Defence Research and Recherche et développement
Development Canada pour la défense Canada

Towards an evidence base for the effectiveness of Individual Training and Education modernization in the Canadian Armed Forces

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The challenges facing training in the CAF

- Top-down:
    - Instructor attrition/burn-out/resources
    - Pressure to train/learn outside of classroom
    - Efficiency (cost, time)
- Bottom-up:
    - "millennial" culture (wired, collaborative)
    - Consumer technology pull
- Cross-cutting: a changing world
    - Challenge of dealing with "complex" "uncertain" "play well with others" world → metacognition

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Some solutions to these problems

- Top-down
  - Technologies to support instructors (distance/distributed learning, knowledge management tools, decision aids)
    - Mostly proven technologies, but how can they be best adapted to the CAF context?
    - Knowledge management & representation still a field in development
  - Technologies to support learning outside of classroom (intelligent tutoring systems, e-learning, mobile learning, simulation & VR, embedded trainers)
    - Neuro-adaptive systems are still an immature technology
    - Design of embedded training systems is challenging
    - Unclear how well learners can regulate own learning outside of classroom, or how to support them
    - Evidence for effectiveness of these technologies still lacking

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Some solutions (cont'd)

- Bottom-up
  - New teaching models (flipped classroom/collaborative or peer-to-peer learning)
    - Are becoming more widely accepted in civilian world
    - Evidence for effectiveness unclear
    - Unclear how to apply to CAF context
  - Mobile & ubiquitous internet as support to new teaching models & outside-of-classroom delivery (see Top-down challenges)
    - Anecdotal & survey evidence for usefulness of these technologies is positive
    - Experimental evidence for effectiveness still lacking
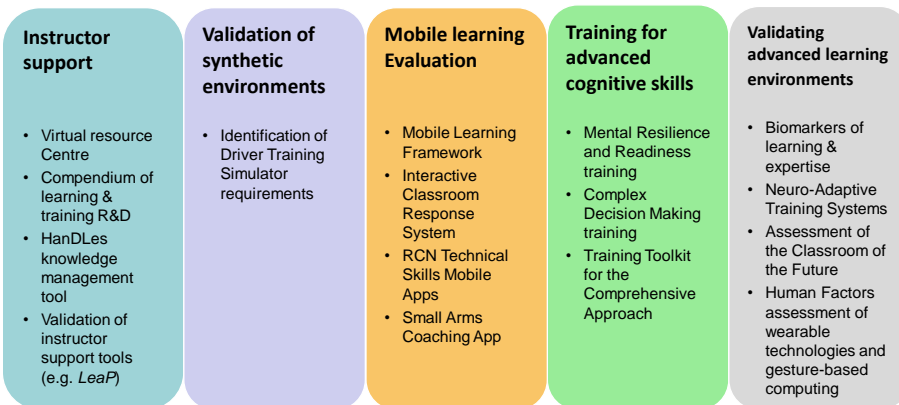   - Application in CAF context unclear

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Some solutions (cont'd)

- Cognitive challenge
  - Variously: strategic uncertainty, complex/ill-formed problem space, mental flexibility, "comprehensive approach"
  - Unifying thread: metacognitive skills
  - Training interventions for metacognition still under-developed, lack evidence
  - Metacognition & other complex cognitive skills still not that well understood
  - The application domains (e.g., strategic decision making) are often themselves "messy," poorly defined & inherently difficult to represent to learners

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DRDC Research on Individual Training & Education (IT&E): Themes

Instructor support	Validation of synthetic environments	Mobile learning Evaluation	Training for advanced cognitive skills	Validating advanced learning environments
• Virtual resource Centre • Compendium of learning & training R&D • HanDLes knowledge management tool • Validation of instructor support tools (e.g. *LeaP*)	• Identification of Driver Training Simulator requirements	• Mobile Learning Framework • Interactive Classroom Response System • RCN Technical Skills Mobile Apps • Small Arms Coaching App	• Mental Resilience and Readiness training • Complex Decision Making training • Training Toolkit for the Comprehensive Approach	• Biomarkers of learning & expertise • Neuro-Adaptive Training Systems • Assessment of the Classroom of the Future • Human Factors assessment of wearable technologies and gesture-based computing

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Research methods

- Reviews of literature & knowledge integration
- SME interviews & work/task analyses
- Conceptual model building
- Human-in-the-loop experimentation
  - Training effectiveness
  - Transfer of training
  - Reverse transfer of training
  - Knowledge & skill retention studies

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Virtual Resource Centre

- Objectives: Support CAF instructor development with user-friendly web-based, searchable/tailorable resources providing a knowledge base of validated learning & training practices and decision support tools.

- One-stop shop for CAF instructors needing resources
- Vehicle for making results of DND research learning & training more accessible to instructors & trainers
- Deliverables:
  - Knowledge management tools for efficient, intuitive search of instructional material repositories, and matching learning objectives to instructional materials.
  - Compendium of individual learning & training (first round of content generation done by Mar 2015, further content generated from findings of rest of IT&E portfolio as projects progress)

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Identification of Driver Training Simulator Requirements

- Objectives: To scientifically study a number of simulator and simulation technologies for suitability to driver training in order to provide evidence for a business case for driver training simulator acquisition.

