What's My Status? – Best Practices for Self-Led Debriefs

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ABSTRACT

Debriefs – a tool critical for effective training – are traditionally facilitated, meaning they are led by an individual (e.g., instructor, teammate). While there are various ways to execute facilitated debriefs, the combination of expert guidance and structured discussion has proven particularly fruitful in military domains (Keiser & Arthur, 2020). However, with increased use of asynchronous or remote learning, and automated or instructorless training systems, it is essential to consider approaches to maximize training effectiveness through automated debriefing capabilities when immediate facilitated feedback is not available.

As a first step to defining self-led and non-traditionally facilitated debrief capabilities, we review best practices for facilitated debriefs. This supports identification of gaps in effectiveness that may exist due to the nature of non-facilitated debriefs. Further, adapting those best practices to non-guided debriefs serves two purposes; to provide a starting point to researching which changes are effective in this environment, and to document a structured approach to developing non-facilitated debriefs that are more familiar to the user.

To illustrate non-facilitated debriefing concepts derived from this analysis, we employed an emerging game-based communication trainer for H-60R crewmembers as a use case. This training system simulates realistic job task performance related to communication behaviors. This paper will focus on potential ways to increase training effectiveness during a self-led debrief. For example, multiple debrief methodologies and structures (e.g., mission, thematic, timeline) will be explored. Further, we will review ideas derived from traditional debriefs such as leveraging self-report performance data for comparison with automated metrics to emulate a feedback discussion. The objective of these analyses and requirements development is to inform design of a testbed for laboratory evaluation of concepts hypothesized to provide effective instructorless debriefs. As a result of these activities, the authors aim to define best practices for self-led debriefs.

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INTRODUCTION

Debriefs are a very useful feedback tool in training and real-world tasks. A debrief – also referred to as an After-Action Review (AAR) – typically consists of a discussion guided by series of questions or metrics that summarizes the training or task that just occurred (Gardener, 2013). It is commonly facilitated by an instructor, a leader, or a superior. The purpose of debriefs is to enhance learning and future performance though discussion of strengths, weaknesses, and areas of improvement (Keiser & Arthur, 2020). Research has shown that an effective debrief can increase future performance by up to 25% (Tannenbaum & Cerasoli, 2013). Learning or performance is enhanced because individuals become active participants, who can relate their experiences to important goals or outcomes, as opposed to being passive recipients of knowledge. However, it is not always possible for debriefs to be facilitated, due to the nature of training or other organizational limitations (e.g., instructor workload, asynchronous training). Therefore, it is important to consider how self-led debriefs can be designed, and improved, in order to facilitate better learning and debriefing in all situations. This first starts with understanding what typically constitutes an effective facilitated debrief, and how these best practices may be adapted to a self-led debrief.

There are different, non-exclusive components to effective debriefs: individual vs. team-focused, objective vs. subjective, unstructured vs. structured, and facilitated vs. self-led (Bui et al., 2021; Keiser & Arthur, 2020; Tannenbaum & Cerasoli, 2013). First, individual vs. team-focused debriefs mainly depend on the training or task at hand. The emphasis of the debrief can focus on individuals for mostly solo tasks, or groups for mostly collaborative tasks. However, for team-focused debriefs, it can also be beneficial to reflect on an individual's performance and how that can affect team performance (Keiser & Arthur, 2020). For example, one strategy, called the Team Dimensional Training, emphasizes the importance of a positive and constructive feedback climate to promote self-correction, which ultimately helps the team better understand collaboration and execution for the mission (Smith-Jentch et al., 1998). Second, the use of objective or subjective measures for a debrief largely depends on the flexibility of the training or the task. If it is very structured, like a checklist, it may be most helpful to debrief using an objective performance measure. However, if the training or task requires human intervention or has varying degrees of task success, it is beneficial to utilize subjective measures, like highlighting all the potential outcomes within a particular scenario and how to best respond.

