Building Readiness: A Competency-Based Framework for Military Medical Training in U.S. Marine Corps Exercises

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ABSTRACT

In this paper, we present a case study on the integration of competency-based frameworks into military training within the Bold Quest 24 (BQ24) Medical Thread, a Joint Staff J6 exercise. The study explores the Synthetic Training Environment Experiential Learning for Readiness (STEEL-R) architecture applied across realistic, networked training scenarios to enhance readiness assessments for medical personnel. STEEL-R applies methodologies from the Generalized Intelligent Framework for Tutoring (GIFT) and adheres to Total Learning Architecture (TLA) standards (Goldberg et al., 2021), ensuring data interoperability and structured evidence collection.

Through competency-based methodologies applied to the BQ24 Medical Thread, the U.S. Army Soldier Center's STEEL-Rx (STEEL-R in exercises) project categorizes, structures, and assesses training objectives aligned with the U.S. Marine Corps' Training and Readiness program. The approach focuses on key Mission Essential Tasks, with training events designed to enhance real-world operational capability. Targeted objectives include providing Role 2 health services, damage control resuscitation, casualty management, and evacuation procedures. Each training event is structured to evaluate knowledge, skills, and behaviors critical to mission success.

The learning framework employs a dual-phase approach: a pretraining phase consisting of eLearning modules, and a main event phase featuring live, virtual, and mannequin-based scenarios. The use of Experience API (xAPI) statements facilitates tracking and analysis of individual and team performance, enabling granular assessment of competency across these many learning platforms. The value and timeliness of Observer Trainer assessments are elevated with a tablet solution, supporting real-time performance observations, categorizing competencies, and providing feedback – even as the exercise is still in the field.

STEEL-Rx in BQ24 illustrates the applications of competency-based multimodal analytics in hard case multinational training. The approach supports efficient training delivery, enhances readiness, and aligns training outcomes with mission objectives. As military training continues to evolve, the STEEL-Rx model provides a scalable framework that integrates technology-driven assessments, ensuring military medical personnel are well-prepared for real-world challenges.

ABOUT THE AUTHORS

Biljana Presnall has extensive experience in eLearning and military training. She led the digital team on a Department of Defense R&D project to mature the operational integration of ADL in multinational exercises (MADLx) and contributed to Annex to NATO ADL Handbook on Advanced Distributed Learning in Exercises. Her research is primarily focused on leveraging advanced data science methodologies within big data environments to develop innovative data strategies and solutions. This includes the application of artificial intelligence and natural language processing techniques to optimize and drive actionable insights. She is currently team lead for US Army DEVCOM Soldier Center's Project STEEL-Rx, field-based validation testing of STEEL-R with exercise planners, observer/trainers, and trainees.

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Introduction

Military medical readiness is a critical component of operational effectiveness, directly impacting the ability of armed forces to respond to diverse combat and humanitarian missions. As warfare scenarios become increasingly complex, joint, and multinational exercises such as the JSJ6 Bold Quest series provide opportunities to test and refine training models under realistic conditions. The Bold Quest 2024 (BQ24) Medical Thread offered a unique case study in the integration of advanced training technologies with competency-based frameworks to evaluate medical performance across distributed environments. This paper presents the development and implementation of a competency-based training model within the Bold Quest 2024 Medical Thread. The model supports the integration of the Synthetic Training Environment Experiential Learning for Readiness (STEEL-R) system into the STEEL-Rx project—an effort to enhance data-driven decision-making and performance evaluation through the Generalized Intelligent Framework for Tutoring (GIFT) applying Total Learning Architecture (TLA) standards. This approach enabled real-time performance tracking across live, virtual, and constructive (LVC) environments.

