

Mar 4th, 9:00 AM - 10:30 AM

Dynamic and Adaptive Training for Enhanced Aviation Knowledge Transfer and Retention

Jason P. Kring Ph.D.
Fort Hill Group

Michael W. Sawyer
Partner, Principal Human Factors Engineer, Fort Hill Group

Meredith Carroll
Florida Institute of Technology

Katherine A. Berry
Fort Hill Group

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Dynamic and Adaptive Training for Pilots and Air Traffic Controllers



32nd National Training Aircraft Symposium

Jason Kring Ph.D.

Fort Hill Group – Orlando, FL

Michael Sawyer Ph.D.

Fort Hill Group – Washington, DC


Meredith Carroll Ph.D.

Florida Institute of Technology – Melbourne, FL

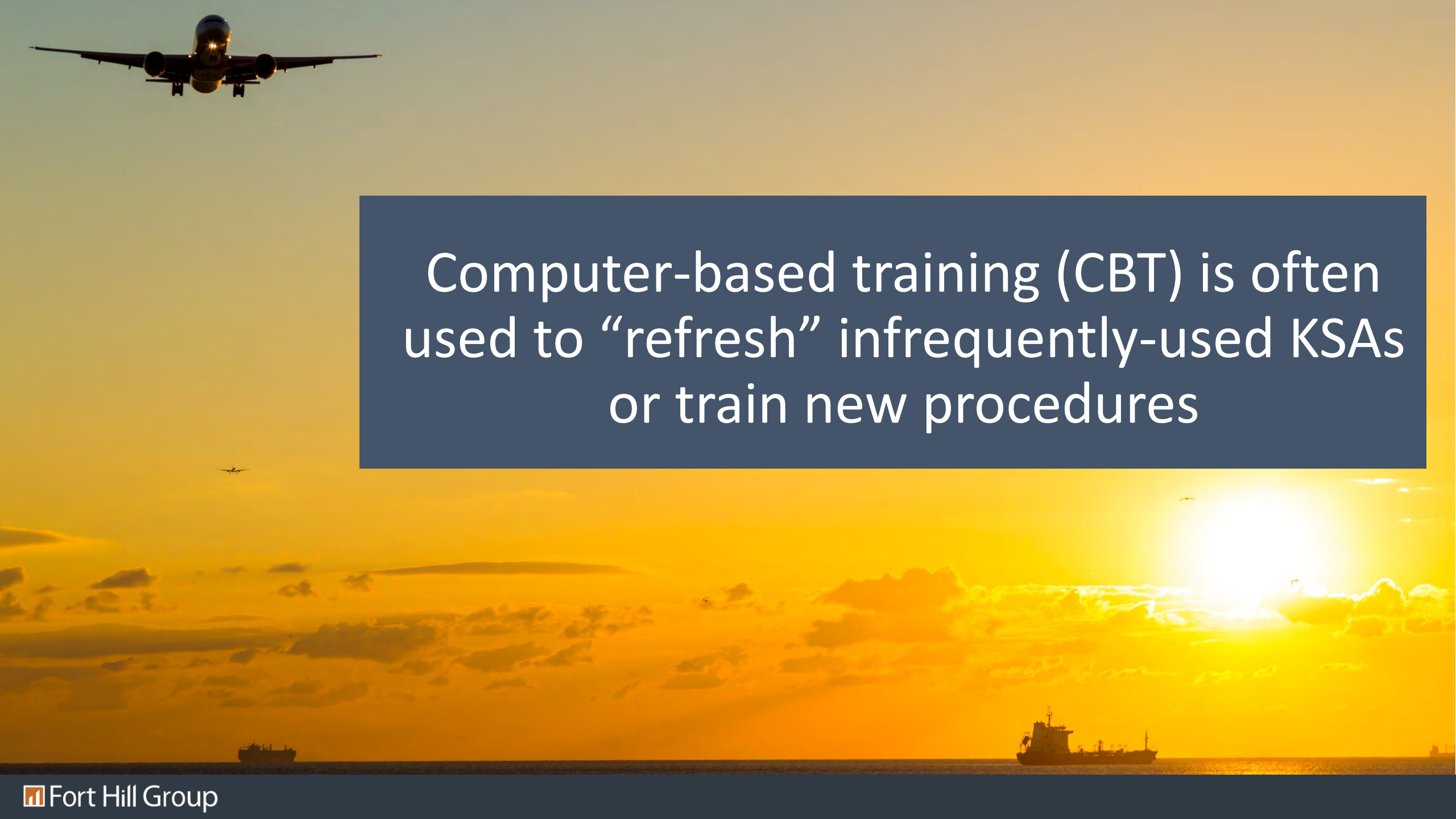
Katherine Berry Ph.D.