Additionally, debriefs can be unstructured or structured. For unstructured debriefs, there is typically no format for the instructor to follow, so the discussion is open-ended (Bui et al., 2021). Alternatively, there are many approaches to structured debriefs, including Jaye and colleague's (2015) Debrief Diamond. In this framework, as shown in Figure 1, the debrief procedures start with descriptive discussion, then analyses, and then application. In the *Description* phase, the facilitator or team should have open discussion on the events and actions that occurred during the training (Jaye et al., 2015). The emphasis should be creating a safe environment where everyone involved can contribute without fear of judgement. The team then transitions to the *Analysis* phase, where feedback on positive and negative behaviors, as well as strengths and weaknesses of actions, become the primary emphasis (Jaye et al., 2015). The goal of this phase is to examine why trainees took certain actions, what responses were, and how that impacts the overall outcome. It is also important to ensure that the team understands and validates everyone's perspectives based on their roles. Ideally, this phase is productive in the most positive manner possible. Lastly, the team transitions to the *Application* phase, where positive behaviors and actions are highlighted and reinforced, and areas of improvement are provided to enhance learning in future training. Debriefs can also be structured according to the task or duty being performed; for example, a flight task might be separated by phase of flight, or a surgical procedure might be broken down into sub-tasks when debriefing.

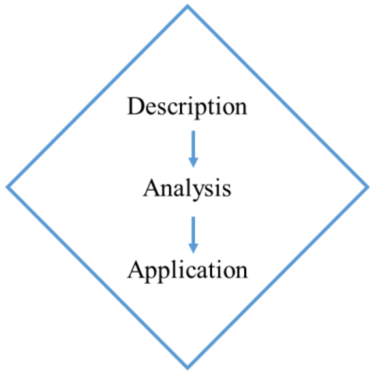

Figure 1. Debrief Diamond (Jaye et al., 2015)

Lastly, debriefs can be facilitated or self-led. Traditionally, a facilitator may be an expert or a superior, but can also be a peer or teammate. This individual will guide the debrief discussion, likely bringing up critical points for discussion, or asking participants to reflect on or discuss their performance. Without a facilitator, the individuals guide themselves through an examination of their training performance. While facilitated debriefs have been heavily supported by research, there is a need to improve effectiveness of self-led debriefs due to the increasing use of asynchronous[1] and/or virtual training (Tannenbaum & Cerasoli, 2013; Keiser & Arthur, 2020).

Best Practices to Facilitated Debriefs

In addition to the components outlined above, there are several factors that generally improve the quality of debriefs. To enhance self-led debriefs, these best practices for facilitated debriefs may serve as an evidence-based foundation to adapt and improve current practices. Table 1 presents six best practices with additional information on how to execute those practices.

Table 1. Best Practices on Content of Facilitated Debriefs

Best Practice	Additional Information	Citation
Use structure to guide debrief	Can focus on training themes, performance goals, timelines, etc. as it serves as an improved memory aid for trainees	Bui et al., 2021
Debrief both positive and negative events	Include details on good and bad performance, so students can identify behaviors or practices to continue or adopt	Bentley et al., 2021
Highlight critical elements of scenario	If trainee experiences various tasks, prioritize feedback based on criticality of task	Bui et al., 2021
Scale feedback to experience level	If the feedback incorporates language or terminology that is beyond what is the trainee's knowledge is, the debrief will likely be less effective	Tutticci et al., 2018
Use objective media for self-led debriefs	Use of structured guidelines can help trainee understand the range of performance, where their performance is, and what to strive for	Keiser et al., 2020

[1]Asynchronous training occurs when a trainee completes tasks at a time that differs from instructor assignment or original delivery (e.g., recorded lectures). Therefore, it may not be possible for the trainee to receive immediate feedback because the instructor is not available during that time.

Provide opportunities and/or tools for reflection and discussion	Offer trainees the time to think and talk about their recent training, so that they may develop better self-awareness during future trainings and enhance learning	Zell & Krizan, 2014

ADAPTING TO SELF-LED DEBRIEFS

Though there are specific benefits to expert or peer-led debriefs (Tannenbaum & Cerasoli, 2013), having another individual present to guide the trainee through debrief is not always feasible, or recommended. In some military training environments, such as Naval Aviation training, automated and instructorless systems are becoming increasingly popular for a variety of reasons. Typically, the curriculum of instruction (COI) is intense – such that instructors have a high workload – both when considering specific training events, as well as the overall curriculum they are responsible for delivering. Instructorless systems can be used to deliver training, without instructors needing to be present at the point of instruction. These systems can provide structured practice for students to fit in at certain points in the curriculum, or simply when the students have availability or need to access a certain piece of training (e.g., in preparation for a joint training exercise, remediation prior to increasingly complex event). In these situations, an instructor will not be around to provide a debrief for the student. It is possible that another student could provide a peer-led debrief, but this would highly depend on the individual expertise, schedules, and other unknowable aspects of the particular COI.