STEEL-Rx in BQ24 aligned training events drawn from the Marine Corps Training & Readiness (T&R) program with Mission Essential Task Lists (METL) using structured competencies. The integration of these frameworks allows for measurable, behaviorally anchored assessments that reflect the operational demands placed on military medical personnel. The approach emphasizes enduring competencies—those knowledge, skills, and attitudes (KSAs) that are transferable, observable, and trainable—providing a scalable model for competency development in dynamic, mission-oriented environments. By linking METL-derived training events with performance expectations, the system supports evidence-based assessments that contribute to the calculation of Combat Readiness Percentages (CRP). This approach offers a replicable framework for the design, implementation, and validation of military medical training that bridges doctrine with tactical execution.

In this paper we describe the background of the Bold Quest exercise series and the Marine Corps training ecosystem, the development of the competency framework, its implementation within STEEL-Rx, and insights from its application during the Bold Quest 2024 event.

Background

Bold Quest is a multinational, joint-force series of exercises led by the Joint Staff's J6 Directorate. It provides a technologically integrated and operationally realistic environment for testing interoperability across coalition partners. Within this complex training ecosystem, the Bold Quest Medical Thread addresses medical readiness by simulating real-time casualty management, medical evacuation, and coordination across service branches and allied forces. These scenarios are informed by real-world operational needs and contribute directly to validating both procedural knowledge and applied medical competencies in contested resource-constrained environments. The 2024 iteration of Bold Quest introduced the Medical Thread as a structured platform to test the integration of emerging technologies such as STEEL-R, while grounding training in the Marine Corps' doctrinal frameworks.

The U.S. Army Synthetic Training Environment Experiential Learning for Readiness (STEEL-R) system is designed to integrate learning, evaluation, and adaptation within complex training environments. It leverages tools and

methodologies from the Generalized Intelligent Framework for Tutoring (GIFT)—an open framework developed by the U.S. Army DEVCOM to support adaptive learning through personalized feedback and performance tracking. GIFT's modular architecture allows it to ingest and analyze learner data in real-time, providing automated guidance that enhances human instruction. STEEL-R strategically integrates GIFT within the broader ecosystem of the Total Learning Architecture (TLA), a DoD initiative that standardizes learning data across platforms through interoperable formats, such as xAPI (Experience API). This architecture ensures that performance data gathered across varied environments can be aggregated and analyzed to assess individual and unit competencies. In the STEEL-Rx extension (STEEL-R in exercises), the competency-based model categorizes training evidence to inform after-action reviews (AAR), personalize learning pathways, and contribute to strategic readiness tracking through mission rehearsals.

The U.S. Marine Corps employs a rigorous training system grounded in the Training and Readiness (T&R) program[1], which serves as the foundational guide for planning, conducting, and evaluating training across all echelons. The T&R manual provides a standardized method for aligning training events with METL core task sets derived from the Marine Corps Task List that define the fundamental capabilities required for operational success. Training activities, including those conducted in multinational exercises, are linked to METLs to ensure alignment with real-world mission requirements. The Marine Corps does not assign numerical scores to individual training events. Instead, it uses a qualitative measure known as the Combat Readiness Percentage (CRP) to express the extent to which a unit has recently executed relevant training. CRP is based on the completion of E-coded events—collective training activities designed to build operational capability at the team, crew, and unit levels. These events provide a reliable indicator of unit proficiency and contribute directly to strategic readiness assessments.

The STEEL-Rx project serves as proving ground for operationalizing and validating the STEEL-R frameworks in an integrated, data-driven, and competency-centered manner.

Methodology

This paper employs a case study methodology to examine the development, implementation, and preliminary evaluation of a competency-based training framework applied within the BQ24 Medical Thread. The goal is to document how structured competencies can be operationalized within the STEEL-Rx data strategy to provide measurable indicators of performance across multiple training modalities (i.e., distributed, virtual, live). The research design is situated within a practical, field-deployed exercise environment, focusing specifically on medical training tasks executed by U.S. Marine Corps units and supported by Subject Matter Experts (SMEs). The case study documents how E-coded collective training events are aligned with METLs and can be mapped to specific competencies. The scope is limited to a defined subset of six medical tasks (HSS-SVCS series), enabling focused competency modeling and integration with the STEEL-R system.