Fort Hill Group – Washington, DC

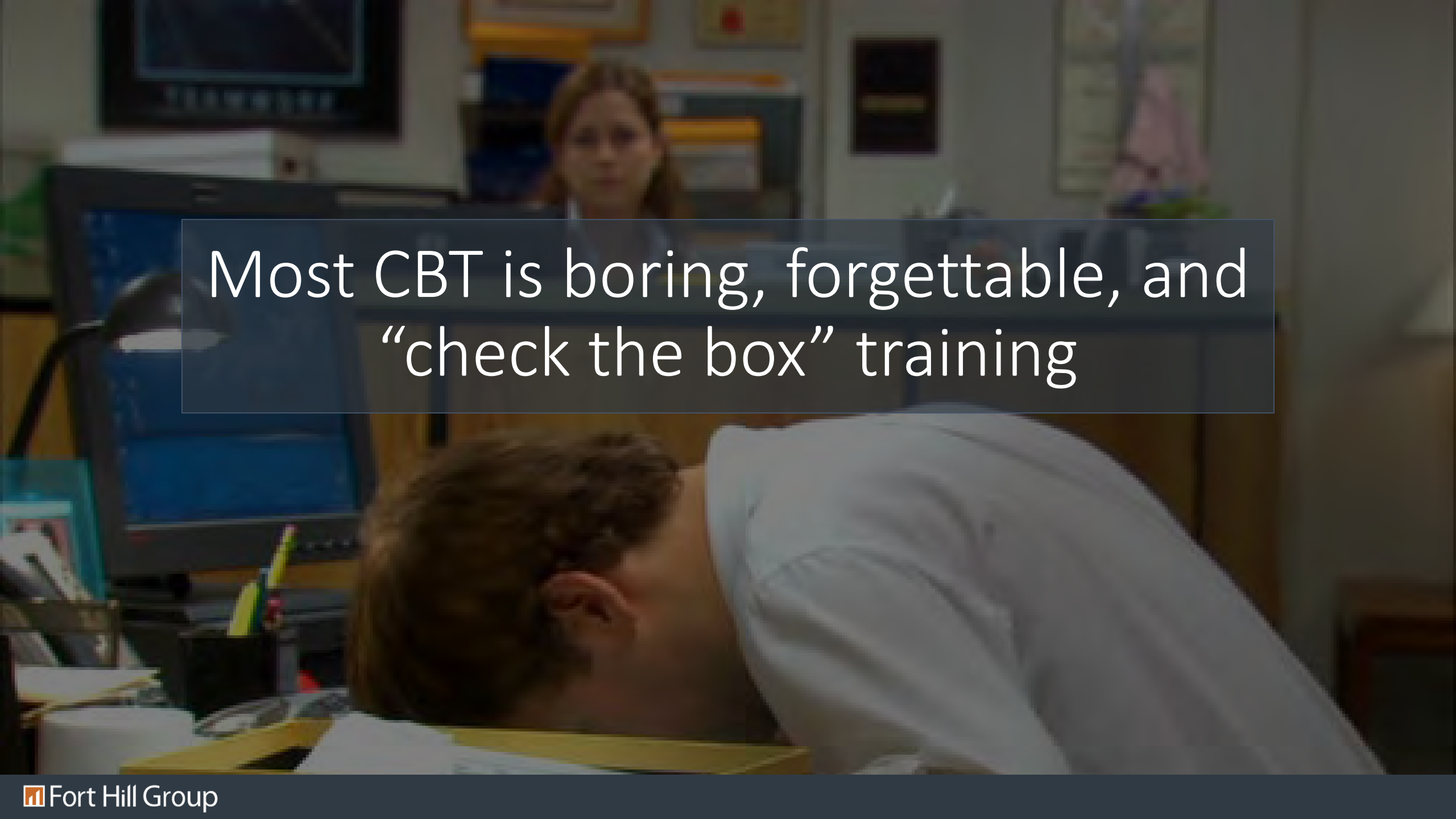
March 4, 2020 – Daytona Beach, FL

A large commercial airplane is shown from a rear perspective, flying over a control tower. The scene is set against a sunset sky with orange and blue hues. The control tower is a tall, dark structure with a glass-enclosed observation deck at the top. The airplane has four engines and its landing gear is visible.

