Squad Leader Mastery: A Model Underlying Cognitive Readiness Interventions

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ABSTRACT

In support of the Marine Corps Vision and Strategy 2025 task to "improve small unit leader intuitive ability to assess, decide, and act in a more decentralized manner," the Training and Education Command (TECOM) initiated a Small Unit Decision Making (SUDM) program to improve the cognitive agility and readiness of the force. The SUDM initiative seeks to harness the vast amounts of expertise resulting from the past decade of combat to instantiate training and assessment strategies that accelerate the development of small unit leader decision expertise, especially in light of demands for individuals who can adapt across the range of current and future missions and environments. A fundamental requirement of the SUDM objective is a description of the gold standard for the small unit leader and the progression to mastery of that standard. This paper reports on the construction and application of a squad leader mastery model that has become the foundation for Marine Corps efforts to reduce the variation in infantry forces and purposefully design instructional interventions across the training and education continuum that target higher order cognitive competencies. The mastery model has its theoretical underpinnings in a five-stage model of cognitive skill acquisition. Researchers applied three knowledge elicitation techniques with 58 Marine subject-matter experts. Data analysis resulted in nine key performance areas, and profiles and behavioral indicators of each of five stages of cognitive skill development within each performance area. Incidents from the data supported operational definitions of 15 cognitive constructs hypothesized to enable decision making. The mastery model is informing development of cognitive readiness training by other researchers supporting Marine initiatives, and was applied to create a behaviorally anchored rating scale for assessing domain mastery as part of the development of a larger SUDM assessment battery.

ABOUT THE AUTHORS

Jennifer K. Phillips is the Chief Operations Officer and a Senior Scientist at the Cognitive Performance Group. Her research interests include skill acquisition, cognitive performance improvement, and the nature of expertise. Ms. Phillips applies cognitive task analysis and related techniques to model performance across the levels of proficiency, designs learning solutions including decision-centered training scenarios and facilitation techniques, and develops metrics for cognition and decision making. She is currently supporting the USMC Small Unit Decision Making and instructor development programs, and most recently served as program leader for an effort to develop a Decision Training Toolkit for Marines and Soldiers.

Karol G. Ross is the Chief Scientist for the Cognitive Performance Group. She previously held positions at the University of Central Florida Institute for Simulation and Training, Klein Associates, the Army Research Lab, and the Army Research Institute. She has conducted research and development for the US Army, the US Marine Corps, the US Air Force, and the Office of Naval Research. She conducts applied qualitative and blended design research in the areas of performance model development, assessment of expertise, and the development of training interventions for military environments. Currently, Dr. Ross is supporting the USMC Small Unit Decision Making initiative as the Principal Investigator for the development of a Maneuver Squad Leader Mastery Model and a decision making assessment battery. She is also leading efforts to develop a mastery model for USMC instructors as a foundation for assessment. Recently, Dr. Ross has also conducted work in cross-cultural competence modeling and assessment, as well as developing a model of civil-military teaming performance. She has conducted research to develop assessment tools for cognitive skills related to counter-IED performance and developed a high-level model of and supported training development for performance in Joint, Interagency, Intergovernmental, and Multinational operating environments. Dr. Ross earned a Ph.D. in Experimental Psychology from the University of Tennessee.

Iris D. Rivera is an Industrial Organizational Psychologist for the Cognitive Performance Group. Her research practice focuses on the application of cognitive competency modeling to support cognitive skills training and assessment. She conducts qualitative and quantitative analysis of simulation-based and cognitive task analysis interviews to produce models of expertise, development, and performance. She uses cognitive competency and other analyses to create situational judgment tests and other cognitive metrics. Dr. Rivera is currently supporting the USMC Small Unit Decision Making initiative by developing a SUDM Assessment Battery. Other recent efforts include construction of a Joint Decision Training Toolkit and modeling of military planner expertise for purposes of personnel selection and training. Dr. Rivera previously held positions at the U.S. Army Research Institute for the Behavioral and Social Sciences, The Center for Organizational Effectiveness at Florida Tech, and Adecco Spain.

Kenneth A. Knarr is a Senior Program Manager and Training Analyst at II Corps Consultants, Incorporated. His research interests include teaching, learning, naturalistic decision making, accelerated development of expertise, complex adaptive systems, and ill-defined problem solving. For the past four years, Mr. Knarr has led the Small Unit Decision Making and instructor development initiatives for the Marine Corps' Training and Education Command (TECOM). Currently, Mr. Knarr is drafting a new Marine Corps Order that establishes a service-level Squad Leader Development Program. He was a High School teacher for several years before serving as an infantryman, surface to air weapons officer, aviation command and control officer, and an information management officer during his more than 20 years of service in the Marine Corps. Mr. Knarr earned a Bachelor's degree in History and Education from Wabash College and has completed graduate work at Chicago State University (history), Marine Corps University (military studies/global insurgency), and George Mason University (instructional design).