The competency framework was developed through collaboration with SMEs from operational forces participating in the BQ24 Medical Thread. The modeling process included:

- Decomposition of METL-aligned training tasks into discrete knowledge, skills, and attitudes (KSAs)
- Identification of observable behaviors associated with successful task execution
- Use of a behavioral-anchored rating scale (BARS) approach for coding performance indicators
- Emphasis on adaptability, transferability, and contextual relevance of competencies

Each competency was designed to be measurable within both synthetic and live environments, and to support individual and collective assessment. The development process followed best practices in medical education and military human performance research (Frank et al., 2010; Zook, 2006).

A multimodal data collection strategy was used to capture training evidence across disparate environments. Key components include GIFT (Generalized Intelligent Framework for Tutoring) deployed to provide adaptive feedback and to log behavioral responses in real-time. Human observers used structured checklists derived from the competency model to validate performance against key behavioral indicators and a post-exercise After Action Review (AAR) was aggregated to assess alignment between observed outcomes and expected competency performance.

[1] Health Services Support Training and Readiness Manual, Department of the Navy Headquarters United States Marine Corps, 11 June 2018.

Competency Framework Development

Competencies represent the integrated abilities of an individual to apply knowledge, skills, and attitudes in performing tasks within a specific operational context. In military environments, particularly within dynamic and high-stakes fields like medical operations, the use of competency-based frameworks has proven to be effective for personnel management, performance evaluation, and targeted training (Zook, 2006; Frank et al., 2010). Competencies are enduring capabilities that are trainable and observable. They can be developed through deliberate practice and measured through the behaviors individuals exhibit in task performance.

In developing a competency framework, it is essential to consider multiple dimensions—including behaviors, knowledge, skills, and attitudes—and how these elements collectively shape performance. Competency models must be dynamic, adaptable to evolving mission needs, and aligned with real-world tasks.

The BQ24 Medical Thread competency framework was constructed in direct alignment with E-Coded training events that support unit-level METLs and contribute to CRP metrics. E-Coded events represent critical, observable training milestones rather than generalized knowledge indicators. While they occur at specific points in time, their cumulative execution provides a holistic picture of a unit's operational readiness. In this framework, each E-Coded event was deconstructed into a set of subtasks, with individual responsibilities clearly delineated. These subtasks were further parsed into action lists, each of which was identified as primarily demonstrating knowledge, skill, or behavior. This decomposition enables targeted training and provides measurable indicators for assessment that can align to a data source. According to the World Health Organization (WHO), effective task performance is achieved through the integration of Knowledge, Skills, Attitudes, and Behaviors (KSAB).[2] Knowledge enables understanding of the context and rules; skills enable execution; attitudes shape the willingness to engage; and behaviors reflect real-time application. Competency models must ensure that these dimensions are not treated in isolation but understood as mutually reinforcing. Competence arises when individuals can fluidly apply these elements in a coordinated manner under operational pressure.

Skills refer to applied techniques and practical abilities acquired through training and experience. In the medical context, this includes clinical procedures, problem-solving strategies, and effective communication (Epstein & Hundert, 2002; Frank et al., 2010).

Knowledge encompasses theoretical understanding, factual information, and procedural awareness relevant to the task. It is foundational and essential for competent task execution (Eraut, 1994; Harden, 2002).

Behavior involves observable actions and interpersonal conduct during task performance. Behaviors serve as indicators of underlying competencies and can be quantified in real-time by trainers or automated systems (Zook, 2006; Issenberg et al., 2005).