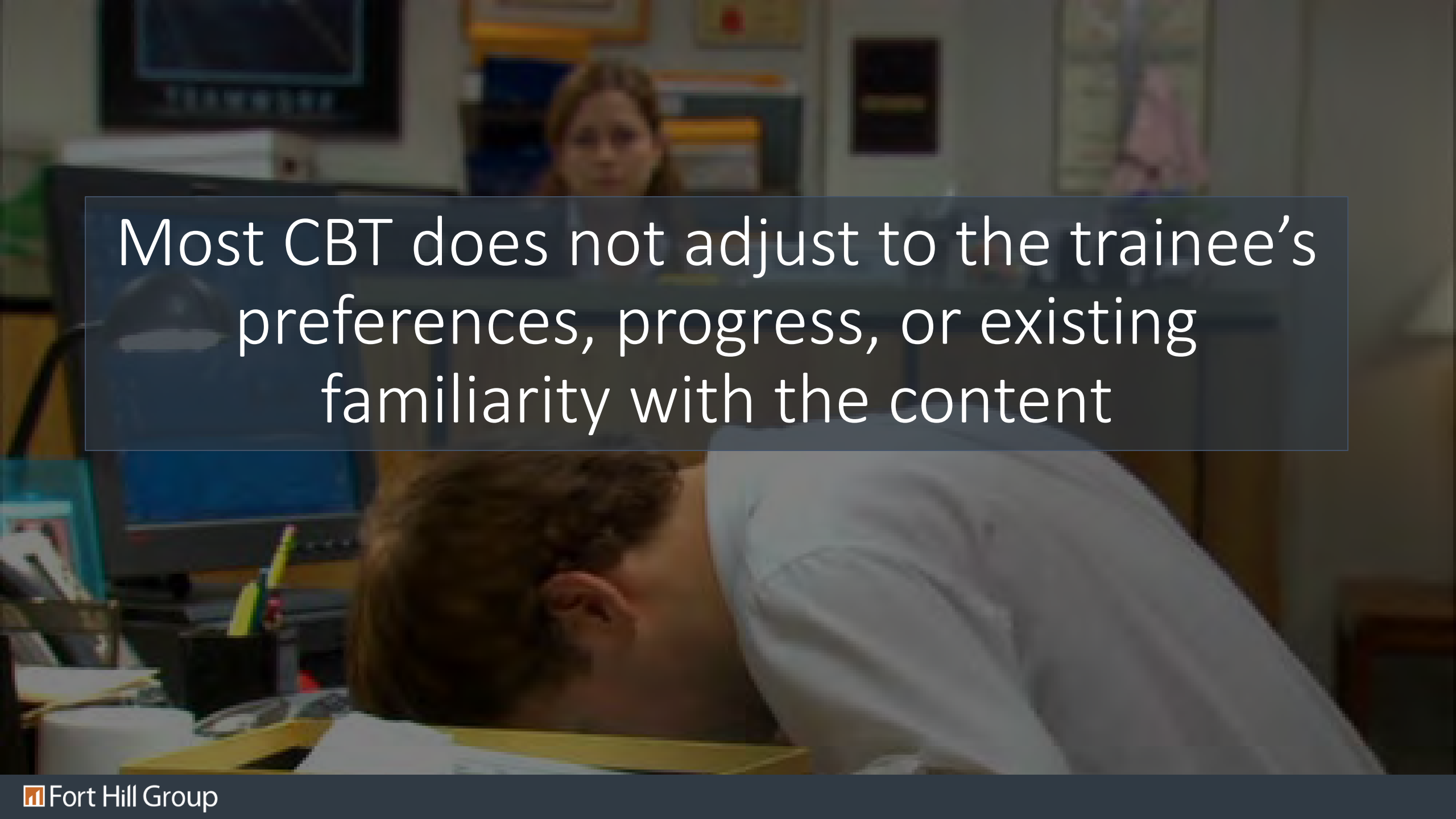
Knowledge, skills, and abilities (KSAs)
deteriorate over time if not used or
applied routinely



Computer-based training (CBT) is often used to “refresh” infrequently-used KSAs or train new procedures

A man with curly hair is sleeping at his desk in an office. He is wearing a light blue shirt and has his head resting on his hand. In the background, a woman with long brown hair is sitting at her desk, looking towards the camera. The office environment includes computer monitors, papers, and a desk lamp. A semi-transparent dark blue box with white text is overlaid on the image.

