

Concurrent Presentation Session
BRIDGING ADL AND SIMULATION



Leveraging xAPI for AI-Based Performance Measurement and Adaptive Learning

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Leveraging xAPI for AI-based Performance Measurement and Adaptive Training

Presented at iFEST: 28 August 2019

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Aegis Computer Network Technician (ACNT)

Mission Critical Enclosure (MCE) Block

Lack of lab practice time due to schedule and physical constraints

Students enter course with varying levels of skill proficiency and experience

Formal knowledge and skill assessments are summative in nature

Numerous equipment baselines must be tracked across training courses

Lack of objective measurement of student performance

- Asynchronous virtual lab that gives students *reps and sets* practice and provides a **clear and self-evident view** of their knowledge and skill progression.
- The system interoperates (i.e., “wraps around”) with **existing simulation-based environments** to extend xAPI statements into more granular measures of performance.
- **Continually assesses** each student’s strengths and weaknesses, and selects fault scenarios that will best improve skill level and proficiency.
- The skill progression graph shows the **student’s current progress toward proficiency** using the six-step troubleshooting process mental model.
- Maintains scenario difficulty with **basic, intermediate, and advanced** faults within the student’s Zone of Proximal Development (Vygotsky 1978).
- The Artificial Intelligence (AI) recommendation engine **optimizes a learner's path** using “middle-loop adaptation,” helping to accelerate time to proficiency.



My activity

23 APR

Completed [View Results](#)
Scenario 004: Basic Firmware

Completed [View Results](#)
Scenario 003: Basic Hardware

Completed [View Results](#)
Scenario 002: Basic Hardware

21 APR

Milestone [View milestone](#)
3 scenarios completed!

Completed [View Results](#)
Scenario 001: Basic Hardware

20 APR

Attained: Basic Level – Fault Analysis

My Skill Progression [View details >](#)

Equipment Initialization / Operational Verification



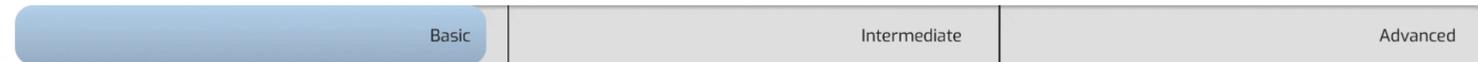
Fault Isolation



Fault Analysis



Symptom Recognition



Fault Localization



Repair Procedures



Recommended Scenario

Scenarios Completed: 22 Attempted: 6

Continue My Recommended Learning Path
Based on your continually assessed skill level.

[Choose a different scenario](#)

