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

Army Selection and Training
Research Interests

Army Science Conference

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Director and Chief Psychologist of the U.S. Army
### Army Selection and Training Research Interests

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<thead>
<tr>
<th>a. REPORT</th>
<th>b. ABSTRACT</th>
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Purpose

Provide an overview of ARI’s research mission

For Soldier selection and training:

• Describe key Army challenges and research interests
• Highlight ARI research efforts
• Outline challenges for neuroscience research
Some Army S&T Labs & Mission Areas

Deputy Chief of Staff, G-1

Army Research Institute (ARI)
- Personnel
- Training
- Leader development

U.S. Army Medical Command
Medical Research and Materiel Command (MRMC)

Walter Reed Army Institute of Research
- Physical and psychological health

Army Materiel Command
Research, Development, and Engineering Cmd (RDECOM)

Human Research Engineering Directorate (HRED), ARL
- Human-systems design

Simulation & Training Technology Center (STTC)
- Simulation technology

NATICK Soldier System Center
- Food, clothing, shelter,…

Communications-Electronics Research Development Center
- Communication/info technologies
ARI Overarching Research Goals

• Develop new measures to meet Army personnel goals without reducing quality.
• Develop effective methods to train Soldiers and units, and grow agile leaders.

Selection and Classification

Training and Leader Development

Outcomes

Performance

Attitudes
## Trainability Continuum for Characteristics Related to Human Performance

<table>
<thead>
<tr>
<th>Stable Attributes (less trainable)</th>
<th>Malleable Attributes (more trainable)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Abilities &amp; Traits</strong></td>
<td><strong>Higher Order Skills &amp; Attributes</strong></td>
</tr>
<tr>
<td>• Cognitive ability</td>
<td>• Problem solving/decision making skills</td>
</tr>
<tr>
<td>• Resiliency</td>
<td>• Metacognitive skills</td>
</tr>
<tr>
<td>• Tolerance for ambiguity</td>
<td>• Interpersonal skills</td>
</tr>
<tr>
<td>• Achievement motivation</td>
<td>• Communication skills (e.g., negotiation, persuasion, collaboration)</td>
</tr>
<tr>
<td>• General self-efficacy</td>
<td>• Awareness (self, others, situation)</td>
</tr>
<tr>
<td>• Other temperament and personality characteristics (e.g., openness, conscientiousness)</td>
<td>• Complex motor and physical skills</td>
</tr>
<tr>
<td></td>
<td>• Moral development/ ethical reasoning</td>
</tr>
<tr>
<td></td>
<td>• Goal orientation (learning, mastery)</td>
</tr>
</tbody>
</table>
**Army Enlisted Selection**

**Knowledge & Skills**
- Ability, Aptitude
- Attitude

**Physical Health and Fitness**
- Person-Environment Fit

**Current Measures**

**Physical Fitness and Medical Exams**

**Credentials and Records**
- High School Diploma
- Alternative (e.g., GED)
- Criminal history

**Knowledge & Analytical Tests**

**Armed Forces Qualification Test**
- Language and math
- Technical (e.g., mechanical)
Army Selection: Research Areas

**Need:** Army must meet accessions goals without reducing quality.

**Challenges:** Decreasing percentage of population meets Army enlistment standards. Declining propensity to enlist. Changing demographics.

**Current measures:** Predict trainability and attainment of knowledge and skill during training, but do not account for all the variance in job performance. Weak predictors of attitudes, attrition, and career intentions.

**Areas of research interest:**
- Assessment of cognitive potential (ability to learn, mental flexibility, …)
- Assessment of temperament (motivation, dependability, …)
- Integrated ‘whole person’ assessment of cognitive and non-cognitive attributes
- Prediction of best match for an Army career/ specific jobs
**Mental Flexibility**
Tests to assess abilities such as:
- Flexible inference
- Flexible mapping of rules

Select the best word to complete the analogy (pretend that the statements are true):

*Toothbrushes are made of ice.*

tool : toolbox :: toothbrush : ?
freezer  garage  tool shed  bathroom

Prelim findings: Adequate reliability and construct validity with college population (Matthew & Stemler, 2007).

**Temperament**
Self-report measures assess constructs such as:
- Dependability
- Leadership
- Excitement seeking

Which of these statements is most like you?
- I like roller coasters.
- I enjoy parties.

Findings: Predicts Soldier attrition.
Prelim findings: Predicts Soldier discipline rates and physical fitness. Contributes to prediction of training exam scores.
Neuroscience Challenge

Can measures based on neuroscience improve the assessment of an individual’s potential and predict behaviors and attitudes?

Valid  Reliable  Feasible (cost, efficiency, practical)
- above and beyond existing measures

Specific metrics for:
- Knowledge & skills
- Ability
- Aptitude
- Attitude

That predict measurable behaviors and attitudes
- Training and performance scores
- Discipline rates
- Career intention/progression
Army Training and Leader Development

Knowledge
Skills
Attitudes

Basic combat skills
Tactical & technical proficiency
Leadership and team skills
Interpersonal skills
Cross-cultural competence

Command & control
Army Values

Current Methods
• Instruction
• Demonstration
• Practice with feedback
• Mentoring
• Self-development

Environments
• Live (Classroom, Field)
• Virtual (simulations, computer-based instruction)

Current Measures
• Objective measures
  - time, accuracy
  - behavioral-anchored rating scales
  - mission accomplishment

• Subjective measures
  - Leader/peer ratings
  - Self-assessment/report
Need: Army must develop effective training methods for individuals and units. Develop agile leaders.