For each training event, SMEs from the 2MLG assigned actions and subtasks percentage weightings that contribute to the overall evaluation of a Marine's or team's performance. Observer Trainers (OTs) use these metrics to classify each individual's training level as:

- Above Expectation
- At Expectation
- Below Expectation

These classifications are based on observed execution of required competencies, using structured evaluation forms that mirror the competency framework's design.

After defining these model parameters, indicative behaviors were identified for each of the competencies' delineated task step/sub-task. Each of these measures assesses a different aspect of performance, such as communication, documentation, decision-making, and logistical management and are then connected to Level 3 competences, where the H-ABC teamwork model (Vatral et al., 2022) is adopted (see Figure 1). The task steps/sub-tasks from training

[2] Global Competency and Outcomes Framework for Universal Health Coverage. (2022). Geneva: World Health Organization.

events represent elements in Level 4 of the H-ABC model, which are supported with level 5 Observable Behavior and Data.

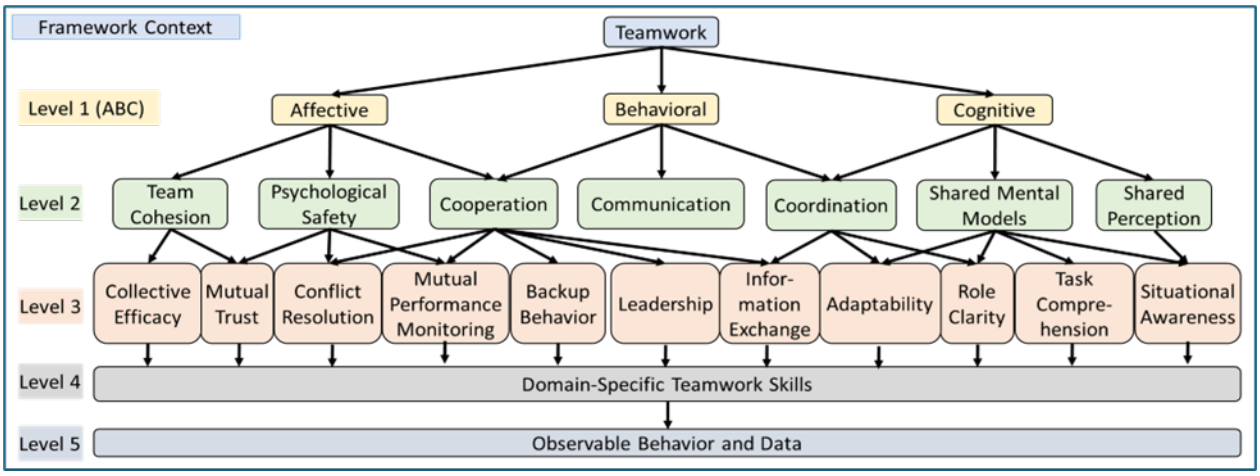

Figure 1. The H-ABC Teamwork Model (Vatral et al., 2022)

To enhance clarity and ensure consistent assessment, it was agreed—through consultation with BQ24 Medical Thread SMEs—that each Level 2 or lower-level task would be associated with one dominant Level 3 competency (ten Cate, 2018). While task performance may draw on multiple competencies, this one-to-one mapping provides structure to assessment and analytics. The dominant competencies used in this model include the following:

- Leadership: Guiding and influencing team members while adapting strategies in real-time.
- Task Comprehension: Understanding objectives, assigned roles, and execution strategies.
- Information Exchange: Effective communication and timely sharing of critical updates.
- Role Clarity: Clear understanding of team roles, minimizing overlap and confusion.
- Mutual Performance Monitoring: Monitoring team actions and offering feedback in real time.
- Situational Awareness: Recognizing environmental and operational dynamics to adapt performance.
- Backup Behavior: Readiness to assist or substitute for team members under strain.
- Conflict Resolution: Managing disagreements constructively to preserve team effectiveness.
- Mutual Trust: Confidence in team members' capabilities, supporting openness and cohesion.
- Collective Efficacy: Shared belief in the group's ability to achieve its mission objectives.