Simulation Environment



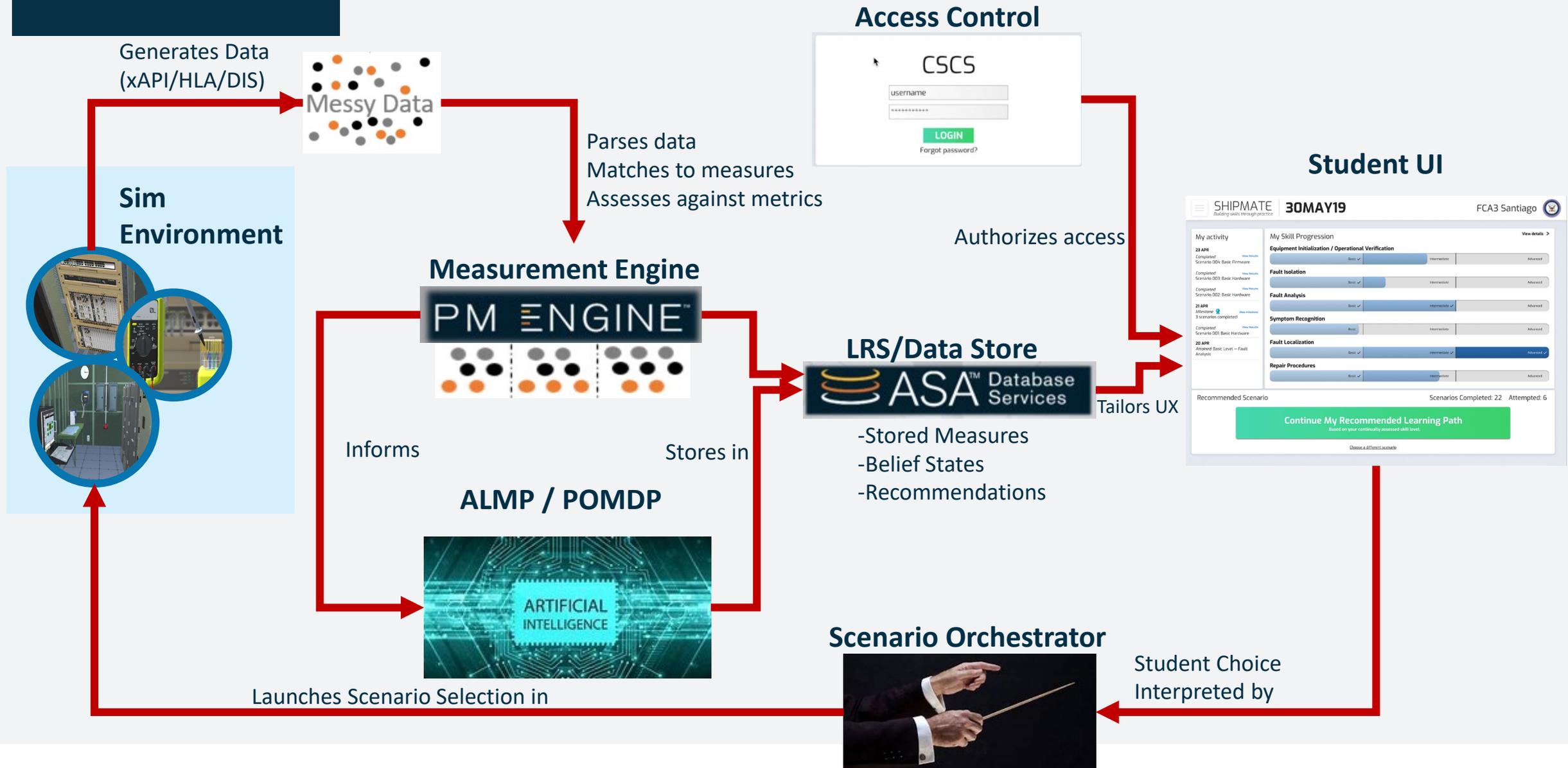
SHIPMATE's Scenario Summary Screen

The screenshot displays a web browser window with the URL `localhost:4200/student/history/44065816-fe9b-40b0-8c04-1809115cf017`. The page header includes the SHIPMATE logo with the tagline "Building skills through practice", the date "16JUL19", and the user "FCA3 Santiago". A left sidebar contains navigation options: Landing, Training History, Launch Tutorial, Launch Freeplay, and Logout. The main content area is titled "Training History for student" and lists the following training scenarios:

Scenario ID	Scenario Name	Status	Completion Date
01.001	Basic Hardware	Completed	Jul 16, 2019, 1:32:31 PM
	Equipment Initialization/Operation Verification	2 / 4	
	Symptom Recognition	4 / 4	
	Fault Localization	16 / 16	
	Fault Isolation	60 / 60	
	Fault Analysis	4 / 4	
	Repair Procedures	12 / 12	
02.002	Intermediate Hardware	Completed	Jul 11, 2019, 2:32:30 PM

A score of 98 is displayed in a dark grey rounded square in the center of the screen.