Challenges: Increasing (and continually evolving) training requirements. Decreasing resources and time for training. Increased responsibility and operational challenges at lower levels of command.

Areas of research interest:
- Basic Combat Training (civilians to Soldiers)
- Unit training and collective measurement
- Developing leader skills (influence, team building, complex organizations)
- Developing cross-cultural competence and language skills
- Rapidly turning lessons learned into training
- Determining skill decay and methods to sustain skills
- Tactical employment of new technologies
- Optimal blend of live, live co-located and distributed training
- Effective design of virtual and game-based simulations
Flexible Thinking Skills
Leaders develop flexible thinking skills during operational experience.
Research challenge: Create method to capture tacit knowledge of experts. Develop effective training method to accelerate development of flexible battlefield thinking skills.

Research findings: Training method accelerates development of tactical thinking skills of junior officers.

Tailored Training
Extensive empirical evidence to conclude that tailoring training and feedback to the individual accelerates the rate of learning.

Research challenge: Create intelligent agents that can provide individualized tutoring/coaching in synthetic training environments.

Components
- Model of domain/expert
- Model of instructor/coach
- Model of learner
Neuroscience Challenge

Can neuroscience improve the measures and methods to train Soldiers and develop Leaders?

- Valid
- Reliable
- Feasible (cost, efficiency, practical)
  - above and beyond existing measures and methods

Measures and methods to develop:
- Psychomotor Skills
- Knowledge
- Situation Understanding
- Reasoning
- Leadership

That achieve measurable behaviors and attitudes for differing levels of required proficiency.
- Training and performance scores
- Mission outcomes
Hypothesis: Experts are more cognitively efficient than novices.

**Primary Evidence: Behavioral Science**
- Primary task performance (time, accuracy, quality)
- Secondary and multi-task performance (quantity, quality)

Expertise is determined by observable performance.

**Corroborating evidence: Neuroscience**
Fewer neural resources needed.
# A Learning Taxonomy

<table>
<thead>
<tr>
<th>Competence</th>
<th>Skills Demonstrated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>Observe and recall information, knowledge of dates, events, places, major ideas, mastery of subject matter</td>
</tr>
<tr>
<td>Comprehension</td>
<td>Understand information and meaning, grasp meaning, translate knowledge into new context, interpret facts, compare, contrast, infer causes, predict consequences</td>
</tr>
<tr>
<td>Application</td>
<td>Use information, methods, concepts in new situations, solve problems using required skills or knowledge</td>
</tr>
<tr>
<td>Analysis</td>
<td>See patterns, organization of parts, recognize hidden meanings, identify components</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Use old ideas to create new ones, generalize from given facts, relate knowledge from several areas, predict, draw conclusions</td>
</tr>
<tr>
<td>Evaluation</td>
<td>Compare and discriminate between ideas, assess value of theories, make choices based on reasoned argument, verify value of evidence, recognize subjectivity</td>
</tr>
</tbody>
</table>

Bloom (1956)
Advance scientific theories, models, methods, measures, and technologies relevant to Army needs.

**Selection & Classification**
- Mental flexibility
- Motivation theories
- Language and social dynamics
- Emotional abilities

**Organizational Behavior and Network Science**
- Social networks
- Collaboration and trust at a distance

**Training & Leader Development**
- Implicit and explicit knowledge
- Interpersonal skills
- Adaptive performance
- Leadership in complex environments
- Self-initiated development

**Soldier Leader Unit Organizations**
# Learning Theory and Strategies

<table>
<thead>
<tr>
<th>Year</th>
<th>Behaviorism</th>
<th>Cognitivism</th>
<th>Constructivism</th>
<th>Blend</th>
<th>Biopsychosocial</th>
<th>Cyber-psychology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>Strategies: Discovery learning Collaboration Guided experiences</td>
<td></td>
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<tr>
<td>2000</td>
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<tr>
<td>Emerging</td>
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</tbody>
</table>

**Theories and Strategies**

- **Behaviorism**
  - Theory: Learning occurs through repetition and reinforcement.
  - Strategies: Drill and practice Mastery learning

- **Cognitivism**
  - Theory: Learning is an information management process.
  - Strategies: Cognitive analysis Structured learning

- **Constructivism**
  - Theory: Learning occurs by active construction of knowledge not just receiving it.
  - Strategies: Discovery learning Collaboration Guided experiences

- **Blend**
  - Integrated/modified models - Constructivism - Cognitivism - Behaviorism

- **Biopsychosocial**
  - Holistic theory of - Biology - Psychology - Sociology

- **Cyber-psychology**
  - Models of human and non-human entities and networks

**Warfare History**

- Conventional warfare
- Cold War 'chess moves'
- Guerilla warfare
- Technology superiority
- Network operations
- Counter-insurgency
- Stability operations
- Major combat ops

**Year Range**

- 1950
- 1970
- 1980
- 2000
- Emerging
Enhancing performance of Soldiers and Units and sustaining a quality all-volunteer Army during an era of persistent conflict.