While non-facilitated, or self-led debriefs have several limitations, these may be remedied through research, design, and testing to improve the quality of debriefs. For example, when debriefing themselves, students are at least partially relying on self-assessment. Previous studies have indicated that the connection between self-assessment scores and objective measures is moderate (Sitzmann et al., 2010; Zell & Krizan, 2014). This underscores the limitations experienced when taking the instructor out of the picture – not only have you removed the expert from the equation, but you have also removed another source of student assessment. In addition, by removing the instructor, a source of memory and tracking is also removed. With the burden of assessment on the student, research and development focused on the student and the system interaction and methods to augment traditional feedback from a third party become important considerations.

Therefore, while there is clear evidence in the literature of what makes effective AARs, debriefs must function differently when self-led due to capability gaps (e.g., additional assessment, memory, expertise of the other individual). Opportunities to compensate include methods for enhancing self-assessment processes and/or system-based assessment feedback. Investigating methods to adapt debriefing best practices for generating recommendations or requirements for non-facilitated/self-led debriefing offer a path toward identifying the research and development necessary to advance the state of the practice for automated, instructorless, and asynchronous systems. As a part of the requirement refinement process, capturing iterative instructor and/or student feedback on user interface designs can help ensure training effectiveness and student understanding of feedback.

Based on initial considerations for adapting best practices from facilitated debriefs, several design considerations emerged. First, there should be enough structure to help trainees guide themselves through examination of their training performance, but the structure should not be so rigid that it becomes restrictive or decreases engagement. Second, it is important to identify an appropriate visualization method for objective data to guide trainees, without being overly complex or information dense resulting in an inability to extrapolate and learn from their personal perspectives. Lastly, systems leveraging this approach may benefit from offering some level of training either before or during the debrief to help trainees understand how to best debrief themselves. Incorporation of a simple wizard-style walkthrough or thought-provoking questions that mirror the layout of the debrief feedback offer options for guiding individuals through their performance while also orienting them on what to expect.

Below, we expand on current best practices and present various designs for self-led debriefs within an H-60 communication-based training use case. Additionally, we present feedback from subject-matter experts to highlight perceived strengths and weaknesses of the presented self-led debrief design concepts.

H-60 COMMUNICATION-BASED TRAINING USE CASE

To assist with conceptualizing design recommendations for self-led debriefing, the team identified communication-based training intended for use as remediation or to serve as prerequisite training prior to larger aircrew events as a use case. Since this training would augment the typical COI, instructor involvement would be limited due to resource limitations and would therefore rely primarily on self-led debriefs. One such solution is a prototype training system targeted toward the H-60 community, Respond. This software includes a high-fidelity three-dimensional (3-D) graphical game engine environment with interactive communications training prompts using measured Automated Speech Recognition (ASR). Practice sessions model real-world scenarios based on input from Navy pilots and aircrew Subject Matter Experts (SMEs) and Naval Air Training and Operating Procedures Standardization (NATOPS) Guidelines. The current design allows students to practice scenarios to increase their communications knowledge, and using automation within the system provides a method for delivering feedback to a student while executing a scenario and in AARs in an effort to increase overall test scores (La Cerra et al., 2019).

DESIGN CONCEPTS

In this section, we discuss early designs of a basic concept for the debrief screen within the Respond use case. From there, we will explore two additional innovations based on the traditional debrief best practices: self-assessment/reflection and pseudo-facilitation. For each of these, we will review the features of early design concepts, highlighting their adherence to current best practices and innovations, and then discuss subsequent human factors (HF) and SME feedback. Internal reviewers from NAWCTSD provided HF feedback as part of an iterative design process, while SME feedback from experienced Naval Aviators focused on debrief completeness and applicability of displayed content. Additionally, SME input included consideration of stakeholder characteristics that might affect display design decisions.