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BACKGROUND AND PURPOSE

Operations in Iraq and Afghanistan have enhanced the understanding of irregular threats and the complexities of modern day mission environments for our ground fighting forces. The U.S. Marine Corps (USMC) continues to leverage this experience by gathering knowledge and best practices from past operations and applying insights proactively to future requirements. Indeed, the stated vision for the Marine Corps of 2025 is to be the nation's expeditionary force of choice, demonstrating the ability to rapidly deploy to a wide range of complex and irregular operating environments as lean, agile, and adaptable individuals and units (United States Marine Corps, n.d.). One crucial element of the strategy to achieve this vision lies with ground force small unit leaders who form the tip of the spear by carrying out missions against evolving asymmetric threats within the bounds of the commander's overarching intent. Small unit leaders represent one of the most critical positions on the battlefield with regard to their impact on mission success, prompting the Marine Corps Vision and Strategy task directive to "improve small unit leader intuitive ability to assess, decide, and act in a more decentralized manner." Similarly, the Commandant's Planning Guidance (CPG) specifies a task to improve training and experience levels for maneuver unit squad leaders in support of decentralized operations in the 21st century hybrid threat environment (CPG Task 3-7; United States Marine Corps, 2010). In response to these demands, the USMC Training and Education Command (TECOM) is institutionalizing the Small Unit Decision Making, or SUDM, initiative.

The SUDM initiative seeks to improve small unit decision making through enhancements to the training and education continuum for noncommissioned officers (NCOs), development of decision making assessment capabilities at the organizational level, and in a related TECOM program, modifications to the career tracks available to NCOs. The SUDM initiative recognizes that NCOs are making battlefield decisions previously intended for platoon commanders and above. Taken together, these measures are intended to accelerate the development of mental agility and expertise for NCOs in maneuver squad leader billets.

Mental agility and expertise are required to successfully operate in the wide variety of situations Marine squad leaders encounter. Trainers and educators are responsible for ensuring Marines are taught and conditioned to accept thinking that is outside of normal paradigms. When Marines are faced with complex, novel, and ill-defined problems on the battlefield, their mental conditioning should enable them to apply their knowledge and experience flexibly to detect changes and anomalies, rapidly update their situational assessment, and adapt appropriately in the dynamic environment. These abilities are not acquired behind a desk or through classroom lectures. The mind must be conditioned over a long period of time to function in this agile and adaptable manner.

A broad range of squad leader tasks demand cognitive agility, and often they are performed simultaneously. When receiving a mission or fragmentary order, the master squad leader critically analyzes the mission requirements and anticipates possible contingencies to develop a plan and coordinate for support that may be needed. He includes his team leaders in the planning process within the bounds of his assessment of their capabilities, and ensures that all his Marines are clear on the purpose of the mission and how it will be executed. Within mission execution, he rapidly and continuously makes sense of the situation as it evolves around him, interpreting a mix of perceptual cues and communications from several sources including his Marines, higher headquarters, adjacent units, and even the local inhabitants. As the mission progresses, he actively anticipates what might happen next and where the adversary is likely to be positioned. He uses these predictions to stay a step ahead and adjust his unit's movement to be poised for action should a threat be detected. If contact is made with the adversary, he maintains his control and leadership posture despite the chaos of even the most emotionally charged situations. At all times he leads his squad and makes adjustments when needed to achieve mission success, but also to develop his subordinates' skills. After the mission concludes, he identifies key lessons learned, communicates them effectively with his Marines, and ensures every individual receives performance feedback when it is necessary.

The cognitive complexities and decision responsibilities of the squad leader are indisputable. Yet the preeminent source of training directives – the USMC Training and Readiness (T&R) manuals – do not yet capture the cognitive tasks of the position, which traditionally fell to platoon commanders. In both objective and content, the SUDM initiative ascribes formal recognition to the squad leader requirement of mental agility and cognitive readiness.

Cognitive readiness is defined as "the mental preparation an individual needs to establish and sustain competent performance in the complex and unpredictable environment of modern military operations" (Morrison & Fletcher, 2002). Specific skills or elements comprising cognitive readiness have been identified to include situation awareness, memory, metacognition, automaticity, problem-solving, decision making, flexibility and creativity, leadership, and emotion (Morrison & Fletcher, 2002). Based on input from the research community and experienced Marine leaders and instructors, the SUDM initiative hypothesized a set of 15 cognitive competencies and cognitive and relational skills (CARS) that support squad leader decision making and enable cognitive readiness for that role (see Table 1). While identification of these enablers contributes to our understanding of what must be achieved in order to "improve small unit leader intuitive ability to assess, decide, and act in a more decentralized manner," the results are limited in that they merely provide the target. *The missing component is a roadmap detailing the integrated performance of the master squad leader and defining the developmental path to reach that standard.*

Now is the optimal time to leverage the expertise and insights of the force to define a roadmap to squad leader decision-making expertise. Maneuver forces have struggled with and learned from the need to quickly prepare NCOs for leadership roles in deployments. Individual NCOs have experienced diverse operating environments, producing in them an ability to apply tactical knowledge and leadership skills in a flexible and adaptable way. Simultaneously, the USMC and the other Services are under pressure to do more with fewer resources. Increasingly, the focus is on achieving efficiencies in training and operations, as opportunities to gain operational experience and develop expertise are diminishing.

