debriefing. This is their experience in the field, and their in-depth knowledge of the realities and professional issues facing the learners.
- The trainer's pedagogical skills include both their general pedagogical background and their specific knowledge of post-simulation debriefing. This includes the trainer's training in the field of education and training, as well as their experience as a trainer.
- Axiological components (Bastiani et al., 2021) pertain to conflicting values and logics between learner training and professional reality. Trainers may encounter ethical dilemmas or divergent perspectives between training objectives and industry requirements. These conflicts can raise concerns, leading trainers to prioritize knowledge transmission over learner support.

- Epistemological components (Bastiani et al., 2017) involve scientific knowledge used by trainers. This theoretical and conceptual foundation guides learners' reflection.
- Trainer well-being components encompass fatigue, stress, and emotional involvement, heightened compared to other teaching formats (Policard, 2018).
- Trainers' motivation and related behaviors vary from professional development interest to personal satisfaction in contributing to learner's progress.

b) Contextual Factors

Four components are listed in terms of contextual factors.

- The "institutional" components include legal norms, standards, and policies governing training. They determine specific skills to be developed based on legal requirements and professional expectations, structuring training content and objectives.
- The "training methods" components consider the training context, whether initial or ongoing, and learners' experience levels—novices, upgrading, advanced, or practicing.
- The "physical" components involve the debriefing environment, including space layout, available equipment, and technological tools. This impacts trainer-learner interactions and ease of implementing debriefing activities.
- The "time" components address training and debriefing session duration, considering distribution across simulation phases and accommodating time constraints and contingencies.

c) Commitment

The combination of personal and contextual factors influences the trainer's commitment to his activity. This box therefore refers to the way in which the trainer engages in his or her guiding activity in relation to the commitment profiles (see theoretical framework).

3.3.2. Level 2: Activity Conducted or Process Variables

a) Instrumental Factors

The activity carried out by the trainer is divided into several areas which form a set of instrumental factors. Each area is activated with the aim of achieving the learning objective targeted by the debriefing. In the same way as (Dehon & Derobertmasure, 2012), the D-STAM is made up of 4 areas.

- The didactic area concerns “all the elements relating to the content and the way in which it is prepared, transposed, transmitted and presented” (Derobertmasure, 2012, p.232). This includes the selection and organisation of information, the teaching methods used, the course materials, the teaching resources and everything else that helps learners learn. The didactic area aims to ensure the clarity, relevance and accessibility of the training content, promoting the understanding and assimilation of knowledge.
- The objectification area refers to the way in which the trainer puts the results of the simulation (behaviours observed) and the debriefing discussions (comments, reflections) into perspective with the learning environment. This involves analysing the learners' actions during the simulation, identifying strengths and areas for improvement, encouraging critical reflection and establishing links with the learning objectives. The

objectivation area aims to facilitate learners' awareness, promote the integration of knowledge and encourage metacognitive reflection.

- The cognitive area refers to the way in which the trainer explores the reasons behind the learners' behaviour during the simulation. This involves analysing the cognitive processes, decision-making, strategies used and mental representations of the learners. The cognitive area aims to understand the factors that influence learners' actions, to encourage problem solving, to foster critical thinking and to promote reflective learning.
- The psycho-pedagogical area concerns the relationship between the trainer and the learner, in particular the way in which the exchange takes place and the verbal interactions that occur. This involves the level of facilitation, the degree of involvement of the trainer (Dismukes & Smith, 2017; Oriot & Alinier, 2018; Savoldelli, 2011), the way in which the trainer supports understanding during exchanges and the way in which he or she fosters a climate of trust and mutual respect. This area aims to create an environment conducive to learning, to encourage the active participation of learners and to support their professional and personal development during debriefing).

b) Regulation Factors

For Bastiani (2018), "the way in which trainers conduct and accompany post-simulation debriefings requires flexibility in order to adapt to the audience" (p.88). Indeed, regulatory factors play an important role in enabling the trainer to navigate effectively in the dynamic debriefing environment. These factors can be divided into two categories: anticipatory adjustment and the search for equilibrium, both of which contribute to adaptive activity. Anticipatory adjustment involves proactive actions where the trainer prepares teaching strategies, resources and methods adapted to the learners' characteristics, objectives and context. By anticipating learners' needs and encouraging their commitment, the teacher facilitates the achievement of learning objectives. On the other hand, the search for balance comes into play when disruptions or unforeseen events occur during the debriefing. In such situations, the trainer quickly adjusts his or her posture, teaching strategies and communication in order to maintain a productive dynamic. This adaptability and flexibility allows the trainer to respond effectively to learners' needs and maintain an appropriate level of activity throughout the debriefing process, effectively managing the dynamic debriefing environment.

3.3.3. Level 3: Effect Variables

Effect variables in D-STAM represent the consequences of the trainer's debriefing activity, impacting both the trainer and the learners. The debriefing activity can influence the trainer's psychology, experience, and practice, leading to conscious or unconscious modifications in their approach (Pastré, 2006). As for the learners, the trainer's debriefing activity influences their skill development, reflective abilities regarding simulation actions, and the formation of operational models applicable to real-life situations (Cheng et al., 2016; Cheng et al., 2020; Bastiani, 2017; Policard, 2018). Assessing these effect variables allows us to evaluate the debriefing's impact and fine-tune pedagogical strategies to optimize learning outcomes. It's crucial to study the impact beyond formal competence measurements, as limited research on trainers addresses the effects of their practices on learners' development.