These competencies are evaluated not only as individual traits but also as essential components of collective performance in dynamic environments. Their explicit inclusion in the framework enables both formative and summative evaluation and strengthens the causal link between observable training actions and broader readiness outcomes. Finally, the model includes standards to assess whether task performance meets, exceeds, or falls below expectations, although final judgment often relies on OTs for contextual accuracy.

The following measures, which guide the OT's assessments of the training events, were identified together with SMEs from the 2MLG at Camp Lejeune:

1. **Verbalize:** The participant communicates their planned actions, strategies, or decisions aloud, allowing assessors to evaluate their thought process.
2. **Show Forms:** Participants present the required forms or documentation to demonstrate that they understand and have completed necessary reporting or administrative tasks.
3. **Notional Action:** Participants simulate a theoretical response to a scenario, focusing on decision-making without physically conducting the action.
4. **Electronic Report/Request Sent:** The participant successfully submits an electronic report or request, demonstrating their ability to use relevant communication systems.
5. **Log Maintained:** The participant keeps an accurate and updated log of actions and events, ensuring proper record-keeping for audit or review purposes.

6. **Review Inventory**: The participant checks and confirms the availability and condition of necessary supplies or equipment, ensuring readiness for operations.
7. **Administrative Board Updated:** The participant ensures that all required updates are made to the administrative board, providing accurate and current operational information.

Overview of Framework Implementation

The competency-based framework developed for the BQ24 Medical Thread was successfully implemented across six mission-critical E-coded medical tasks, each drawn from the U.S. Marine Corps Training and Readiness (T&R) program and aligned to unit-level METLs. These tasks include:

- HSS-SVCS-4001: Provide Role 2 Health Services Support (HSS) capabilities
- HSS-SVCS-4004: Provide Damage Control Resuscitation
- HSS-SVCS-3001: Receive Casualties
- HSS-SVCS-3002: Manage a Mass Casualty
- HSS-SVCS-3003: Conduct Casualty Holding
- HSS-SVCS-3004: Conduct Casualty Evacuation

Each of these primary tasks was deconstructed into a set of subtasks. For example, the task "Receive Casualties" includes eight subtasks such as “Develop a Casualty Reception Plan,” “Conduct Triage,” and “Submit Reports.” These subtasks were then broken down further into detailed, observable steps—such as “Establish contingency for COMMS outage” or “Integrate a CBRN response plan (if applicable)”—providing the necessary granularity for both human and system-based performance evaluation.

This hierarchical structure—**Task > Subtask > Action Step**—allowed for the explicit mapping of competencies at each level and the generation of fine-grained xAPI statements based on learner and team actions. Competencies were modeled not as static checklists, but as observable, behavioral indicators that could be assessed across skill acquisition phases, training modalities and operational contexts.

The pretraining phase was designed to build foundational competencies that support performance across multiple main-event tasks, with a particular focus on patient documentation workflows. This included subtasks such as "Record patient data," "Verify casualty identity," and "Update treatment logs," which recur in various forms throughout all six major tasks. The pretraining was delivered through an eLearning module on the Battlefield Assisted Trauma Distributed Observation Kit (BATDOK 5.0). This tool served as both a training content area and a data source, enabling the generation of behavior-based xAPI statements for documentation-related actions during the pretraining module. By designing the pretraining event to address shared subtasks and documentation competencies, the framework ensured that learners entered the main event phase with baseline proficiency in critical administrative and procedural elements. This strategy also enabled a continuous learning loop: competencies introduced in pretraining were reinforced, observed, and evaluated during the subsequent live, mannequin-based, or VR training scenarios.

In total, the competency framework spanned:

- **6 primary E-coded tasks**
- **Over 40 subtasks with specific performance responsibilities**
- **More than 120 granular action steps mapped to knowledge, skill, or behavioral domains**

These were operationalized in the STEEL-Rx system through GIFT-driven assessment logic and visualized in the STEEL-Rx Dashboard, enabling real-time tracking of individual and team performance across both synthetic and live environments.