Best Practices Basic Concept

Best Practices and Innovation. Figure 2 details a non-interactive debrief screen that encompasses general debriefing best practices adapted for non-facilitated debriefing. This user interface offers a simplified design of what a system might provide as a debriefing screen to a student who has just completed an exercise. Focusing on a basic training exercise, the display indicates the path of the helicopter and target estimation in diagram form, performance strengths and weaknesses, and specific objective details regarding communications-based performance metrics. The mockup shown adheres to best practices including: providing positive and negative information, providing multiple visualizations, providing specific objective data, and providing structure.

HF Feedback. HF inputs indicated that the interface mockup has some benefits and drawbacks. The use of a static screen ensures that individuals do not need instructions for accessing non-visible content or additional orientation to user interface tools for content access – this limits navigation-related confusion and simplifies the student focus. In addition, the display contains good design elements. For example, the use of color in addition to numeric values when communicating performance indicates to students not only how they performed qualitatively, but also orients students to performance goals by providing what is considered an *acceptable* performance range. However, a limitation of the simplified design is the lack of *instructorless facilitation* to guide students through the debrief feedback. While the current design allows flexibility for a self-guided review that may be effective for some individuals, there would be little standardization and no way to track whether individuals read (let alone internalized) any of the information. In addition, providing ground truth and performance data with no diagnoses of issues or discussion of *why* certain metrics received low scores may be more beneficial to task experts. As noted from best practices, some amount of reflection or facilitation is necessary for students to get the most out of the debrief information. At a minimum, it would be beneficial to indicate high priority items, and why they are important, as well as diagnosing how the student may improve.