SHIPMATE Concept of Operations



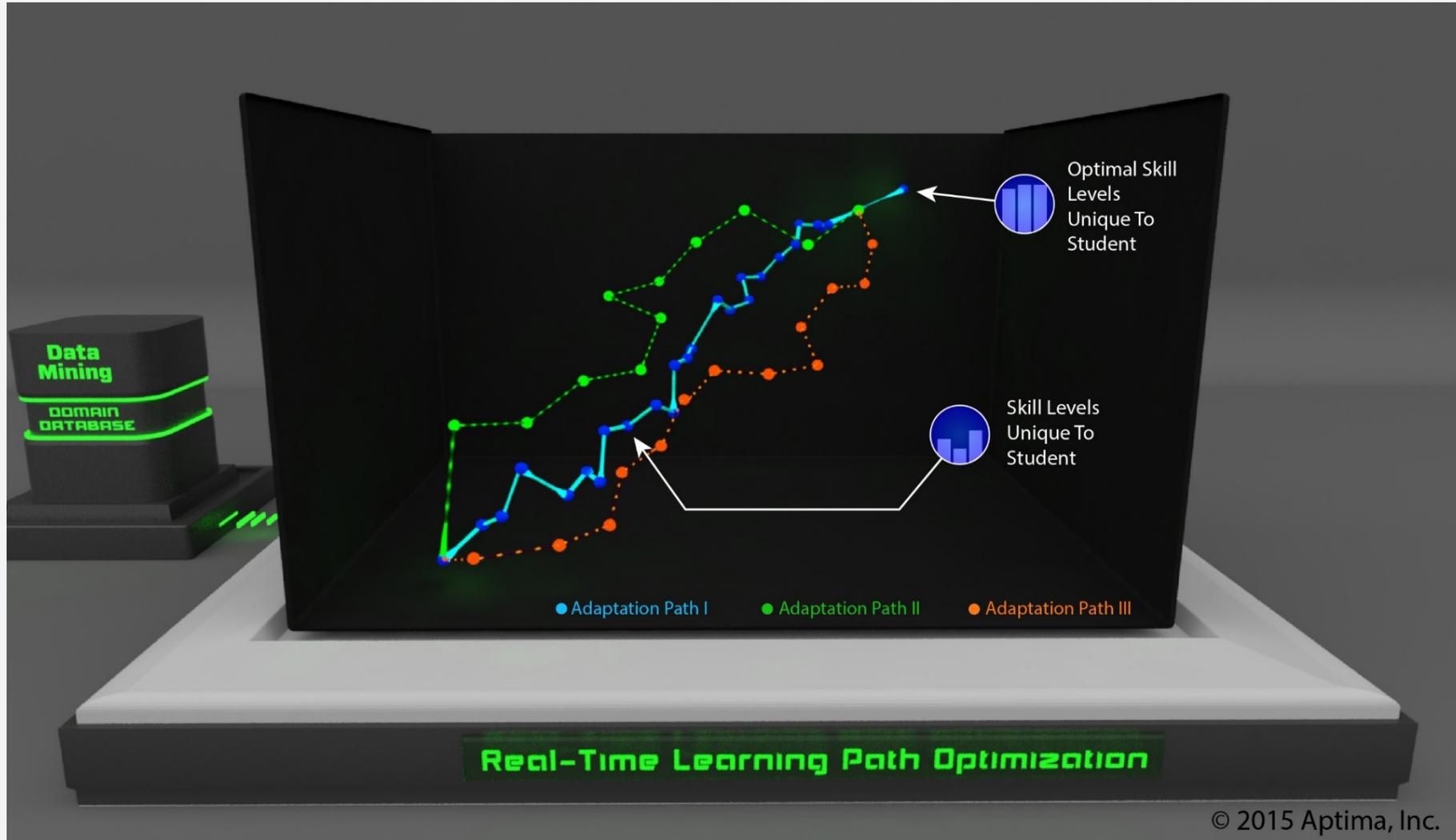
Immersive Training Environment

- Tracks user interactions
- Generates xAPI statements (actor, verb, object)
- Sends xAPI statements

SHIPMATE

- Parses xAPI statements according to actor, verb, object
- Matches xAPI statements to performance measure(s)
- Extends xAPI statements as needed with additional data (HPML)
- Assesses xAPI statements against metrics
 - Binary scale
 - Tertiary scale
- Assigns full, partial, or zero credit
- Stores results in an LRS
- AI Algorithms run on the results in the data store to generate recommendations
- Landing page retrieves results, aggregates, and visualizes the proficiency data in the user interface