Selected Example: Develop a Casualty Reception Plan

To illustrate the practical application of the competency framework, the following example traces one complex task - ‘Develop a Casualty Reception Plan’ - from doctrine (HSS-SVCS-3001: Receive Casualties) to xAPI statement, showing how a complex medical operation was decomposed into assessable components and integrated into the STEEL-Rx ecosystem. This task was broken down into eight core subtasks, each aligned to operational doctrine and SME-reviewed procedures. These included:

1. Develop a Casualty Reception Plan
2. Conduct Triage
3. Treat Casualties
4. Provide Ancillary Capabilities (as needed)
5. Disposition Casualties
6. Coordinate Evacuation (as needed)
7. Prepare Casualties for Evacuation (as needed)
8. Submit Reports (if applicable)

Each subtask was further decomposed into discrete steps—over 20 for the planning subtask alone. For example, within "Develop a Casualty Reception Plan," steps include establishing contingency protocol for communications (COMMS) outage; Chemical, Biological, Radiological, and Nuclear (CBRN) response planning (if applicable); assigning triage roles to medical staff; determining location for casualty staging and overflow or identifying expected casualty inflow rates and surge procedures. These steps were coded into the system as Level 5 observable behaviors, allowing GIFT to generate specific xAPI statements when actions were performed, omitted, or performed incorrectly. Each xAPI statement included a timestamp, actor ID, activity, and associated competency domain. For Developing a Casualty Reception Plan, the dominant competency selected (as per SME consensus) was Task Comprehension, supported by sub-competencies such as Situational Awareness, Information Exchange, and Role Clarity (Figure 2.)