Most CBT is boring, forgettable, and
“check the box” training

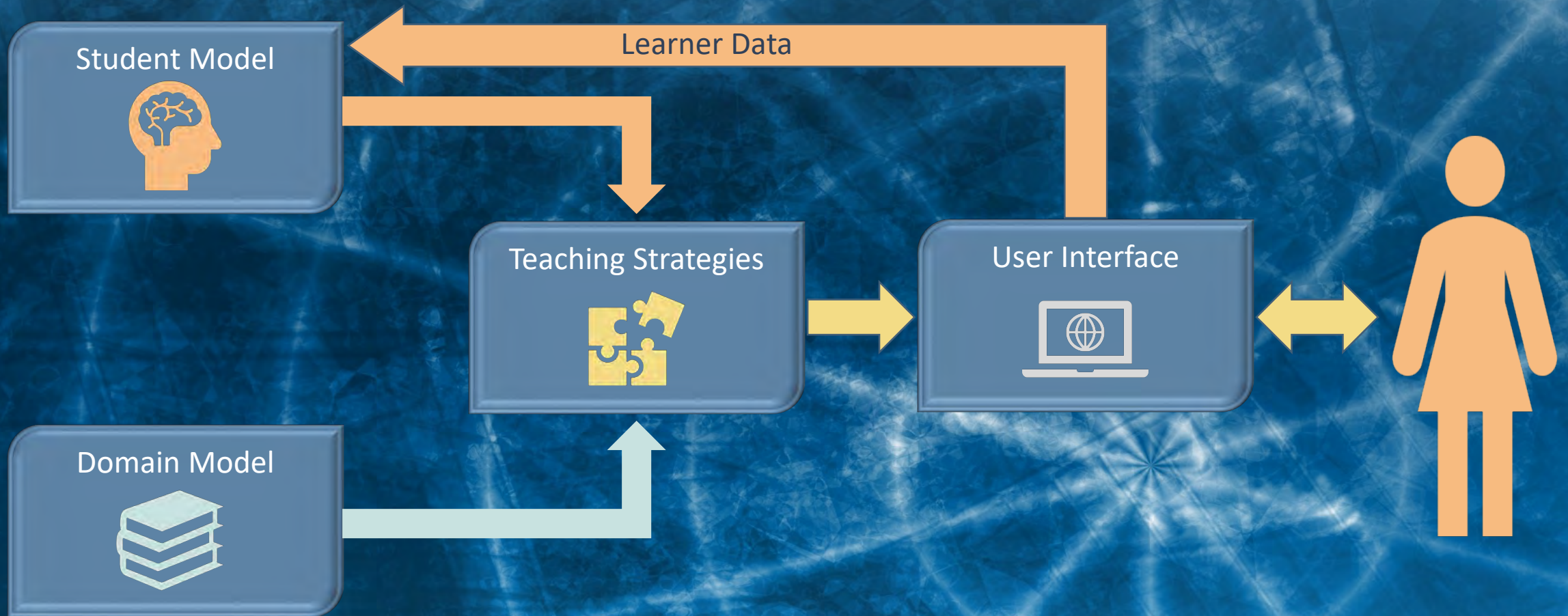
A blurred office scene. In the background, a woman with blonde hair is looking towards the camera. In the foreground, a man with dark hair is leaning over a desk, looking down. The scene is dimly lit, and the background is out of focus. A semi-transparent dark blue box is overlaid in the center, containing white text.

Most CBT does not adjust to the trainee's preferences, progress, or existing familiarity with the content

Adaptive Instructional System (AIS)

- ▶ Intelligent agent monitors learner
- ▶ Strategies and actions change based on:
 - Learner variability and attributes
 - Preferences
 - Proficiency
 - Attention and engagement

Basic Adaptive Instructional System



| Key Elements of Effective Training | Traditional CBT | Adaptive Instructional Systems | Evidence |
|---|-----------------|--------------------------------|---|
| Efficiency | | | |
| Development cost | Green | Yellow | <ul style="list-style-type: none"> • Bove, 2019 • McCarthy, Kennedy, Grant, & Bailey, 2019 • Sottolare & Brawner, 2018 |
| Required infrastructure | Green | Yellow | |
| Ease of distribution | Green | Green | |
| Individualization (progress, preferences) | Yellow | Green | |
| Relevance | | | |
| Domain accuracy | Green | Green | <ul style="list-style-type: none"> • Khan & Mustafa, 2019 • Mavroudi, A., & Hadzilacos, 2016 |
| Context specific | Yellow | Green | |
| Engagement | | | |
| Degree of engagement | Yellow | Green | <ul style="list-style-type: none"> • Carroll, Kokini, Champney, Sottolare & Goldberg, 2011 • Petrovica, Anohina-Naumeca, & Ekenel, 2017 • Robison, McQuiggan, & Lester, 2009 |
| Engagement metrics | Yellow | Green | |



Adaptive Dynamic and Personalized Training

Combines traditional CBT and AIS elements to improve

- ▶ Efficiency
- ▶ Relevance
- ▶ Engagement



Adaptive
Dynamic
and
Personalized
Training

Data sources inform ADaPT's algorithm

- ▶ Pre- and post-test
- ▶ Response time and accuracy
- ▶ Learner preferences
- ▶ Engagement metrics
 - Affect

