

# Design and Development of an Adaptive Hypermedia-Based Course for Counterinsurgency Training in GIFT: Opportunities and Lessons Learned

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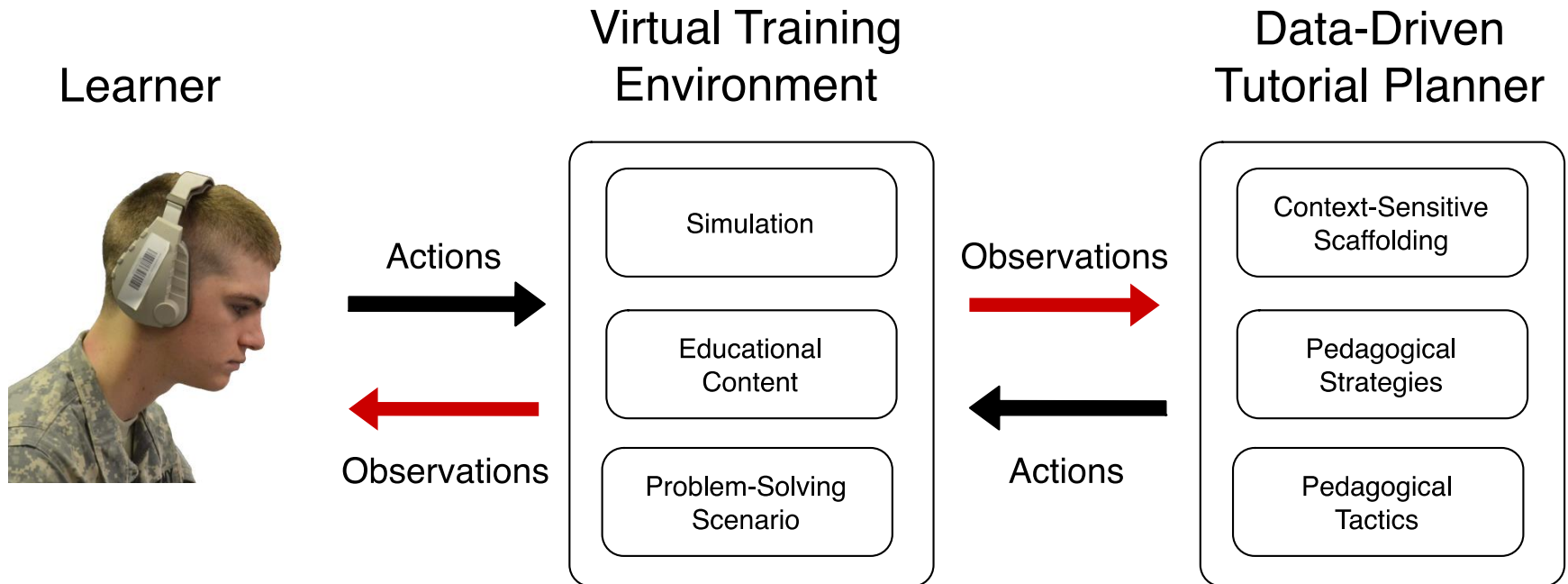


# Tutorial Planning



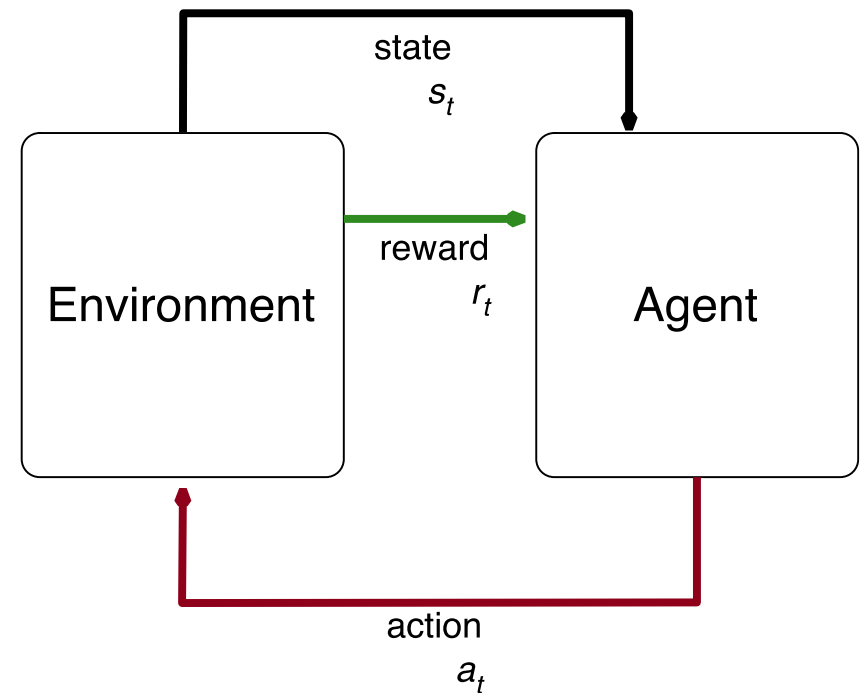
- Hints
- Feedback
- Scenario adaptations
- Embedded assessments
- Remedial instruction