Table 1. Hypothesized Squad Leader Cognitive Competencies and CARS

Cognitive Competencies	Cognitive and Relational Skills	
Sensemaking	Cognitive Flexibility	Analytical Reasoning
Adaptability	Resilience	Perspective Taking
Problem Solving	Anomaly Detection	Ambiguity Tolerance
Metacognition	Change Detection	Self-Awareness
Attentional Control	Situational Assessment	Self-Regulation

The purpose of this paper is to describe the development of a maneuver squad leader mastery model that defines the developmental progression to expertise and provides a learning roadmap for squad leader cognitive readiness. "Maneuver squad leader" refers to individuals representing one of the five infantry Military Occupational Specialties (MOSs; i.e., rifleman, machinegunner, mortarman, assaultman, or antitank missileman) and serving as a squad or section leader. The maneuver squad leader mastery model is currently being applied to the assessment of cognitive readiness interventions and the definition of SUDM learning goals.

In the next section, we describe the foundational research underlying the mastery model and the scientific rationale for using mastery models to guide assessment and learning. We then provide the methodology employed to produce the mastery model. Finally, we discuss how the USMC is applying the squad leader mastery model as part of the SUDM initiative to achieve the Commandant's stated objectives, and address broader application of mastery models as roadmaps for achieving cognitive readiness in other domains. In documenting this effort, our hope is to engage the training and education community in a dialogue about the value of applying a deep understanding of the stages of cognitive development to improve the efficiency and effectiveness of training and assessment for higher-order cognitive skills. Without an appreciation of the developmental stages of learning cognitive tasks, interventions cannot serve to effectively and efficiently accelerate or measure learning outcomes.

DEVELOPMENTAL PROGRESSION TO EXPERTISE

A five-stage model of skill acquisition was originally posited by Dreyfus and Dreyfus (1980) to describe how individuals progressively attain knowledge and improve their performance in cognitively complex domains. They contended that in ill-structured domains requiring higher-order cognition, learners experience little benefit from abstract principles as they become more skilled, and instead require more concrete experiences to continue to advance their performance. Furthermore, they asserted that training interventions for higher-order skills (i.e., cognitive skills) will be most effective when they take into account the learner's current stage of development and apply techniques and strategies that will facilitate advancement past that particular stage (Dreyfus & Dreyfus, 1980).

Since its introduction, the five-stage model has been applied to training and instruction in a number of cognitively complex domains, including combat aviation, tactical thinking, nursing, industrial accounting, psychotherapy, and chess (Benner, 1984, 2004; Houldsworth, O'Brien, Butler, & Edwards, 1997; McElroy, Greiner, & de Chesnay, 1991; Phillips, Ross, & Shadrick, 2006). In each and every domain, the generalized stage-specific characteristics set forth by Dreyfus and Dreyfus (1980) have been confirmed.

Most recently, and to further study the implications of the five-stage model for training interventions, the Office of Naval Research (ONR) and the USMC Program Manager for Training Systems (PM TRASYS) sponsored a comprehensive review of the research literature. Findings were extracted from every domain-specific study of the five-stage model, the expert-novice differences literature, and relevant constructivism, cognitive development, and adult learning sources, to produce an enhanced and extended stage model of cognitive skill acquisition (Ross, Phillips, & Cohn, 2009). A general, domain-agnostic stage model was produced, consisting of thorough descriptions of the elements of knowledge and characteristics of performance at each developmental stage. Then, the general stage model was applied to the domain of tactical thinking to produce a tailored, domain-specific stage model applicable to the design and implementation of simulation-based training for tactical decision making.

The expanded model of cognitive skill acquisition describes the nature of performance at five stages identified as novice, advanced beginner, competent, proficient, and expert (Dreyfus & Dreyfus, 1986). Novices have limited to no experience in situations characteristic of their domain. They may have a substantial textbook or classroom knowledge, but in those cases their lack of lived experience places them at this stage. A novice's understanding of the job and the domain is largely based on rules or procedures learned absent of context (Benner, 1984; Dreyfus & Dreyfus, 1986; Glaser, 1996; McElroy, et al., 1991). Therefore, performance is limited to the application of those rules, and more often than not, application is unsuccessful under the situational circumstances.

Once individuals move to the advanced beginner stage, they have enough experience to demonstrate marginally acceptable performance (Benner, 1984). They can recognize recurring elements of situations because they have experiences to use as comparison cases (Benner, 1984). Further, their experience base provides a set of guidelines for operating in the domain depending on whether recognizable attributes of situations occur (Dreyfus & Dreyfus, 1986). However, advanced beginners are limited by their inability to perceive patterns in the environment and their tendency to prematurely jump to action. They also become easily overwhelmed because they cannot prioritize; they see every task to be just as critical as the rest (Benner, 1984; Dreyfus & Dreyfus, 1986; Shanteau, 1992).