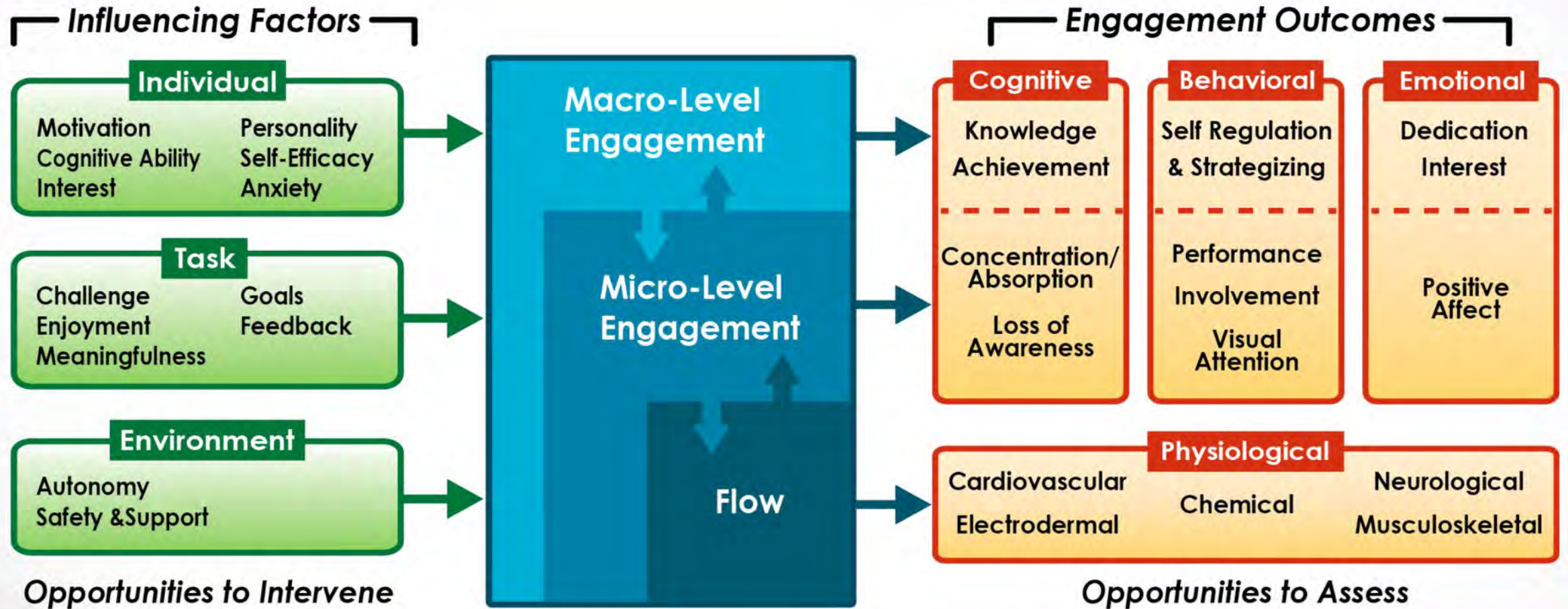


Adaptive
Dynamic
and
Personalized
Training

Algorithm generates optimal strategies for efficiency and engagement

- ▶ Personalized
 - Context and trainee level
- ▶ Module format
- ▶ Metacognitive prompting
- ▶ Attention maintenance

