



U.S. Army Research Institute for the Behavioral and Social Sciences (ARI)

Establishing the Psychometric Properties of the Multirater Assessment for Systems Thinking

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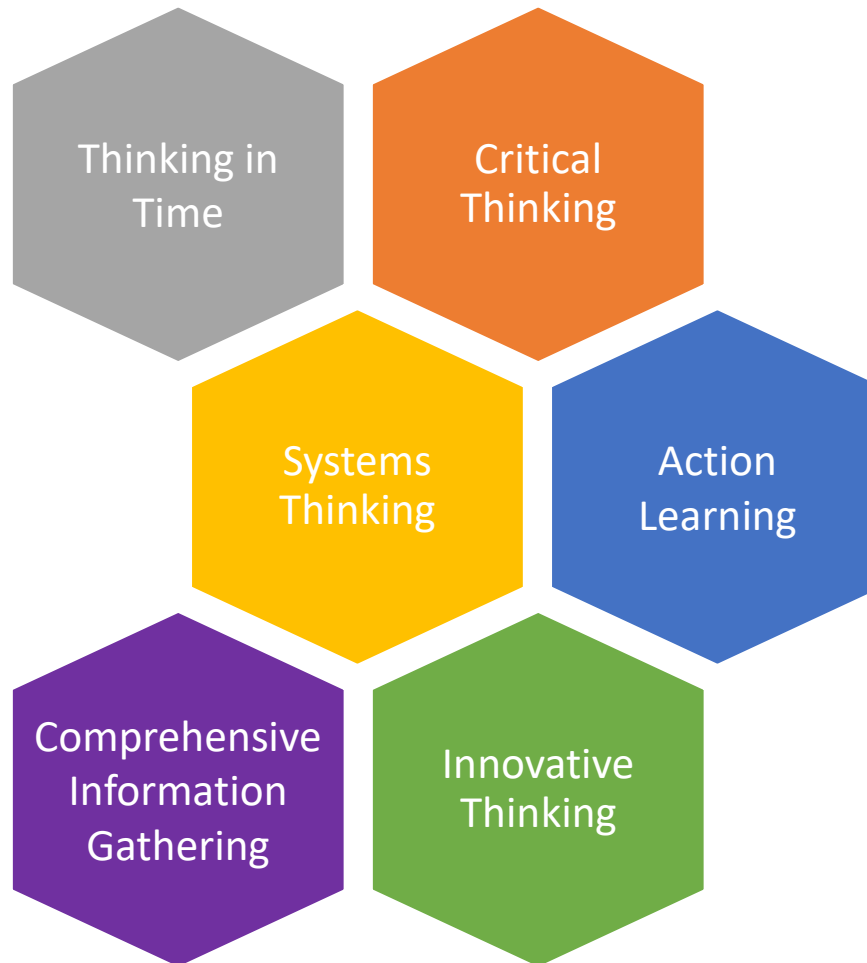


Project Objectives

- To create a valid and reliable systems thinking assessment tool to assess systems thinking across multiple levels and contexts
 - Multirater Assessment for Systems Thinking (MAST)
- Psychometric properties of MAST



Defining Systems Thinking



Sackett, A.L., Karrasch, A.I., Weyhrauch, W.S., & Goldman, E.F. (2016). *Enhancing the strategic capability of the Army: An investigation of strategic thinking tasks, skills, and development* (Research Report 1995). Fort Belvoir, VA: U.S. Army Research Institute for the Behavioral and Social Sciences.



Learning About Systems Thinking



- Ingrained in Captains' Career Courses (CCCs), Command and General Staff College (CGSC), and Army War College (AWC)
- Also in programs such as School for Advanced Military Studies (SAMS) and Red Team
- Importance of feedback
- Assessments that can provide Army leaders with standardized feedback



Foundation for MAST



Constructing the systems thinking competency model

- a. Literature review
- b. Interviews with Professional Military Education (PME) instructors, officers assigned to operational units, and 4 academic systems thinking subject matter experts (SMEs)
- c. Drafted systems thinking competency model
- d. Solicited feedback from PME instructors and operational officers
- e. Revised competency model based on feedback



Systems Thinking Literature Review



- Various definitions of systems thinking
- Key themes
 - Systems thinking has multiple dimensions
 - Importance of systems thinking varies by job