Competent performers are characterized by their deliberate, analytic, and planful performance. They have acquired enough experience to understand how goals dictate appropriate actions, and as a result of that experience they are skilled at formulating plans and prioritizing tasks (Benner, 1984; Dreyfus & Dreyfus, 1986). They are also able to manage large sets of incoming information due in part to their understanding of priorities. However, because they are so reliant on structured and formulaic analysis, they tend to wed themselves to plans and fail to adjust when the situation changes (Dreyfus & Dreyfus, 1986). Their highly analytical problem solving approach is in stark contrast to the agile and flexible approach seen by more advanced performers and required of squad leaders.

Once individuals reach the proficient stage of development, they become less formulaic and analytical in their approach. They perceive patterns in situations and assess them holistically and intuitively, in contrast to Stage 3 performers who tend to see the situation as a set of independent attributes (Benner, 1984). They are able to recognize when the situation has changed and the plan no longer holds up. Proficient performance is characterized by this automatic and dynamic situational assessment ability enabled by an extensive base of experience from which to draw comparisons. However, when it comes to making decisions based on recognition of situational changes, proficient performers still require detached analysis and deliberation to reach an acceptable course of action (Dreyfus & Dreyfus, 1986; McElroy, et al., 1991).

The final stage of development – expert – is characterized by fluid, adaptable, intuitive performance in both situational assessment and decision making. The expert focuses attention on only the critical elements of the situation, recognizes changes with immediacy, flexibly applies knowledge and experience even to novel problems, and implicitly knows what course of action will remedy the situation and how to implement it successfully.

Given the Marine Corps' goal to specify the developmental progression of the master squad leader and generate a roadmap for accelerating the development of future squad leaders' expertise, the five-stage model of cognitive skill acquisition represents a strong candidate as the scientific foundation. In contrast to other three-stage developmental models, the five-stage model distinguishes among the intermediate stages of learning, which are typically the most poorly understood yet account for the performance of the vast majority of individuals in a given domain. Similarly, individuals tend to spend the most time in intermediate phases of development. It follows that a five-stage model providing meaningful differentiation of intermediate levels of performance offers more value to the USMC than three-stage models, especially considering the Marine Corps' organizational culture of reassignment to a new position on two- and three-year cycles. Competency modeling techniques are common for identifying key competencies and the associated knowledge, skills, and abilities required for job performance, and in some cases address the question of skill development over time. However, these approaches are limited in their applicability to training and assessment interventions by their overgeneralization of competencies, lack of detail in performance descriptors, and underrepresentation of the cognitive dimension of performance (e.g., Shippmann et al., 2000). Small unit decision making squarely fits the description of an ill-structured and cognitively complex domain as offered by Dreyfus and Dreyfus (1980, 1986) and others, where higher-order cognitive demands and mental agility characterize the job responsibilities. Finally, the validation of the five-stage model of cognitive skill acquisition across a number of domains lends credence to its employment as a foundational description of the natural progression of skill development, and forecasts its utility for Marine small unit leaders. For these reasons, our efforts to develop a mastery model of the developmental progression specific to maneuver squad leaders were grounded in the expanded five-stage model of cognitive skill acquisition.

MASTERY MODEL DEVELOPMENT PROCESS

We use the term "mastery model" to refer to a description of the developmental progression to mastery and cognitive readiness, customized for a particular domain. In developing the squad leader mastery model, the goal was to tailor the expanded five-stage model to the squad leader domain by describing (1) the **key performance areas** required of squad leaders; (2) **stage profiles** within each performance area specifying the hallmarks of performance and characterizing the progression of skill over time; and (3) **performance indicators** at each stage and within each performance area defining what NCOs *know* and what they can *do* in relation to the complex cognitive tasks.

The purpose of defining key performance areas is twofold. First, identification and description of the performance areas enable a comparison of the research findings to doctrine, thereby lending face validity to performance areas that accurately reflect doctrine, and revealing important discrepancies between doctrine and practice if it is the case that the model presents an alternate portrait of squad leader performance. Second, assuming that each of these core job responsibilities is represented in NCO training and/or coaching activities, organization of the model by performance area facilitates its application to the training and assessment of the pertinent learning objectives.

The stage profiles present a high-level depiction of performance characteristics associated with individuals operating at each of the five stages of learning. They support a high-level view of how squad leader performance improves over time, without requiring a detailed reading of the behavioral indicators in each performance area.

The performance indicators are bulleted lists of actions, attitudes, or other behaviors an individual is likely to exhibit at each stage. They connect the cognitive development characteristic of the developmental stage with the observable behaviors reflective of that level of cognition and degree of experiential knowledge. As such, they are the essence of the mastery model and the concrete, descriptive elements that inform learning goals and the measurement of cognitive readiness. They represent the stepping stones to mastery, mental agility, and cognitive readiness.