Applied Model of Learner Engagement



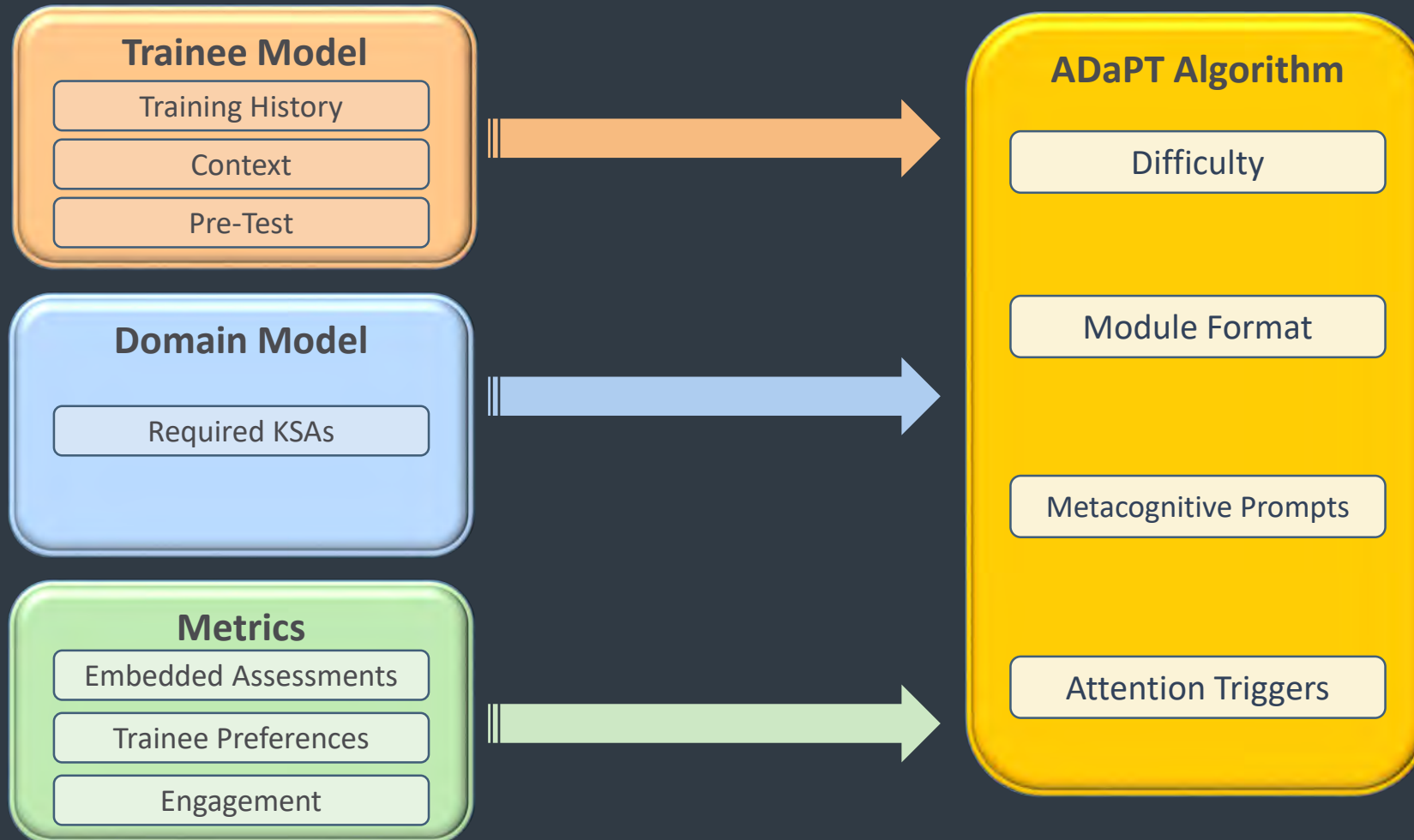
Carroll, M., Lindsey, S., Chaparro, M., & Winslow, B. (2019). An applied model of learner engagement and strategies for increasing learner engagement in the modern educational environment. *Interactive Learning Environments*, DOI: 10.1080/10494820.2019.1636083.