Systems Thinking in the Military



- Open systems
- Necessary in order for the Army to be a learning organization
- Differentiated successful organizational leaders from less successful ones
 - Anticipatory



Systems Thinking at All Levels



- Important at strategic levels of leadership
- Needs to be developed and applied earlier in Soldiers' careers
 - Understand interdependencies within the organization to deal effectively with changing situations
 - Understand own roles and impact in various systems



Interview Findings

- Most participants were familiar with systems thinking and saw it as important at all levels
- Most participants saw systems thinking developing over time and should be developed early
- Differences among novice, intermediate, and expert systems thinkers
- Most institutional participants said a tool to assess systems thinking would be valuable



Systems Thinking Competency Model



Dimension	Definition
Identifying Elements	Identifies people, objects, locations, or concepts in an environment or situation that together serve a purpose as a whole or nested whole
Understanding Dynamic Relationships	Conceptualizes nonlinear, bidirectional, and changing relationships among a set of elements that form a whole or nested whole
Shifting Perspectives	Recognizes how subordinate and superordinate levels relate to one another in a system, switching perspectives from one level to another as needed
Identifying Holistic Patterns	Understands the larger picture of a system and common systemic patterns
Responding to Change	Remains open to new information and takes multiple points of view when examining how a set of elements are related and interdependent; maintains a fluid and flexible concept of the boundaries that link elements



Multirater Assessment for Systems Thinking



- Designed to be appropriate across multiple levels and contexts
- Results and feedback designed to
 - Highlight leader actions that demonstrate systems thinking
 - Promote leader skill development
- Designed to be filled out by multiple raters but can also be completed by just one rater



MAST



4. Systems Thinking: Identifying Elements
How proficient is this leader in identifying people, objects, locations, events, or concepts in an environment or situation that function together as a system? Please check the boxes of any written statements that specifically affected your rating.

Opportunity for Improvement	Standard	Exceptional
<p>1</p> <p>The leader struggles to describe or discuss elements of systems, systems encountered at their activities.</p> <ul style="list-style-type: none"> 1) Omits observations that are relevant when discussing a given situation. 2) Fails to include critical resources when describing what is needed for a mission. 3) Discusses problems or situations without considering key aspects. 4) Omits critical people, objects, locations, events, or concepts when describing the operational environment of the leader's activities. 5) Omits key elements that are critical to the system elements that are discussed when describing or discussing a system. <p>Areas for Improvement:</p>	<p>3</p> <p>The leader is typically able to describe or discuss elements of systems, systems encountered at their activities.</p> <ul style="list-style-type: none"> 1) Describes or discusses all key identifiers relevant to a given situation. 2) Includes all critical resources when describing what is needed for a mission. 3) Discusses all relevant aspects when addressing a problem. 4) Describes critical people, objects, locations, events, or concepts that are important to the operational environment of the leader's activities. 5) Distinguishes elements that are critical from elements that are less critical when discussing a system. <p>Strengths:</p>	<p>5</p> <p>The leader consistently and accurately describes or discusses elements of systems, systems encountered at their activities.</p> <ul style="list-style-type: none"> 1) Accurately identifies relevant identifiers when describing a given or higher situation. 2) Comprehensively discusses all critical resources needed to complete or solve situations and missions. 3) Provides descriptions that show a deep understanding of the key aspects of a given or complex problem. 4) Describes critical people, objects, locations, events, or concepts that are important in particularly complex or non-operational environments. 5) Distinguishes elements that are critical from those that are less critical when discussing novel systems or systems at higher activities.

- MAST uses a behaviorally-anchored rating scale in which observable behaviors are described in relation to specific levels of performance.
- In addition to providing a numeric rating of performance for each dimension, supervisor and peer raters are encouraged to provide written responses in two text boxes. This written feedback is intended to support self-development initiatives of the rated leader by identifying both Strengths and Areas for Improvement.