3.3.4. Technological Factors

Technological factors refer to the trainer's use of technology in debriefing. This may include audiovisual recording (Krogh, 2015; Horczik, 2014; Oriot & Alinier, 2018; Sawyer et al. 2016), digital or case management tools or debriefing. In D-STAM, this includes their prior knowledge and skills related to technology, such as familiarity with tools and platforms, understanding their functionalities, and effective use in the debriefing context. At level 2, technological factors involve how the trainer utilizes technology during debriefing, utilizing tools like simulators, video recordings, data capture systems, and online platforms. This may involve recording and reviewing learners' performances, facilitating group discussions, sharing resources, providing real-time feedback, and promoting reflection and learning.

3.3.5. Links Between Trainer-Related Factors and Feedback

The repercussions of the effects generated by the debriefing activity are felt both in the short term and in the long term, both for the trainer and for the learners, and at all levels of the G-STAM model. These impacts are symbolised by the grey dashed arrows.

For the trainer, the effects are psychological, affecting confidence, motivation and commitment to practice. Positive feedback from learners increases their confidence in their skills and encourages them to persevere to improve. Debriefing also contributes to the overall improvement of the trainer's practice by enabling him or her to reflect on the different situations experienced during the sessions and to make appropriate adjustments.

On the learners' side, the effects of debriefing are also significant. It gives them the opportunity to reflect on their actions during the simulation, to analyse the results obtained and to become aware of their strengths and weaknesses. Constructive feedback enables them to identify their mistakes, understand the reasons for them and explore alternative strategies to improve their future performance. In addition, debriefing encourages learners to be reflective and to analyse their thoughts, feelings and behaviours in order to make informed decisions. This reflexivity enhances their professional development and their ability to transfer their learning to real-life situations.

4. Conclusions

The lack of a specific model for post-simulation debriefing of trainers poses a challenge in understanding their role and how they perform this role and for what impact on the learners. To fill this gap, we propose to clarify the role of the trainer in post-simulation debriefing and to identify the unique components of their activity in a model (D-STAM).

For this purpose, two parallel integrative reviews of the literature were carried out, including 33 papers. The results aimed to answer two questions: 1) "What is the unique role of the trainer in postsimulation debriefing and how can this role be comprehensively elucidated in order to improve understanding of its influence on learners' reflective processes?" and 2) "How can we systematically identify and model the unique components of the trainer's activity in post-simulation debriefing while ensuring the preservation of situational specificity in an overall model?”

Following a qualitative analysis according to Braun and al. (2019) and supported by the N-vivo12 software, the results highlight that the debriefing trainer is first and foremost a

facilitator. Although this concept has not yet been stabilised (Policard, 2018), it seems that the trainer-facilitator a) encourages and helps the learner to take action to identify and solve problems related to his or her professional field, and b) guides the learner in an in-depth reflection on this action in order to enable him or her to develop operational models that can be transferred to similar real-life situations in the future. Being a facilitator therefore corresponds to a pedagogical attitude that aims to promote learning within the framework of active teaching methods and that includes, but goes beyond, coaching.

Secondly, debriefing takes place in a dynamic, double-regulated context where situations, interactions and learners' reactions change in real time, requiring the trainer to adapt continuously. The trainer must therefore regulate his or her activity on the basis of several components, which are detailed in the Debriefing Simulation Trainer Activity Model (D-STAM). This model provides a synthetic conceptual framework for understanding and improving debriefing in different domains. Based on Leplat and Cuny's (1974) model and adopting a multi-component perspective, the DSTAM highlights three levels of variables (input, process and effect) from which the trainer's activity can be described. Level 1 examines the internal conditions associated with the trainer's personal and environmental factors. The combination of these factors influences the way the trainer engages in the debriefing activity. Level 2 focuses on the trainer's activity, approached from cognitive, didactic, psycho-pedagogical and objectification points of view. This activity is flexible and adapts to the dynamic context of debriefing, which is both anticipatory and restorative. In addition, we also examine the trainer's use of technology, taking into account both the prerequisites (level 1) and the way in which he or she implements the technological support. Level 3 is devoted to the effects of the trainer's activity, both on him/herself and on the learners. These effects can be felt in the short or long term, thus consciously or unconsciously reactivating the results produced by the activity.

5. Discussion

The D-STAM model, developed through an integrative literature review, provides valuable insights into the debriefing activity of trainers. It comprehensively considers the various components at play, including internal and external conditions, the activity conducted and its impact. This holistic approach enhances our understanding of the complex interactions that influence the trainer's role. In addition, the model emphasises the concept of dual regulation, whereby trainers adapt their activity based on both personal inclinations and external constraints, in line with pedagogical objectives.

In practical terms, the D-STAM model emphasises the importance of adequate training for trainers, particularly in the specific pedagogical skills required for debriefing. Equipping trainers with the necessary tools and knowledge promotes effective regulation of their activities and supports learners' learning. In addition, recognising the impact of internal and external conditions highlights the need for adequate resources and a conducive working environment to enhance trainers' commitment and effectiveness. Evaluating and reflecting on trainers' debriefing practice also emerges as a crucial aspect, requiring the development of assessment tools to identify strengths and weaknesses, thereby promoting continuous improvement.

Future research could explore a model tailored to trainers acting as facilitators or guides, with a focus on accompanying gestures during debriefing. Precise and operational process variables should be developed to explore the unique dynamics of these roles. Understanding professional guiding gestures and their influence on learner reflection and learning could shed light on their

effectiveness in promoting critical thinking and identify areas for improvement. Furthermore, exploring the match between trainers' actual practice and their stated approaches may reveal factors influencing the use of guidance. Finally, consideration should be given to training trainers in effective debriefing guidance, including appropriate teaching methods and resources to enhance their skills.

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Contact email: valerie.duvivier@umons.ac.be