Taxonomy of Interventions and Learning Environments

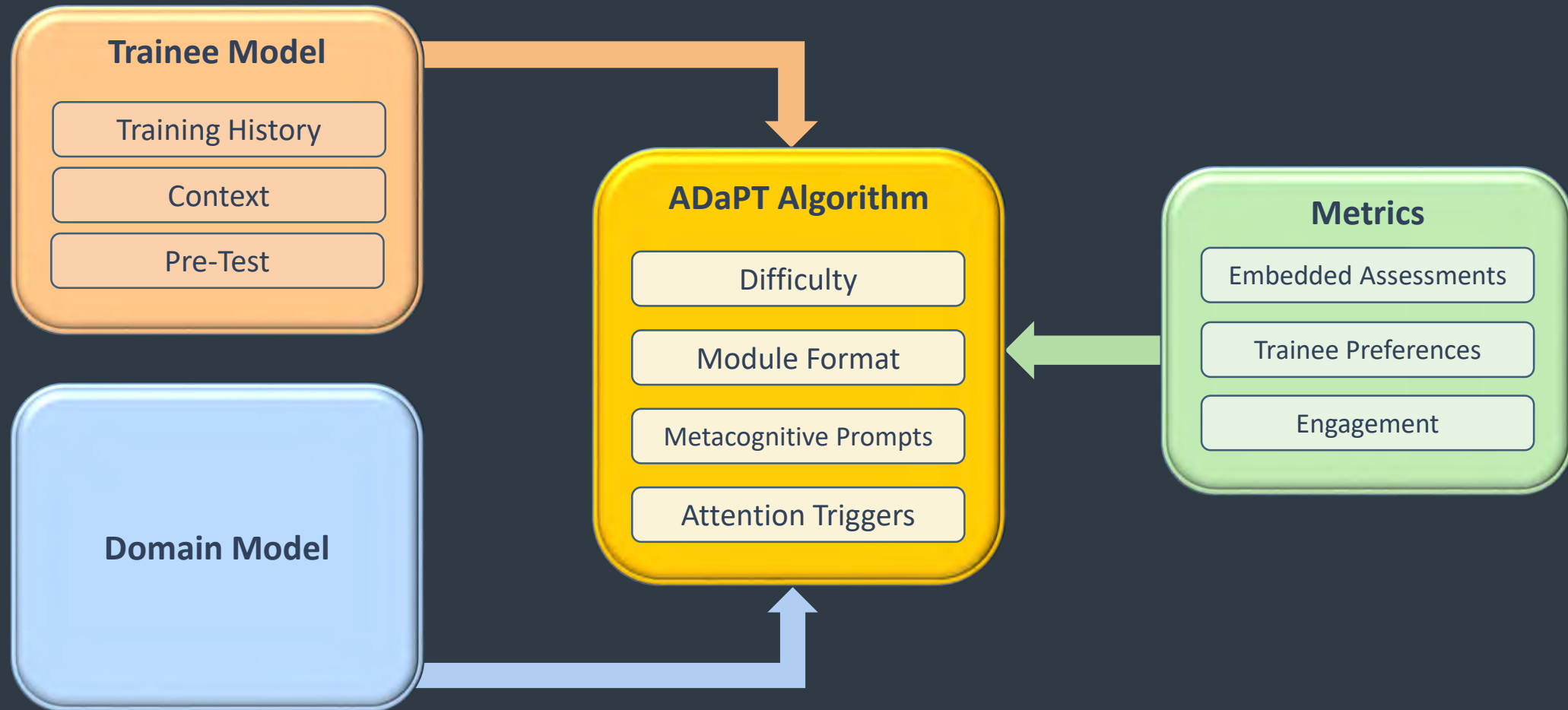
| Instructional Intervention | Effective Environments | | | Shown to Improve | | |
|---------------------------------------|------------------------|---------|------|------------------|-----------|----------------------|
| | Traditional | Virtual | Live | Engagement | Knowledge | Skills & Performance |
| 1. Metacognitive Intervention | ● | ● | ● | ● | ● | ● |
| 2. Challenge Level Optimization | | ● | | ● | ● | ● |
| 3. Goal Clarity | ● | ● | ● | ● | ● | ● |
| 4. Feedback | ● | ● | | ● | ● | ● |
| 5. Autonomous Self-Regulated Learning | ● | ● | ● | ● | ● | ● |
| 6. Personalization | ● | ● | | ● | ● | ● |
| 7. Experiential Learning | ● | ● | | ● | ● | |
| 8. Game Based Learning | ● | ● | | ● | ● | ● |
| 9. Interactivity and Multimedia | ● | ● | ● | ● | ● | ● |
| 10. Meaningful Learning | ● | | | ● | ● | |

Carroll, M., Lindsey, S., & Chaparro, M. (2019, July).