- Partnership with University of Ontario Institute of Technology (UOIT) Automotive Centre of Excellence (ACE) Lab, via a DND-NSERC collaboration (in progress)
- Human experimentation to determine effects of specific simulator technologies on learning
- Deliverables: Recommendations on visual display requirements for driver training; recommendations on motion base requirements for driver training (reports)

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Training Toolkit for the Comprehensive Approach

- Objectives: Develop & evaluate the effectiveness of a range of training tools, including paper tools &mobile apps, in support of training CAF members for the Comprehensive Approach to Operations (i.e., Whole-of-Government missions).

- Leverages previous multi-year projects on whole-of-government operations & comprehensive approach for the Canadian Army
- Deliverables:
    - Skill development tools (scenario-based)
    - Performance support tools (Acronym App, guides to OGD and Military planning processes)
    - Virtual Resources (example: lessons learned resources, lists of relevant courses)
    - Adaptation of Comprehensive Approach tools developed by he Netherlands.
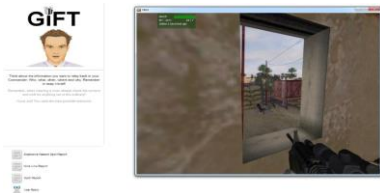   - Evidence for effectiveness or lack thereof and recommendations for employment (report)

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Mental Resilience and Readiness Training Apps

- In support of CAF Surgeon General initiatives
- Partnership with Mental Health Commission of Canada
- Deliverables:
  - Mobile training apps (new or adapted to CAF) for: Goal Setting, Visualization, Self Talk, Attention Control, Memory skills & fluid intelligence.
  - Training effectiveness evidence & recommendations for employment of apps (report)

- Objectives: As a part of the Road to Mental Readiness, mobile applications are being investigated for their potential to providing CAF members with additional training for mental resiliency and self-regulation support.

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Neuro-Adaptive Training Systems Development

- Leveraging open-source framework called Generalized Framework for Intelligent Tutors (GIFT; created for US DoD)
- Deliverables:
  - Analysis of requirements and concept of employment (report).
  - Prototype system (software, some computer & sensor hardware).
  - Recommendations & guidelines for employment in CAF instruction (report).

- Objectives: Enhance the delivery of computer-based training (including distance learning, simulation, intelligent tutoring systems) with system that adapts delivery to learner's progress and skill level based on behavioural measures and biomarkers of learning.

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Assessment of Classroom of the Future (CoF) environment

- Deliverables:
  - CoF proof of concept (hardware and software)
  - Validation and Recommendations on requirements (Technical report)
  - Evaluation of specific instructional interventions suited to the CoF environment (e.g., interactive visual animations of objects or situations that are manipulatable by touch)

- Objectives: validate a collaborative and distributed classroom using multiple interconnected, high-resolution computer displays, mobile devices, alternative input modalities such as touch- and gesture-based input, and high-bandwidth interconnectivity to enhance course delivery in CAF classrooms

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OnliNe Government Advance R&D Environment (ONGARDE)

- **Objectives**
  - To provide a common secure online R&D environment for Federal Security Sector
  - To conduct research, development, and evaluation activities
  - To support of IT&E and CAF Campus Learning Portal
  - To enable information-sharing of projects, lessons learned and best practices
  - To promote collaboration and engagement between S&T/ODG with CAF (doing more with less)

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CAF Mobile App Store (CAFMAS)

- CAFMAS uses mobile devices to address S&T requirements within IT&E CAF Campus Engine
- Secure deployment of mobile apps independent of iTunes and Google Play to iOS and Android devices (the only known platform in GOC/NATO to do this)
- Supports 'Bring Your Own Device' (BYOD) strategy to reduce the cost of Mobile Learning
- CAFMAS is linked to ONGARDE and supports modern learning methodologies and technologies
- IT&E related S&T results will be produced as Apps on CAFMAS

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Some R&D challenges particular to the CAF

- Sensitive nature of some skills, missions, operators
    - Can lead to knowledge gaps in terms of determining competencies, interventions
- Human experimentation requires participants
    - Must often, but not always, be military
    - Who are often busy
    - Even when willing & able, data collection must generally not disrupt ops
- Assessment & measurement always challenging
    - Observations in the target environment often impossible
    - Some competencies are complex & hard to measure (e.g., resilience)
    - Assessing effectiveness of learning & training takes TIME – many people, many courses, much follow-up → rarely possible

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Reaching out

- DRDC can do some of the required research on its own, but we can't do it all
- We need to learn from academics & educators
- We need to understand what organizations with similar mandates or pressures (police, first responders) are doing in this regard
- We can't do it on our own, but we can also contribute to the efforts of others
- Avenues for collaboration between DND & police forces include DRDC CSS & Military Police units

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Thank you!

Any questions?

For further info after the conference, please contact:
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