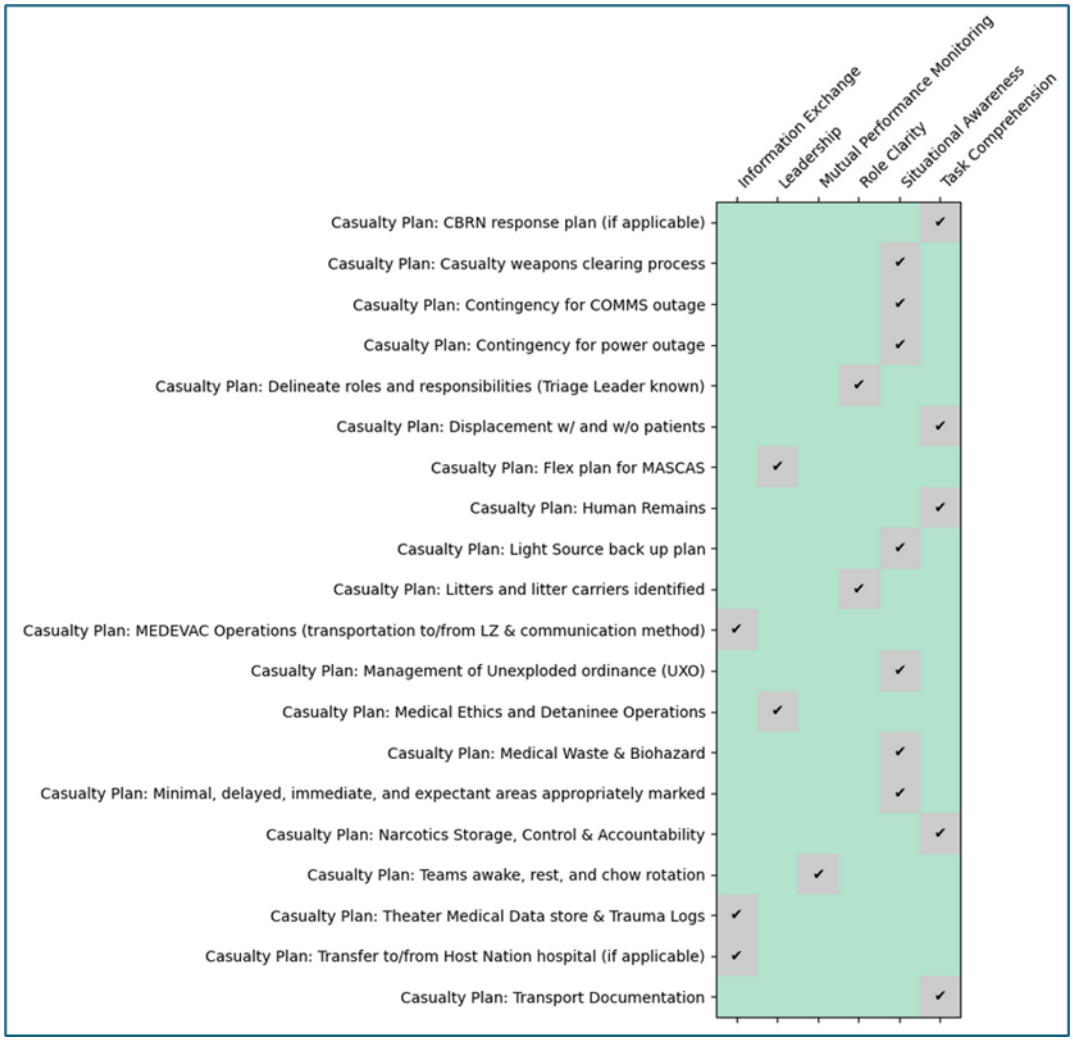

Figure 2. Competency Mapping for "Develop a Casualty Reception Plan" Task

During the live scenario, OTs used a structured checklist linked to these same tasks, allowing human observations to align with GIFT-generated performance state (e.g., below-, at-, above-expectation). For example, when a participant correctly accounted for a COMMS outage in the planning document, both an observer notation and a system-generated xAPI statement confirmed the behavior. Discrepancies between observed and system-logged actions can be reviewed during the After Action Review (AAR).

Performance on this task contributed to both individual competency assessments and the unit's CRP. Specifically, completion of all eight subtasks at or above the "At expectation" threshold (Fully or Partially Trained) was considered essential to claiming proficiency in this task.

This example demonstrates the integrated flow from doctrinal task structure, through competency mapping, into multi-source performance evaluation using both digital and human inputs—culminating in actionable feedback for both learners and training command.

Conclusion

The BQ24 Medical Thread represents a significant step forward in the development and implementation of competency-based training in military medical exercises. Through the integration of the STEEL-Rx system, competency frameworks are being reinforced with real-time, evidence-based assessments that align with Training and Readiness (T&R) program requirements and the Marine Corps' METLs. This structured, data-driven approach ensures that training events are directly linked to competency development, enhancing the ability of military personnel to execute medical tasks effectively in real-world operations.

By leveraging a competency-based experiential learning model, STEEL-Rx facilitates the tracking and evaluation of essential KSAs required for military medical readiness. The integration with the GIFT enables structured data collection and performance analysis across live, virtual, and constructive training environments.

The phased approach of STEEL-Rx application, comprising pretraining and main event phases, ensures that training progresses in a structured manner. The pretraining phase emphasizes foundational skills through eLearning, while the main event phase immerses participants in hands-on training with live, virtual, and mannequin-based scenarios. This multi-modal approach enhances the adaptability of training and provides a realistic context for competency assessment.

Moreover, the competency framework adopted in the BQ24 Medical Thread ensures that each action within a training event is aligned with a dominant Level 3 competency. This method allows for clear linkage between task performance and competency assessment, ensuring a consistent and measurable approach to training effectiveness. OTs play a critical role in monitoring performance, providing feedback, and categorizing training levels based on observed competencies.