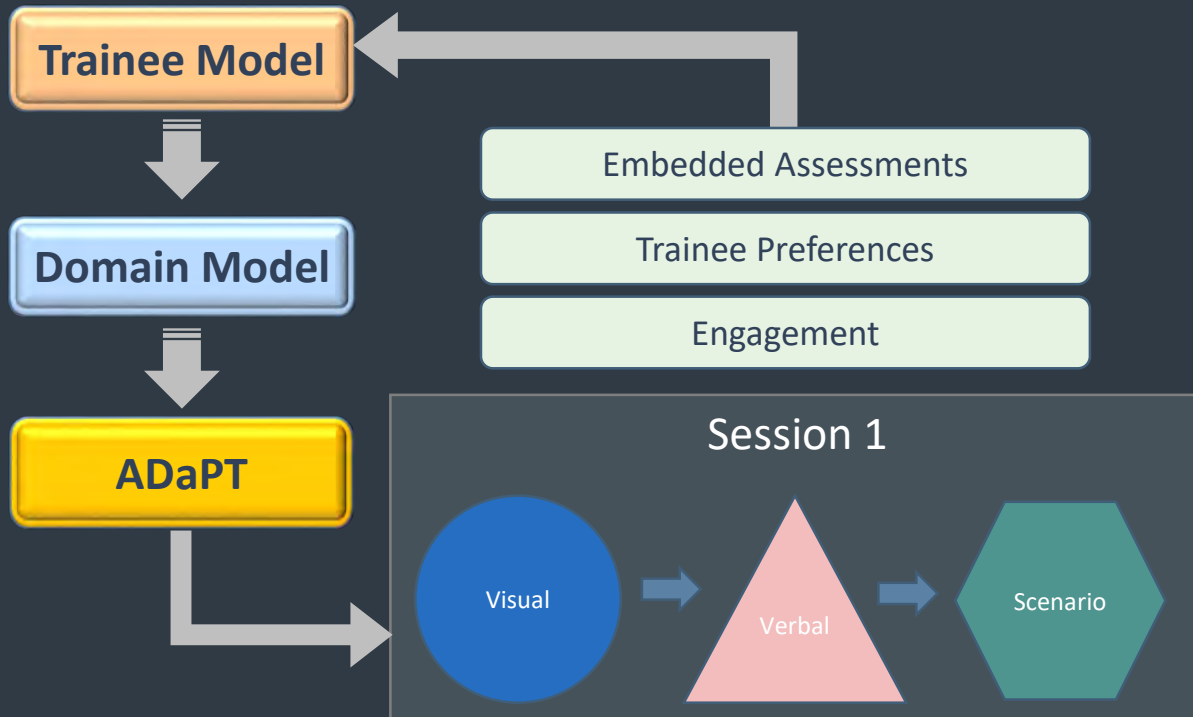
ADaPT Basic Structure



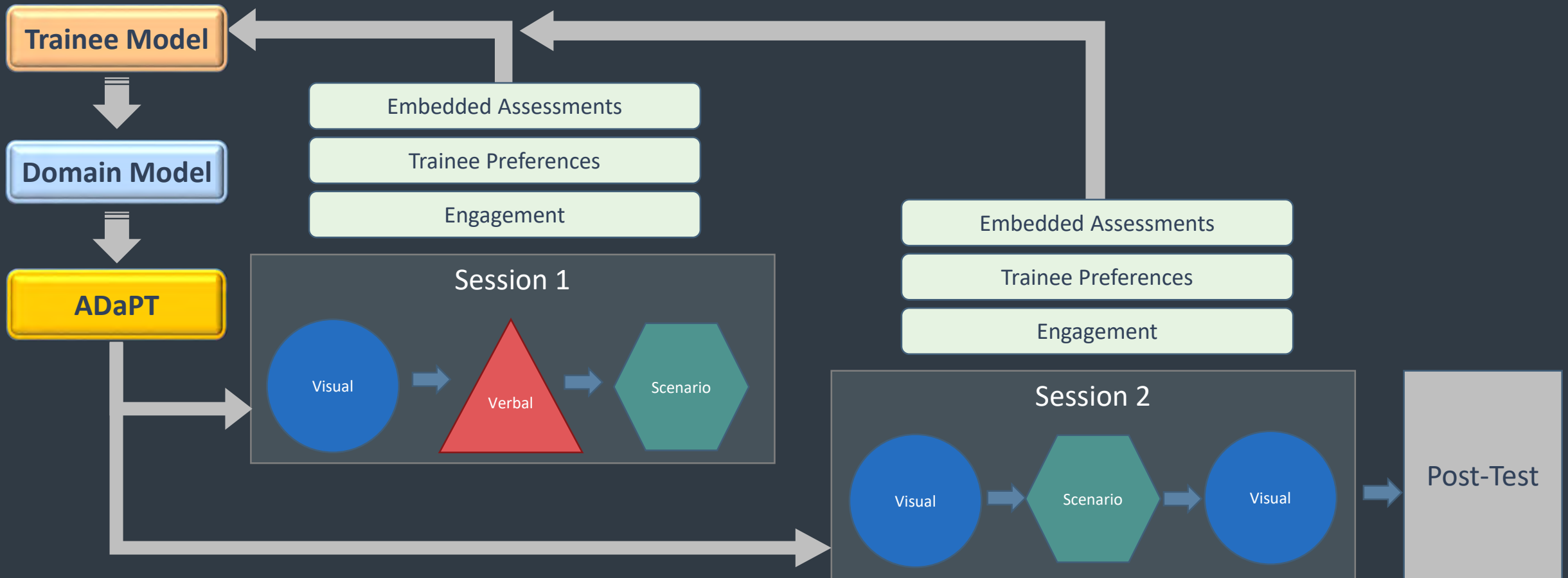
ADaPT Basic Structure



ADaPT Basic Structure



ADaPT Basic Structure





Priorities

- Decrease training development costs
- Increase engagement
- Function within existing infrastructure

Next Steps

- Iterative algorithm testing
- Prototype testing
- Guidance and collaboration



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Thank you

Fort Hill Group provides strategic guidance, analysis, and training to empower organizations to improve human performance and reduce operational risks.

 **Fort Hill Group**

www.FortHillGroup.com

Jason Kring

Jason.Kring@FortHillGroup.com

Michael Sawyer

Michael.Sawyer@FortHillGroup.com