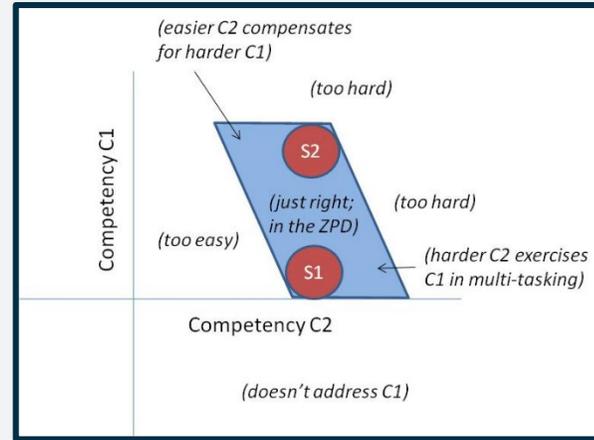
Optimized Paths



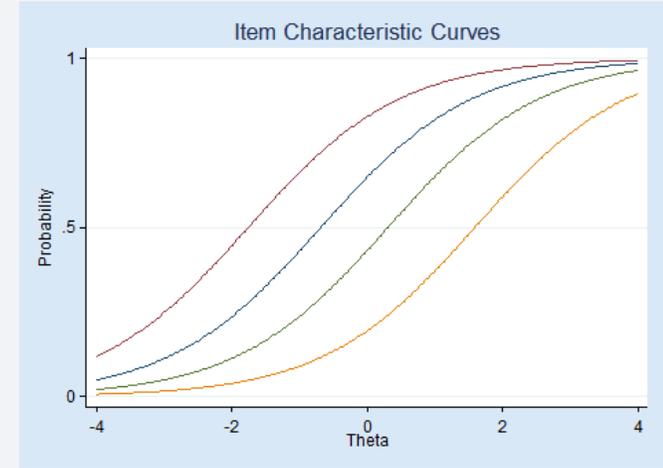
- Theoretical:

- Zone of Proximal Development (Vygotsky, 1979)

- Training should be not too easy, not too hard



Zone of Proximal Development



Item Response Theory

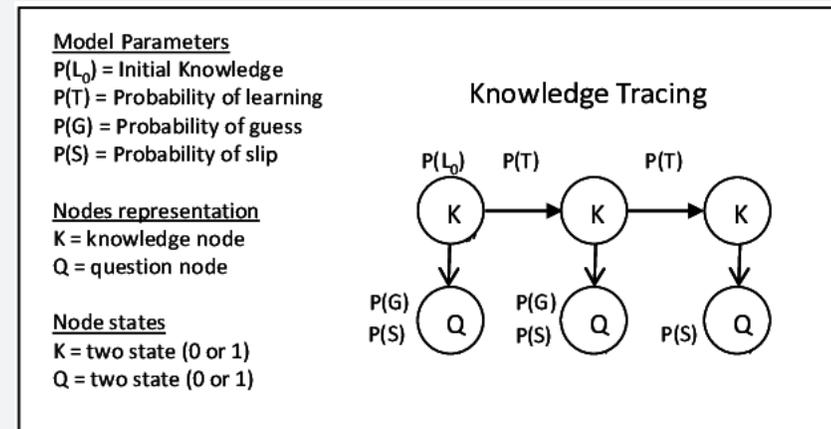
- Modeling:

- Item Response Theory (IRT)

- Relate measures and item difficulty to assessments
 - Used for SAT and other standardized testing