Participants

The mastery model was developed by eliciting the knowledge, experience, and insight of highly proficient Marines familiar with the requirements and challenges of the squad leader billet, and involved in preparing subordinate Marines to assume those duties and responsibilities. Semi-structured interviews were conducted with 58 officers and NCOs representing a range of perspectives on squad leader performance. Twenty instructors from the Schools of Infantry were interviewed, each of whom had served both as a squad or section leader and had trained and coached Marines for the squad leader position. In addition, 28 officers and NCOs from the operating forces with experience working closely with squad leaders in combat environments were interviewed. To round out the sample, ten Marine reservists with varying degrees of operational and instructional experience were interviewed. Table 2 depicts the ranks and sources of the interviewees.

Table 2. Study Participants

Rank	Instructors	Reservists	Operating Forces	Total
LtCol		1		**1**
Maj		2		**2**
Capt			1	**1**
1stLt		1	10	**11**
CWO2		1	3	**4**
CWO	1			**1**
MSgt	3			**3**
GySgt	8	3	2	**13**
SSgt	8	1	12	**21**
Sgt		1		**1**
Total	**20**	**10**	**28**	**58**

Interview Procedure

Interviews were conducted individually and lasted between 90 and 120 minutes. The interview protocol consisted of three major knowledge elicitation techniques. Informed consent and demographic information were also obtained. Knowledge elicitation commenced with the Task Diagram technique (Militello & Hutton, 1998). The Task Diagram requires respondents to describe, in their own words, the four to six main tasks or roles required of a squad leader. Participants often chose to report attributes, such as maturity or command presence, as opposed to tasks, and were permitted to do so because of the level of importance they ascribed to these characteristics. Initiating the interview with the Task Diagram method provided a structure and shared framework for the remainder of the interview.

Next, a new method, the Developmental Progression Interview Technique (DPIT), was conducted. The interviewer began by drawing a five-column table and describing the five columns as representative of five stages of learning, from novice at Stage 1 to expert at Stage 5. Care was taken to ensure that the early stages were affiliated with lower levels of performance due to a lack of time and experience in the position vice a lack of aptitude or motivation to excel. Once the interviewee understood the meanings of the five columns, the interviewer asked the respondent to think of an individual he believes to be a level five performer and describe what it is about his performance that categorizes him as an expert. Additional prompts included questions about the types of decisions that individual could reliably perform, his knowledge of the domain, and his skills. As needed, the interviewer referenced the Task Diagram categories as a basis for ensuring that all elements of the squad leader role were addressed by the descriptions provided during the DPIT portion of the interview. Once the interviewee indicated that he had exhausted the description of a Stage 5 performer the process was repeated for each of the other stages.

A small number of interviewees found it challenging to delineate squad leader performance across five levels, preferring instead three or four levels of performance. In general, these interviewees tended to lack formal instructor experience or have fewer years of USMC experience. When the interviewee was only able to provide three levels of performance, the middle level was affiliated with Stage 3. If four levels were provided, interviewees directed the researchers as to how the two intermediate levels should be regarded (i.e., as Stage 2, 3, or 4).

Finally, the interviewer entered the Critical Decision Method (CDM) portion of the interview (Hoffman, Crandall, & Shadbolt, 1998). The purpose of the CDM for this study was to understand the decisions required of squad leaders and the decision making context. This data would be used not only as an additional means to characterize performance at each stage of development, but also as a means to operationalize the definitions of the SUDM competencies and CARS and provide examples of how the constructs are employed in real world operations. In this interview segment, the participant was asked to identify situations in which he as a squad leader, or another squad leader he observed, made a key decision in a critical situation. In some interviews, participants were asked specifically to provide examples of decisions related to Task Diagram tasks or to the SUDM competencies or

CARS. Interviewers asked the participants to describe how the individual from the incident handled the decision, the stage of performance he believed the associated actions or behaviors to reflect, and opinions about how individuals across the other stages of development would have handled the situation. Responses were included in the DPIT proficiency table as appropriate.

Data Analysis

Two types of analyses were conducted to identify (1) what a squad leader does – i.e., the key performance areas – and (2) how he performs at each of the stages of proficiency – i.e., the stage profiles and performance indicators.

Defining Key Performance Areas

The analysis of key performance areas was conducted in two rounds consistent with the subsets of interview data collected across two separate periods of data collection. In the first round, the first 30 interview transcripts were analyzed. Researchers identified and extracted areas of performance, defined as "a theme, task, or characteristic of the individual that the interviewee states is important for the maneuver squad leader to be able to do or exhibit," and decisions, defined as "a judgment or decision that the maneuver squad leader has to make, either in a combat situation or in garrison." Participant code numbers and transcript page numbers were documented to maintain data traceability. All performance areas were then combined into a master list consisting of 436 performance areas across the first data set. Five individual analysts conducted a card sort of the items into categories of similarity. Then, the research team met to condense, identify, and label the key performance areas resulting from the sorting of the 436 items. Eleven key performance areas resulted. Definitions were generated based on the information contained in the items comprising each key performance area. Finally, each of the five analysts independently regrouped the 436 items into the 11 performance areas, guided by the definitions, to increase the accuracy of the sort.

