Augmented Reality Based Extensible-Experiential-Expertise (X) Learning-Model Objectives

Kevin Owens
Applied Research Laboratories:
The University of Texas at Austin Signal Information Science Lab
Augmented-Reality Based Extensible-Experiential-Expertise (X) Learning...

Measuring and Managing Experiential-Expertise

Kevin Owens

Applied Research Laboratories: University of Texas at Austin
Discussion Points

1. Case for Experience over Expertise Alone.
2. Extensible-Experiential-Expertise based Learning (X-Learning).
3. The non-measured / non-detected Experiential-Expertise “leaks”.
4. AR can build experiential-expertise on-demand / anywhere (andragogy).
5. Data-data everywhere... but not a drop to link. For humans and AI.
7. Rapidly filling Experiential-Expertise “leaks” in wartime – using AR / AI.
Experiential-Expertise: The Real Measure of Combat Readiness

Case Study: USS Vincennes Airbus Incident (1988)

• USS Vincennes was in “highest state of training and readiness” in all combat areas; conducted multiple simulated and live training scenarios in route to Persian Gulf.
  - typical Aegis Combat Training System (ACTS) synthetic scenario based training – emphasis “reps-n-sets” training
  - USS Vincennes Anti-Air Warfare crew misinterprets sensor data, was cognitively overwhelmed by real combat, and many key roles were qualified to stand watch based on subjective criteria (e.g., time on ship)

• USS Vincennes combat team was heavily biased by earlier combat events, enabled by routine “reps-n-sets” synthetic rehearsal training scenarios.

BLUF: VINCENNES NOT READY!
(Contrary to Assessments & CJCS Testimony)
Experiential-Expertise training and Measured / Managed warfighters could have minimized mistakes

Refs:
My 1995 Epiphany

1. Typical "sausage factory" (pedagogical) one-and-done expertise training doesn't make warfighters.
   • Characteristics: Kirkpatrick Level 1 / 2 only declarative knowledge/skill assessments. "Expert for life" MOS, NEC, degrees, certs. No sustainment assessment, NO REAL EXPERIENCE assessment.

2. Warfighter task-experience more important than just task-expertise.
   • Short-term snap-shot assessments (e.g., Marksmanship – no assessment on when, why, who to use it on).

3. Performance gaps noted in REAL OPS are mainly due to lack of experience
   • Classroom training cannot replace / account for ability to perform job in real conditions under stress.

4. Synthetic training alone creates much of the proficiency problems today
   • Basic "made-up" scenarios designed more for "reps-n-sets" training than building real-experience.
   • Produces poor mental-models of real conditions and combat (easy button training).

FLASH FORWARD 2018

NTSB Report on USS John S. McCain Incident

10 sailors aboard JOHN S. MCCAIN died and 48 were injured when the ship collided with tanker in Singapore Strait Traffic Separation Scheme as result of:

• Poor Human System Integration
• Lost Situation Awareness
• Poor Training (Qualification) Practice and Team / Watchstander (Role) Performance Management

i.e., Poor Experiential-Expertise

SEEM FAMILIAR?
MANY OTHER PERSONAL-SIMILAR STORIES...

VINCENNES INCIDENT WAS A PRODUCT OF POOR COGNITIVE-CONDITIONING AND MIS-MANAGEMENT OF SMALL TEAM/INDIVIDUAL WARFIGHTER READINESS ... so now what?
Experiential

- Tacit knowledge or practical wisdom gained from what one has observed, encountered, or undergone.
- The process or fact of personally observing, encountering, or undergoing something.
- The development of REAL mental models of events as they naturally occur in the course of time – produces “battlefield-wisdom”.

Expertise

- A person who has special skill or knowledge in a particular team-role; a specialist.
  - Assessed WITHIN a degree of performance contexts in real / live experiences.
  - Reassessed – sustained – expanded
- Assessment at Level 3 / 4 only... anything lower has no predictive performance value.

Today’s Education and Training Practices Builds Declarative Knowledge, Some Expertise, little Experience
X-Learning Process: Experience “Farming” and Consuming

Experience Recreation
- Live Data Collection
  - Reconstruction / Analysis Process

Experience Objects
- EO EO EO EO EO EO EO EO
- Meta Data Context Comp Rqmts EE EE EE EE

Experience Events:
- Recorded REAL Combat Situations
- Extensible competencies created as part of reconstruction process, new tech, new exercises

Experience Object (EO)
- Measure of Effectiveness of Team / Warfighter Tasks

Experience Event (EE)
- Remote/Local Observer Controller/Trainer (OC/T)

Soldiers Task Teams / Crews Squad Teams
- Sign-In
- Actor Mangt Qualified Actors
- Truth Baselines

Grader
- Authoritative Data Source
- CaSS Assertions
- Prereq’ Checks

AI Interpreter
- AR Event Experience
- AR Device
- xAPI Statements

Andragogy
- ~ 1-hour Vignettes
- Real / Synthetic Recreated Data
- Live / Synthetic / Games / Collective

EO
- Experience Recreation
- Live Data Collection
- Recon / Analysis Process

AAR Tool
- Prepare / Select Experience Objects
- Monitor / Control Experience
- Observe Performance (team / individuals)
- Prompt / Intervene in Performance (AI or Human pedagogy “micro” learning)
- Conduct AAR – Experience Points Awarded
OBJECTIVE CONCEPT:
Environment/items (trees, shrubs) geo-registered and calibrated in AR Field of View (FOV).