STEEL-Rx's broader objectives include refining automated feedback mechanisms, enhancing AAR processes, and driving adaptive training at the scenario level. The system's ability to collect, process, and analyze data in real time provided Bold Quest Medical Tread OTs with insights for both individual and team performance tracking linked to METs/METLs and a competency framework. The incorporation of multiple data sources, including observer inputs and sensor data, further strengthens the assessment process, ensuring a comprehensive evaluation of medical training readiness.

The implementation of this competency-based framework tested in BQ24 is expected to yield several key benefits:

- Improved Training Efficiency: By structuring training around competency-based models, training efforts can be better targeted, reducing time wasted on redundant instruction while reinforcing critical skills.
- Enhanced Readiness Tracking: The systematic assessment of competencies ensures that unit and individual readiness levels are accurately monitored and documented.
- Data-Driven Decision-Making: Real-time data collection and analysis support commanders in making informed decisions about training priorities and resource allocation.
- Scalability and Adaptability: The STEEL-Rx model provides a scalable approach that can be expanded to other training environments and adapted to evolving military medical requirements.

- Synchronized Training with Operational Needs: Aligning training events with METL and T&R ensures that Marines are prepared for the demands of real-world missions.

In conclusion, the integration of competency-based frameworks into military medical training through STEEL-Rx is a transformative step in enhancing readiness and effectiveness. The approach ensures that training is data-driven, adaptable, and aligned with operational requirements. As the U.S. Army and U.S. Marine Corps continues to refine and expand its competency-based training initiatives, STEEL-Rx provides a foundation for future advancements in military medical education and readiness assessment. The findings from Bold Quest 24 will serve as a model for future joint exercises, contributing to the continuous evolution of military training methodologies and the optimization of medical readiness in operational environments.

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REFERENCES

Epstein, R. M., & Hundert, E. M. (2002). Defining and assessing professional competence. JAMA, 287(2), 226–235. https://doi.org/10.1001/jama.287.2.226

Eraut, M. (1994). Developing professional knowledge and competence. Routledge.

Frank, J. R., Snell, L. S., Cate, O. T., et al. (2010). Competency-based medical education: Theory to practice. Medical Teacher, 32(8), 638–645. https://doi.org/10.3109/0142159X.2010.501190

Global Competency and Outcomes Framework for Universal Health Coverage. (2022). Geneva: World Health Organization.

Goldberg, B., Sottilare, R., Brawner, K., & Holden, H. (2021). Leveraging GIFT for adaptive military training. In Proceedings of the Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC). National Training and Simulation Association.

Harden, R. M. (2002). Learning outcomes and instructional objectives: Is there a difference? Medical Teacher, 24(2), 151–155. https://doi.org/10.1080/0142159022020687

Issenberg, S. B., McGaghie, W. C., Petrusa, E. R., Gordon, D. L., & Scalese, R. J. (2005). Features and uses of high-fidelity medical simulations that lead to effective learning: A BEME systematic review. Medical Teacher, 27(1), 10–28. https://doi.org/10.1080/01421590500046924

ten Cate, O. (2018, November 1). *Supervision and entrustment in clinical training: Protecting patients, protecting trainees*. PSNet (WebM&M), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services. Retrieved from https://psnet.ahrq.gov/web-mm/supervision-and-entrustment-clinical-training-protecting-patients-protecting-trainees

Vatral, C., Biswas, G., & Goldberg, B. S. (2022). Multimodal learning analytics using hierarchical models for analyzing team performance. In Weinberger, A. Chen, W., Hernández-Leo, D., & Chen, B. (Eds.), Proceedings of the 15th International Conference on Computer-Supported Collaborative Learning - CSCL 2022 (pp. 403-406). International Society of the Learning Sciences.

Zook, K. B. (2006). Competency-based frameworks in military human performance (DTIC No. ADA451636). Defense Technical Information Center.