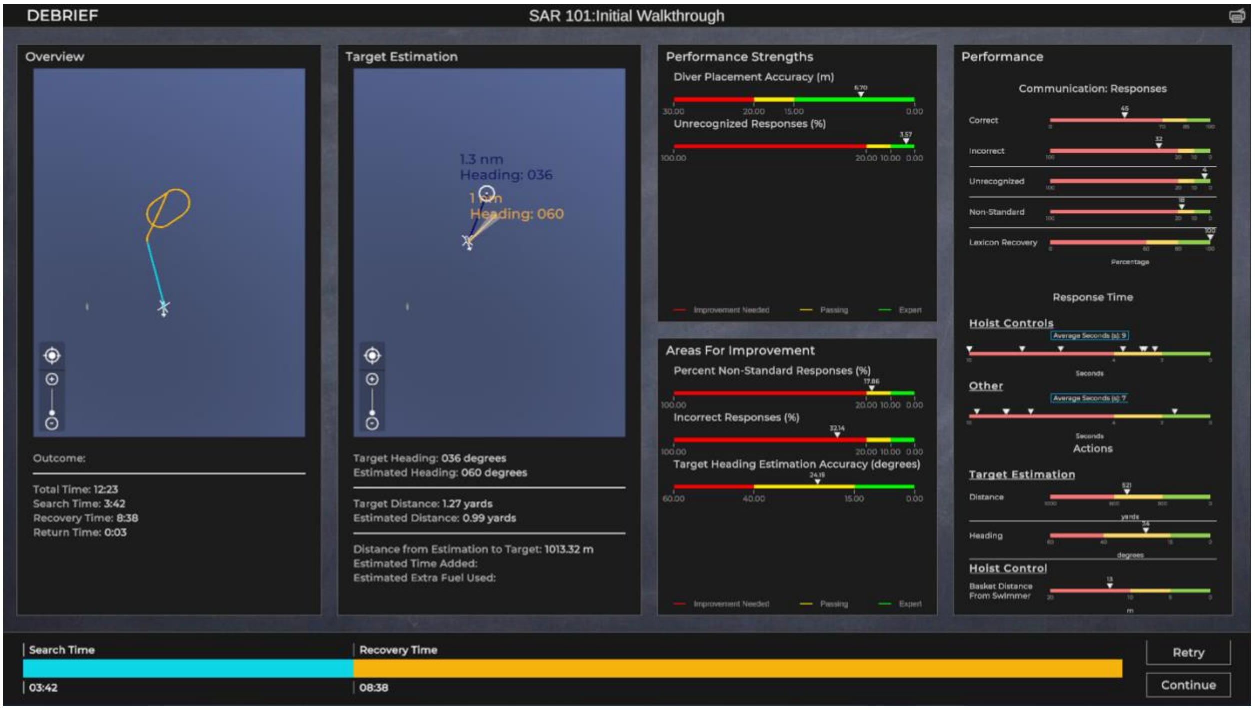

Figure 2. Non-Interactive Debrief Screen

SME Feedback. Feedback from SMEs indicated that this debrief screen provides a lot of valuable information to students, with limited concern that students may not be able to interpret the results. Experts favored the left-hand side pictorials due to relevance to student performance. However, SMEs mentioned that it would be useful to have a vertical look (e.g., altitude) as well as the top-down view of patterns to assist with reviewing performance. In addition, SME input on the "stoplight look" of the performance bars with red/yellow/green was positive, indicating that the match to real world aircraft visuals would increase students' familiarity with the design concept. Generally, SMEs thought this debriefing concept was useful, as long as the terminology was correct, and mission critical items were present.

Self-Assessment and Reflection Concept

Best Practices and Innovation. Figure 3 shows a post-training debrief reflection screen, meant to provide students an opportunity to consider their performance prior to showing objective measures of performance. The concept is to have students indicate how well they thought they performed on mission phases – pickup, transport, and drop-off – on various measures (e.g., performance, effort, frustration). In addition to a performance range, students would provide some narrative content about their perceived strengths and weaknesses during each mission phase. This allows students to reflect on their performance prior to receiving automated feedback. Although there is not an instructor or another student available, this design feature could provide a way for the student to get some of the experience that a traditionally facilitated debrief would normally provide because this concept's processes are similar. In addition, this provides a method for comparison of system-based performance assessment and student perceptions of performance, which would allow the system to highlight concepts with significant deltas. For example, if a student indicates that they think they did very well in Pickup but not very well in Transport, but the objective data indicates the opposite, emphasizing the discrepancy provides additional targeted information about improving performance or areas of mastery.

Figure 3. Post-Training Debrief Reflection Screen

HF Feedback. HF feedback indicates that overall, the interface is simple and provides students a mechanism by which to reflect on their training experiences before receiving feedback. However, surveyed HF experts indicated that the performance outcomes screen following this interface is key. The student, if a beginner, may not be able to assess accurately how they did, or why they may not have performed well. Without objective measures of performance that correspond to student inputs, students who wrongly assess themselves may not have appropriate correcting feedback and come away from debrief with mistaken beliefs. Since there is a limit to how much information the system can provide for feedback on the user's reflection, further exploration of mitigating solutions is necessary. In addition, there is some risk to asking the student to reflect before seeing the metrics of interest. Students may form an opinion of their performance before seeing the data, which could influence motivation or mindset when reviewing their scores.

SME Feedback. SME inputs indicated that the reflection screen might deliver limited utility. The general concern is that students would not take a lot of time considering this screen, given that they are assessing themselves during the training, and should already have a clear idea of how they performed without the need for reflection. The target user base consists of high-performing, analytical individuals; SMEs indicated that even novice trainees would likely have little trouble accurately diagnosing their own performance issues. For at least this target user community, regular discussion groups happen with students and instructors outside of training that would likely satisfy the need for reflection/discussion that this screen aims to prompt.

Pseudo-Facilitation Concept

Best Practices and Innovation. Figure 4 shows a pseudo-facilitated debriefing concept, in which there is a virtual instructor who steps the student through several key pieces of information on the debrief screen. The student can step through the numbers on the bottom left-hand corner of the screen to see all the instructional feedback and recommendations. This concept could be as smart as desired through integration of complex algorithms (e.g., machine learning, deep learning, and artificial intelligence), providing pertinent information and strategies to students including recommendations to practice certain modules, read certain texts, and review SME-distilled information. Alternatively, the system could be relatively simple, designed to go over the same collection of points with each student. These would likely consist of the few points deemed mission critical, or most difficult to master. These approaches would help standardize the debrief process for each student and ensure that they are taking away specific pieces of information. In addition, a virtual instructor provides structure, which is a known best practice for debriefing (Bui et al., 2021). Finally, this concept facilitates implementation of other best practices such as providing positive and negative information, and providing multiple means of assessment, including objective data.