With AR on, real (recorded) threats and neutral stimulus “events” can appear “inside” synthetic (or live) environment skirts.

Andragogic stimulus from real prior experience in same geographic synthetic or actual live environment appear naturally or on-demand as part of test or demonstration.

Eye-gaze tracking provides critical cognitive data collection, feedback and expertise indicator support.

Other cognitive tracking shows item recognition, stress, and supports automated just-in-time declarative pedagogic support.

Augmented Learning
Real Environment or “Semi-Synthetic” “Skirts”

*Human eyes true FOV – 180°H x 135°V*
Please Save the Data… Expertise Depends on It

Artificial Intelligence Supported AR (Realistic Environments/Entities/Performance) NEEDS DATA

<table>
<thead>
<tr>
<th>TRAINING LOCATION</th>
<th>THE PLATOON PREPARED FOR WAR</th>
<th>OBJECTIVE STAGE</th>
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</thead>
<tbody>
<tr>
<td>UNIT</td>
<td>Platoon Training SQUAD/PLT</td>
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<tr>
<td>UNIT</td>
<td>Squad Training ARM: SQUAD/PLT</td>
<td></td>
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<tr>
<td>UNIT</td>
<td>Fire Team Training ARM: FIRE AND MOVEMENT</td>
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<td>UNIT</td>
<td>Crew Training MAINTENANCE: ZERO: QUALITY</td>
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<td>Buddy-Team Training</td>
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<td>UNIT</td>
<td>WPN MAINTENANCE: BRM: ZERO</td>
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Today lots of task data is collected everyday... then dropped in the "bucket"
How do we rapidly “refill” sudden unit experiential-expertise “leaks”?
The gap or loss of “battlefield wisdom” in combat units

**DoD suffers mass expertise “leaks” daily by attrition:**
1. Perm. Change Station
2. End of Active Service
3. Retirement
4. Combat casualties
5. Other (TDY, etc…)

**Today’s estimated “expert replacement” trajectory**

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**Kurzweil’s Law of Accelerating Returns**
- Naïve – Incompetence
  - (Dunning-Kruger: one thinks they’re competent)
- Aware – Incompetence (No Efficacy)
  - (via Feedback)
- Aware – Competence / Min Efficacy
  - (via Feedback)
- Tacit Competence / Max Efficacy
  - (Intuition – master)

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**Experience (Time) - Years**
- Apprentice Level
- Journeyman Level
- Mastery Level

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**Team OR Role-Specific Experiential-Expertise (True “Qualification”)**

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**Team-Team / Warfighter Experiential-Expertise “Leaks”**

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**Task Team / Warfighter Experience/Expertise NOT MEASURED NOT TRACKED**
### Tracking Experiential-Expertise to Predict Future Performance

#### Warfighter MOE - Measures of Performance (MOPs):

1. Setup sensor for environmental characteristics.
2. Search data for target-like contacts.
3. Investigate and analyze contacts.
4. Report contact to leadership.
5. Etc....

#### Experience OBJECT:
Warfare-Team/Warfighter mission (collective task) vignette - e.g., "Search an Area"

#### Experience EVENTS:
Warfighter performance task - e.g., "Search assigned sector with a [given] sensor"

#### Measure of Effectiveness (MOE)
Warfighter MOE - Measures of Performance (MOPs):

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#### Tracking Experiential-Expertise to Predict Future Performance

- **Raw Performance Data converted to AI & OC/T interpreted Task Measures of Performance**

  - μ+2σ
  - μ+σ
  - Mean (μ)

- **Experience OBJECT**: Warfare-Team/Warfighter mission (collective task) vignette - e.g., "Search an Area"
- **Experience EVENTS**: Warfighter performance task - e.g., "Search assigned sector with a [given] sensor"

#### Bias (based on conditions and team/warfighter experience)

- **Experience-Object Experience**
- **Experience-Expertise Level Boxes**

#### Accumulated Experience

- **Bio-ROC Curve**

#### Role (MOE/P) Qualification Level

- **Pupillometry / EEG signatures**
- **Bias (based on conditions and team/warfighter experience)**

#### BIAS LINE

- Represents Many Conditions

#### Experience-Expertise Level Boxes

- **Correct Action**
- **Wrong Actions**
- **0 Experience Points Region**

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*Owens (2014)
**Experiential-Expertise Based Qualification Required Research**

**Expertise Curve Based on K. Anders Ericsson et.al (1968 -2006)**

**MATLAB 3D ROC Model**

Owens (2014)
All teams / warfighters must re-experience “saved” experiences only few have today!

Can preserve our knowledge with AI but MUST preserve our wisdom with humans

Augmented Reality based Extensible-Experiential-Expertise (X-learning),
Using recorded/recreated real-past Experiences and Artificial Intelligence support,
CAN BUILD BETTER EDUCATION AND MISSION READINESS QUALITY
Questions?

Kevin Owens
Applied Research Laboratories: The University of Texas at Austin
kowens@arlut.utexas.edu
Cell/Text: 512 745-1042