MAST



Multirater Assessment for Systems Thinking (MAST) Score Sheet

Dimension	S E L F	Supervisor/Instructor (S/I)			Peers								Subordinates						Dimension Average ⁴
		S/I Rater 1	S/I Rater 2	S/I Average ¹	Peer Rater 1	Peer Rater 2	Peer Rater 3	Peer Rater 4	Peer Rater 5	Peer Rater 6	Peer Average ²	Sub Rater 1	Sub Rater 2	Sub Rater 3	Sub Rater 4	Sub Rater 5	Sub Rater 6	Sub Average ³	
Identifying Elements																			
Understanding Dynamic Relationships																			
Shifting Perspectives																			
Identifying Holistic Patterns																			
Responding to Change																			
Self Average ⁵ Across Dimensions>		S/I Average ⁵ Across Dimensions>			Peer Average ⁵ Across Dimensions >>>							Subordinate Average ⁵ Across Dimensions >>>							Overall Dimension Average ⁵
Overall Average ⁸ Across Rater Groups >>>																			

¹Add ratings across supervisor/instructors (if needed) within each dimension and divide by two.

²Add ratings across peers within each dimension and divide by the number of peer ratings.

³Add ratings across subordinates within each dimension and divide by the number of subordinate ratings.

⁴Add average rating from all rater types for a given dimension and divide by the number of rater types.

⁵Add ratings in the column and divide by five.

⁸Add averages from all rater types and divide by the number of rater types.

Areas for Improvement:

Strengths:



MAST Psychometrics



Usability and Utility Study

- Methods
- Measures
 - MAST
 - Usability/utility measure
 - Demographics
 - Personality measure
- Analyses



MAST Psychometrics



MAST Validation Approach

- Interrater reliability
 - Between/within
- Scale reliability
- Confirmatory factor structure
- Construct validity
 - Convergent validity
 - Discriminant validity
- Analyses



Questions?



Identifying Elements



Definition	Identifies people, objects, locations, events, or concepts in an environment or situation that function together as an integrated whole
This dimension involves cognitive activities that are demonstrated by an Army leader describing or discussing:	1. Stakeholders relevant to a situation
	2. Resources needed for a mission
	3. Relevant aspects of a problem
	4. Critical elements (people, objects, location, events, concepts) that are important to the operational environment
	5. Distinguishing critical elements within the system from those that are less critical



Understanding Dynamic Relationships



Definition	Understands complex causal and correlational relationships among a set of elements that form an integrated whole
<p>This dimension involves cognitive activities that are demonstrated by an Army leader describing or discussing:</p>	<ol style="list-style-type: none"> 1. Complex connections among multiple elements in the environment when developing a plan 2. Hidden, unusual, or nonlinear relationships among elements in the environment 3. Second- and third-order effects that may affect the unit or the mission 4. How the introduction of new factors in the environment will change existing relationships in a system 5. How to use feedback loops to determine the impact of decisions and actions



Identifying Holistic Patterns

Definition	Understands the larger picture of a system and common systemic patterns
This dimension involves cognitive activities that are demonstrated by an Army leader describing or discussing:	1. A situation or problem as a whole
	2. A mission plan from a big-picture view, rather than just from the perspective of one element
	3. Patterns that emerge between elements within an operational environment
	4. The development of a graphic or a model to better understand and communicate the problem



Shifting Perspectives



Definition	Takes perspectives from different subsystems or levels of a system and switches perspectives as needed
<p>This dimension involves cognitive activities that are demonstrated by an Army leader describing or discussing:</p>	<ol style="list-style-type: none"> <li data-bbox="662 468 1789 622">1. Both big-picture information and details as necessary when briefing a plan <li data-bbox="662 622 1789 776">2. How decisions at one level or unit affect other levels or units <li data-bbox="662 776 1789 931">3. How actions of a specific group affect the mission of the larger organization <li data-bbox="662 931 1789 1085">4. How to effectively coordinate actions between units and headquarters <li data-bbox="662 1085 1789 1223">5. The roles and impacts of multiple groups working in a system



Responding to Change



Definition	Remains open to emerging information and updates understanding of system as needed; maintains a flexible concept of the system boundaries
<p>This dimension involves cognitive activities that are demonstrated by an Army leader describing or discussing:</p>	<ol style="list-style-type: none"> 1. Emerging information that should be considered in order to understand a situation 2. Taking multiple points of view in order to expand their understanding of a situation 3. Changes to plans or approaches that are needed due to changing circumstances 4. The need to change the stakeholders involved in solving a problem or making a decision when the situation changes 5. Redefining the critical elements in the environment as new information emerges

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