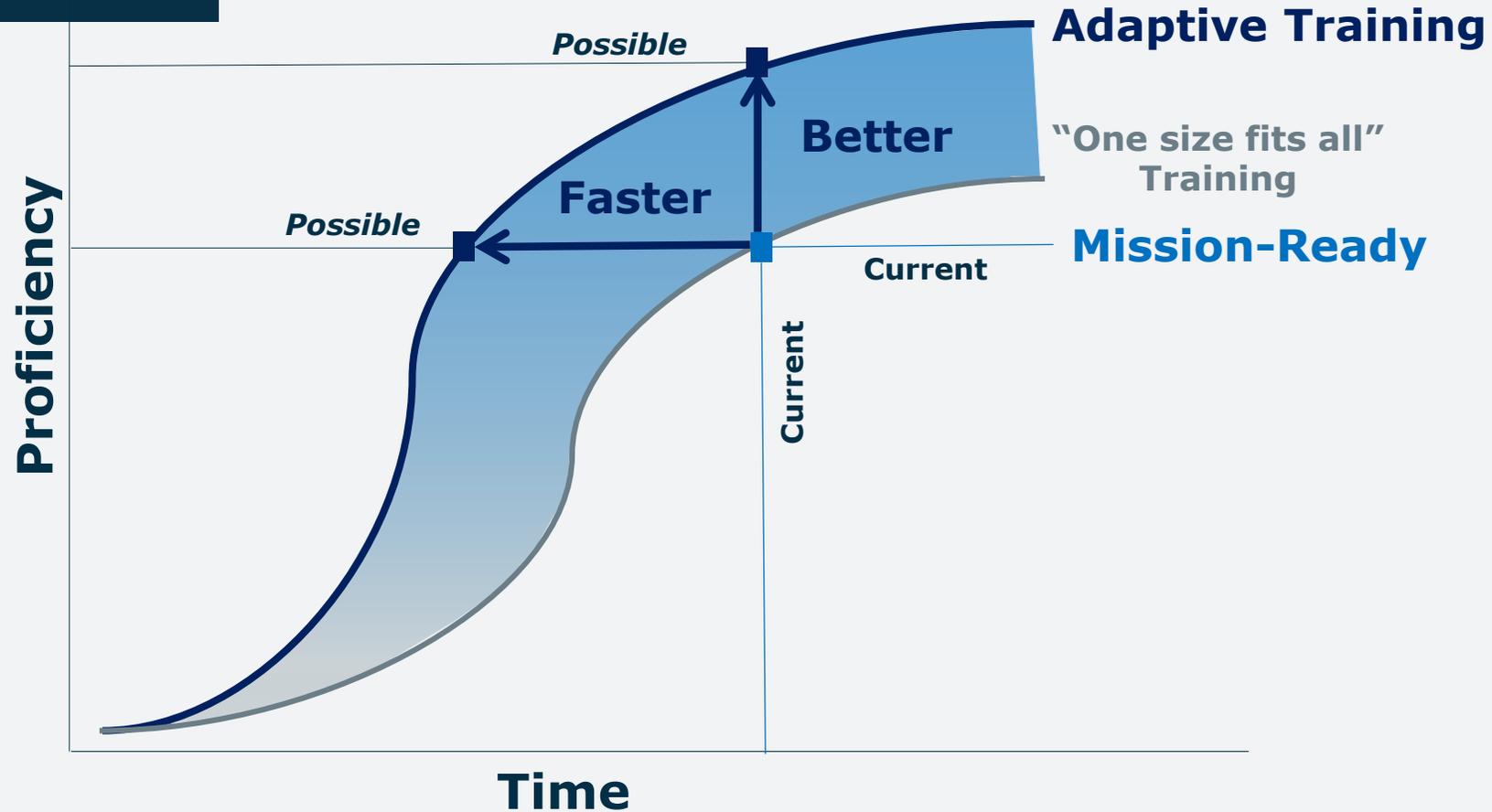
- Bayesian Knowledge Tracing (BKT)

- Predict training progression



Bayesian Knowledge Tracing

Adaptive Training Learning Curve



- Precision training that targets skill/knowledge a student is ready to master
 - Achieve mission-ready proficiency faster, or
 - Increase learning capability given a fixed training time

For additional information, please contact:

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