Upon collection of the second set of 28 interviews, a similar analysis process was repeated. The second set of transcripts was combed, and performance areas and decisions extracted with full traceability back to the transcripts. A total of 438 performance areas resulted from this round of transcript analysis. The 438 items were then sorted by four researchers into the 11 key performance areas. Interrater reliability was examined for the sorting task of the combination of the two data sets using Fleiss' Kappa, and found to be acceptable ($K = .782$).

The final step in the analysis of the performance areas consisted of calculating frequencies of items per performance area, as a means of identifying the relative importance of each performance area. Frequencies were counted for each individual researcher's item sort and then averaged across the four researchers. The average frequencies were examined for the population of interviewees as a whole, and also for the instructor interviewees separately from the operating force and reservist participants to determine whether instructors and operators differ in their views of performance area importance.

Five Stages of Proficiency

The second analysis procedure served to identify the indicators of performance at each of the five stages of proficiency, and then generate profiles of each stage for each performance area. Following the interviews, DPIT field notes were typed into data tables as bulleted lists of behavioral indicators and performance descriptors across the five levels of performance. These field notes were reviewed, confirmed, and augmented as needed through transcript review. Individual proficiency tables were then merged into a single master table. Using the definitions generated in the first analysis, every indicator or descriptor from the master table was categorized into the performance area it best represented. The resulting data table was then reviewed by performance area for consistency of data items within and across developmental stages. Outliers were removed, duplicates were discarded, and the remaining items were modified as needed to improve the clarity of the concepts. When data items were questionable as to their correct placement in a developmental stage, researchers applied the foundational model (Ross, et al., 2009) as a guide to resolve the issue.

Upon finalizing the performance indicators and descriptors across the five levels of proficiency by performance area, additional steps were taken to facilitate the use and readability of the proficiency tables. While the content of each table was rich and robust, the volume of information remained unwieldy and called for another layer of organization. Within each performance area, two researchers independently identified subcategories of performance indicators within the tables and sorted the items accordingly. The researchers then met to resolve differences and decide upon a final sub-structure and sub-categorization of bullets. Bullets were re-sequenced for consistency of flow across the table. Finally, profiles were generated for each stage by performance area to extract the hallmarks of performance for each stage and describe a holistic view of development across the performance area.

THE SQUAD LEADER MASTERY MODEL

The maneuver squad leader mastery model resulting from the analysis portrays the progression of an NCO's cognitive development from a novice squad leader with procedural knowledge but little real-world decision-making experience, to an agile, adaptable, and confident squad leader who has mastered the complex tasks associated with assessing, deciding, and acting in modern day mission environments.

Nine key performance areas describe *what* master maneuver squad leaders do and by extension, the key areas to be trained and assessed for squad leader cognitive readiness. Note that two of the original 11 areas (Initiative and Motivation, and Self-Awareness) were judged to lack sufficient data to support the stages of proficiency analysis, and thus were merged into two other performance areas (Character and Command Presence, and Self-Development, respectively). Table 3 presents the final performance areas and their definitions. Figure 1 depicts the percentage of data items categorized under each performance area across all interview data (i.e., instructors and operators combined), as an indicator of the relative importance of each performance area to the squad leader role.

Table 3. Key Performance Area Definitions

PERFORMANCE AREA	DEFINITION
1 ADAPTABILITY/ FLEXIBILITY	The ability to fluidly apply knowledge and tactical principles across situations, or alter one's plans, actions, or decisions when the situation, environment, or circumstance has changed, while still accomplishing the mission or intent
2 ADMINISTRATION	The coordination and supervision of people, processes, and equipment in conjunction with the abilities to multitask and delegate assignments
3 CHARACTER, INITIATIVE, AND COMMAND PRESENCE	The mental, physical, and character traits of an effective leader who demonstrates confidence, sets a positive example, garners respect and trust from his subordinates, takes full responsibility for his own actions, and accomplishes tasks and goals autonomously within intent
4 COMMUNICATION	Effectively obtaining, relaying, and explaining information to subordinates, superiors, and adjacent squad or section leaders in order to direct actions or maintain shared understanding
5 JOB KNOWLEDGE	The comprehension of procedures, processes, and asset capabilities required to effectively perform the maneuver squad leader role
6 SELF-CONTROL AND STRESS MANAGEMENT	Managing and regulating one's emotional responses, control, and stability in order to prioritize and perform effectively within high stress contexts
7 SELF-DEVELOPMENT	The motivation to continuously acquire and apply new knowledge, skills, and lessons learned to current role requirements and future professional development goals, as a result of an attentiveness to the nature of one's self, personal strengths, limitations, and work styles
8 TACTICAL SKILLS/ TACTICAL THINKING	The cognition required to apply tactical, technical, and team knowledge to analyze mission requirements, plan, solve tactical problems, and execute the mission decisively, within the big picture and Commander's intent
9 TRAIN, MENTOR, AND DEVELOP MARINES	Continuously caring about and fostering the professional and personal development of subordinates, by teaching, training, coaching, building trust, assessing skills and personalities, and providing guidance

The progression of development to squad leader mastery and descriptions of *how* individuals perform at each stage are captured in a series of proficiency tables and developmental profiles. Table 4 provides an excerpt from the Tactical Skills/Tactical Thinking portion of the mastery model as an example of the performance descriptors comprising the model. The full mastery model can be found in Ross, Phillips, & Rivera (2013).