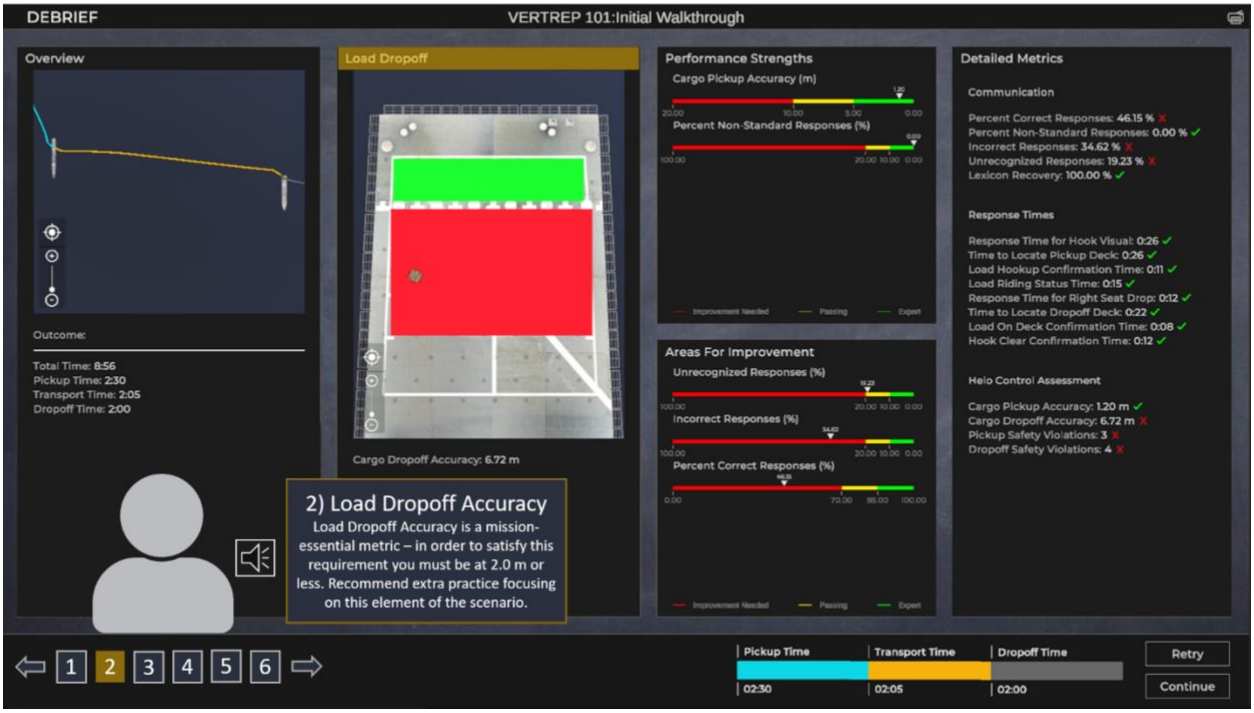

Figure 4. Pseudo-Facilitated Debrief Screen

HF Feedback. HF feedback indicated that this is a reasonable way to provide structure, and that mimicking a traditional instructor led debrief is a good way to ensure that students will not be confused or lost. Additionally, this method may keep students engaged and focused on the information available to them rather than distracted by the additional task of facilitating self-guiding. The main limitation the feedback noted with the current proposed approach to pseudo-facilitation is also one of the main gaps for non-facilitated debriefing in general: a lack of instructor expertise to provide value-added information that will help a student understand their performance and improve. However, research and development into a "smart" virtual instructor with appropriate implementation of advanced algorithms, or a detailed library of expert information, strategies, and feedback that can be used in certain cases, may address this current limitation.