Application to Assessment

Efforts are underway to apply the mastery model to the development of a SUDM Assessment Battery. The purpose of the Battery is to enable an objective measurement capability of NCO, and specifically small unit leader, cognitive readiness. Applied to a large number of NCOs at two- to three-year time intervals, the Battery will allow the USMC to critically assess the impact of new policies or instructional interventions on the collective cognitive readiness of the force. The mastery model supports the Assessment Battery development in that it specifies the key aspects of performance and cognitive constructs to be measured, and it directly informs the production of assessment instruments that measure an individual's level of domain mastery.

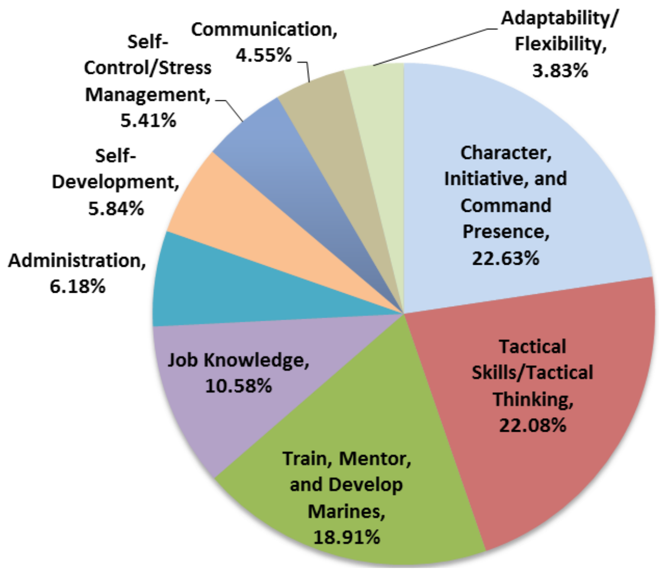

Figure 1. Nine key performance areas and their percentage of representation across all data.

Cognitive Readiness Constructs

The SUDM initiative originally set out to focus training interventions and assessment approaches on the 15 cognitive competencies and CARS hypothesized to support and enable small unit leader decision making (see Table 1). Data collected in support of the mastery model development enabled the generation of operational definitions for each of the 15 constructs, describing how the competencies and CARS are actually applied by squad leaders in combat and garrison settings. Operational definitions are a critical precursor to assessment efforts, and in this case, they support the SUDM Assessment Battery by ensuring battery instruments are selected on the basis of their relevance to the squad leader job, or generated to meet gaps in current assessment instrument capabilities.

Behaviorally Anchored Rating Scale

The mastery model provides a more robust and detailed understanding of the gold standard squad leader and the stages of his cognitive development. Using the succinctly defined descriptors of the knowledge, behavior, and performance affiliated with each stage of the development, a behaviorally anchored rating scale (BARS) instrument is being generated to assess squad leader proficiency. A BARS tool supports measurement of cognitive performance by associating observable behaviors with levels of cognitive task proficiency (Muchinsky, 2008). Numerical scores, such as on a scale from one to five representative of the five stages of cognitive skill acquisition, are awarded for behaviors reflective of a particular level of performance. BARSs have traditionally been used in organizational settings to assess performance on a broad range of job tasks. They are viewed as a favored measurement technique in military domains because they do not rely on subject-matter expert ratings (Alberts & Hayes, 2002) and they are less prone to halo effects or positive leniency biases (Muchinsky, 2008; Riggio & Porter, 2000). These instruments can be applied across a broad range of observational situations including on-the-job performance, field or classroom training scenarios, and even low-fidelity simulation interviews, making them especially desirable for their flexibility and return on investment. The BARS derived from the mastery model will be one of several instruments in the SUDM Assessment Battery, and it will be employed to measure an additional construct: level of mastery.

CONCLUSIONS AND IMPLICATIONS

The squad leader mastery model codifies the qualities and desired performance of a master squad leader and details the developmental sequence to achieve the agility and cognitive readiness necessary for effective performance of the small unit leader role in modern day operating environments. As the USMC pursues implementation of the SUDM program and related initiatives to accelerate the development of small unit leader expertise, the mastery model can serve as a guide and roadmap in several ways.

The goal of cognitive readiness training should be to move individuals from one stage of development to the next stage in the sequence as quickly as possible. Therefore instructional interventions focused on higher-order cognitive skills should take into account a learner's current state of knowledge and ability to integrate and apply it to domain problem sets. Instruction that simplifies tasks into procedures, steps, or rules is inappropriate for advanced learners and offers little value to their continued growth. Similarly, instruction that poses problem sets requiring the integration of knowledge far beyond the mental models of beginners is, at best, limited in its utility, and at worst, a potential source of negative learning. While military training and education has been shifting toward a greater focus on higher-order cognitive skills such as critical thinking and problem solving, and employing instructional strategies that support the experiential learning and application of knowledge required to develop such skills, the community would benefit from a more explicit delineation of how to conduct training that is tailored to specific developmental stages. This is particularly true for intermediate performers, who can be meaningfully discriminated across the advanced beginner, competent, and proficient stages, yet whose training is not differentiated accordingly. Phillips, Ross, and Cohn (2009) suggest stage-appropriate instructional strategies specifically in the context of simulation-based training. However, specific and validated prescriptions for applying mastery models to the examination and modification of learning interventions have yet to be developed. Additional research is necessary in this area.

Table 4. Squad Leader Mastery Model Excerpt from Tactical Skills/Tactical Thinking Performance Area

NOVICE	ADVANCED BEGINNER	COMPETENT	PROFICIENT	EXPERT
UNDERSTANDING THE SITUATION				TACTICAL SKILLS/TACTICAL THINKING
Does not readily notice changes (i.e., anomalies) in the environment. Unable to interpret the meaning of indicators in the environment; unable to take appropriate action. Difficulty filtering information and determining what is relevant. Requires excessive amount of time and assistance to fully understand the current situation. Does not consider the big picture; fails to think outside his job role. Difficulty figuring out the enemy situation. Difficulty prioritizing problems. Ignores problems that are no longer posing immediate threat (e.g., assumes sniper who is no longer shooting has gone away). Unable to remove himself from the situation and look at battlefield as a whole.	Starts to develop situational awareness skill. Knows what to look for in the environment; can identify anomalies but doesn't know how to respond. Can conduct a basic METT-TC analysis. Understands what his assets are but not how to employ them. Has a better understanding of the capabilities of enemy weapons and assets. Unable to think through what enemy is going to do. Begins to develop awareness and understanding of cultural differences to support planning and execution. Thinks in terms of simple cause and effect.	Understands what the cues and changes in the environment mean. Conducts new mission analysis as a result of anomalies in the environment that catch his attention, but is unable to make a change in time to be useful. Spends a lot of time dissecting the situation to make sure it makes sense to him, but can do it independently and completely. Begins mentally simulating potential situations. Understands mission priorities. Begins to understand the big picture, but may still be missing pieces. Able to read contour and satellite maps to judge terrain features and impact on mission.	Notices anomalies in the environment and can make changes in time to react to their meaning. Maintains awareness of his surroundings even while engaged in a specific task. Conducts in-depth analysis of the enemy even under stress to understand what enemy is doing (e.g., the enemy pattern when the squad is being shot at). Can work effectively with other Squad Leaders and the Platoon Commander to make sense of the big picture during mission analysis. Comfortable reading and using Intelligence reports. Takes time to review relevant information (e.g., maps and Intelligence reports).	Recognizes subtle changes or anomalies in the environment, and knows how to respond. Maintains a constant awareness and assessment of his surroundings and anticipates problems (e.g., vehicles bunched too closely). Quickly develops an estimate of the situation. Understands more about a situation with less information than before. Manages a large amount of information effectively. His ability to use more information results in being given more information by Higher. Identifies areas that the enemy can exploit and considers prior enemy tactics as a part of METT-TC analysis. Identifies friction points using Intelligence. Does not fall for enemy bait and ambush. Understands COIN process; analyzes what will drive the local populace to help Coalition Forces.

The use of mastery models as a training roadmap would have an impact not only on how instructional strategies are employed to maximize the efficiency and effectiveness of the interventions, but also in terms of how instructors understand and interact with students. Anecdotal evidence suggests that the five stages of development, when described to instructors, resonate strongly. Given a small set of performance indicators, they are able to identify which students are likely in which stage of learning. They consider this understanding of a student's current developmental stage to be useful in diagnosing why an individual underperforms on particular lessons, and in providing feedback to facilitate students' awareness of where they are now and where they need to go next.

The employment of mastery models to drive learning interventions and assessment approaches is appropriate for any cognitively complex domain where the goal is to accelerate cognitive readiness and the development of learner expertise. Efforts to develop the squad leader mastery model as part of the Marine Corps' SUDM initiative have produced a sound methodology that can be applied to other domains. In support of USMC instructor development efforts, the methodology will soon be reapplied to generate an instructor mastery model. Furthermore, the application of the squad leader mastery model to assessment tools for cognitive readiness is generating a set of new lessons learned and best practices for measuring cognitive readiness and levels of domain mastery. To round out the utility of mastery models, the next steps will be to examine the stage-specific prescriptions for learning, with the goal of enhancing the training community's ability to build training roadmaps that leverage the most appropriate instructional techniques and align them with learner stages of development for the most efficient and effective training and education interventions.

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