SME Feedback. SME feedback indicated that the idea of a virtual instructor is very compelling, but with specific caveats. Instructors teach Tactics, Techniques, and Procedures (TTPs) based on experience, and not all instructors and operators share the same techniques. Automated system recommendations must be clear when recommending strategies that they are not NATOPS specific, that they must not prioritize one TTP over another based on the feedback provided in the debrief and they should indicate that students should speak to instructors to learn alternatives and understand the tradeoffs between different techniques. To this end, the system could provide information about who to contact or where to find the appropriate and relevant additional information. For example, in situations where NATOPS documentation provides relevant information, SMEs recommend that the virtual instructor show students where to find the information, or even link them to the correct publication and location in that document. SMEs responded positively to the concept of the scroll through design, where the virtual instructor would step through certain mission critical items, or moments of interest. Though students will likely understand the various measures of performance, SMEs indicate that it is good to have targeted guidance, which would make students focus more on certain parts of information when considering their performance.

CONCLUSION

While traditional, facilitated debriefs remain the standard of excellence for post training feedback to improve learning, identifying areas for research and technology improvement in asynchronous training in the future grounded in best practices offers opportunities to enhance a variety of training solutions. The post pandemic environment has increased the interest in solutions that allow for remote training due to the benefits (e.g., reduced travel budgets for collocation; ability to meet multiple responsibilities with fewer schedule impacts) and flexibility it affords. Further, as communities such as Naval Aviation move toward *competency-based proficiency* assessments and training models[2] and *family of systems* training devices[3], there is a need to identify how to implement these solutions to maximize effectiveness.

The goal of this paper was to outline a set of best practices based on traditional, facilitated debriefs to assist with the design process and to identify areas for future research. At the highest level, these best practices call for structure, objective content derived from training objectives that highlights both positive and negative aspects of performance and encourages self-reflection during the self-led debrief process to engage trainees. Other areas for consideration to help refine further requirements and best practices would include performance measures and automated technologies. The literature surrounding performance measurement and current best practices in live or simulation-based facilitated training environments offers methods for ensuring diagnostic feedback, ensuring the right amount of information to lead to learning, and discuss implications of feedback timeliness. Additionally, a review of automated technology benefits and challenges in cases where advanced technology might underpin an *intelligent* debrief provides insight into areas for consideration such as trust, transparency, barriers to adoption.

Ultimately, decisions associated with display and interaction types will likely require tradeoff discussions that will need to account for training objectives, purpose or goals, budgets, and the state of technical capabilities. While the communication-based training use case and design options outlined here are not representative of all training domains, they do represent some important considerations and associated benefits or challenges for consideration during the design and development process. Further, as the data captured from both human factors and domain SMEs highlight, involving a diverse set of backgrounds and stakeholders in design discussions will be critical to identifying ideal and technically achievable solutions.

Next steps in this area will involve continued design of self-led debrief interfaces and ultimately development. For our specific use cases, in addition to continued user testing to ensure usability, there are several empirical questions to consider. For example, measuring how performance changes across multiple training scenarios when leveraging self-reflection as part of the debrief process. While experts agree that within military domains trainees are analytical and striving to improve performance through constant self-evaluation, this method offers a means to identify areas where individuals are not accurately gauging performance or through inclusion of trend analysis, provides insight into areas where performance may be commonly over or under underestimated by the trainee population. Additionally, assessing the responsiveness and effectiveness of variations in virtual instructor implementations may guide areas for technology improvement. As an example, understanding if communities find an avatar-based virtual instructor more or less engaging than simply offering text-based instructor guidance would assist with identifying what types of technology advancements support this design option.

Overall, leveraging human factors methods and seeking empirical evidence for best fits across a variety of asynchronous training use cases will enhance products and ensure learners can maximize these opportunities to gain proficiency in new areas, seek remediation, and/or reduce skill decay. As with many training system decisions, there is likely not a one size fits all solution. However, generating general best practices to start from can help minimize design cycles and affords programs with cost and schedule mitigations when exploring these types of training solutions.

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[2] Training and learning models focusing on events that target training needs based on individual learning levels vice a specific number of training events per learning objective.

[3] Expanding to variety of training media types and fidelity to increase training opportunities in a cost effective manner that supports holistic learning needs.

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