# Data-Driven Tutorial Planning



# Reinforcement Learning

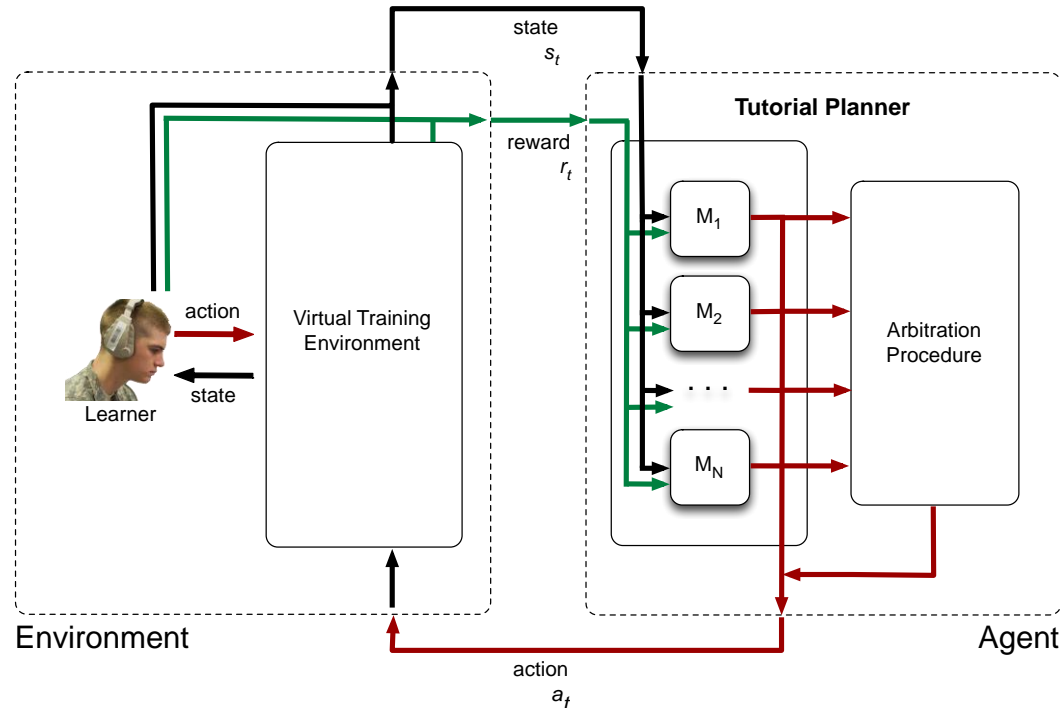
- **Problem:** Devise software agent that learns how to behave in order to maximize numerical reward
- No external supervision
- Delayed rewards



Adapted from Sutton & Barto (1998)

# Reinforcement Learning-Based Tutorial Planning

*Reinforcement learning* provides a computational framework for modeling tutorial planners that induce pedagogical rules from observations of learners' performance and training outcomes.



(Rowe & Lester, 2015; Sawyer, Rowe, & Lester, 2017)

# Outline



- Adaptive Hypermedia-Based Training Environment
- Course Overview
- Design and Development of an Adaptive Hypermedia Training Course in GIFT
- Lessons Learned
- Conclusion and Future Work

# Outline



- **Adaptive Hypermedia-Based Training Environment**
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# Tutorial Planning for Counterinsurgency Training

## UrbanSim Primer



The screenshot displays the UrbanSim Primer interface. At the top, there is a navigation bar with tabs for Lesson 1 through Lesson 6. Below this is a video player showing a man in a military uniform. The video title is "LTC (Ret.) John A. Nagl" and the subtitle is "Co-author 'Counterinsurgency Field Manual' FM 3-24". To the left of the video is a sidebar with a bio for LTC (Ret.) John A. Nagl, including a small portrait and text describing his military and academic background. At the bottom of the interface, there is a progress indicator showing "0 out of 8 completed" and a row of icons for different topics: COIN, Managing Info, and IN Legitimacy.

- Hypermedia-based training environment
- Range of COIN doctrinal concepts
  - Population support
  - Intelligence gathering
  - PMESII analysis
- Preliminary instruction on UrbanSim usage

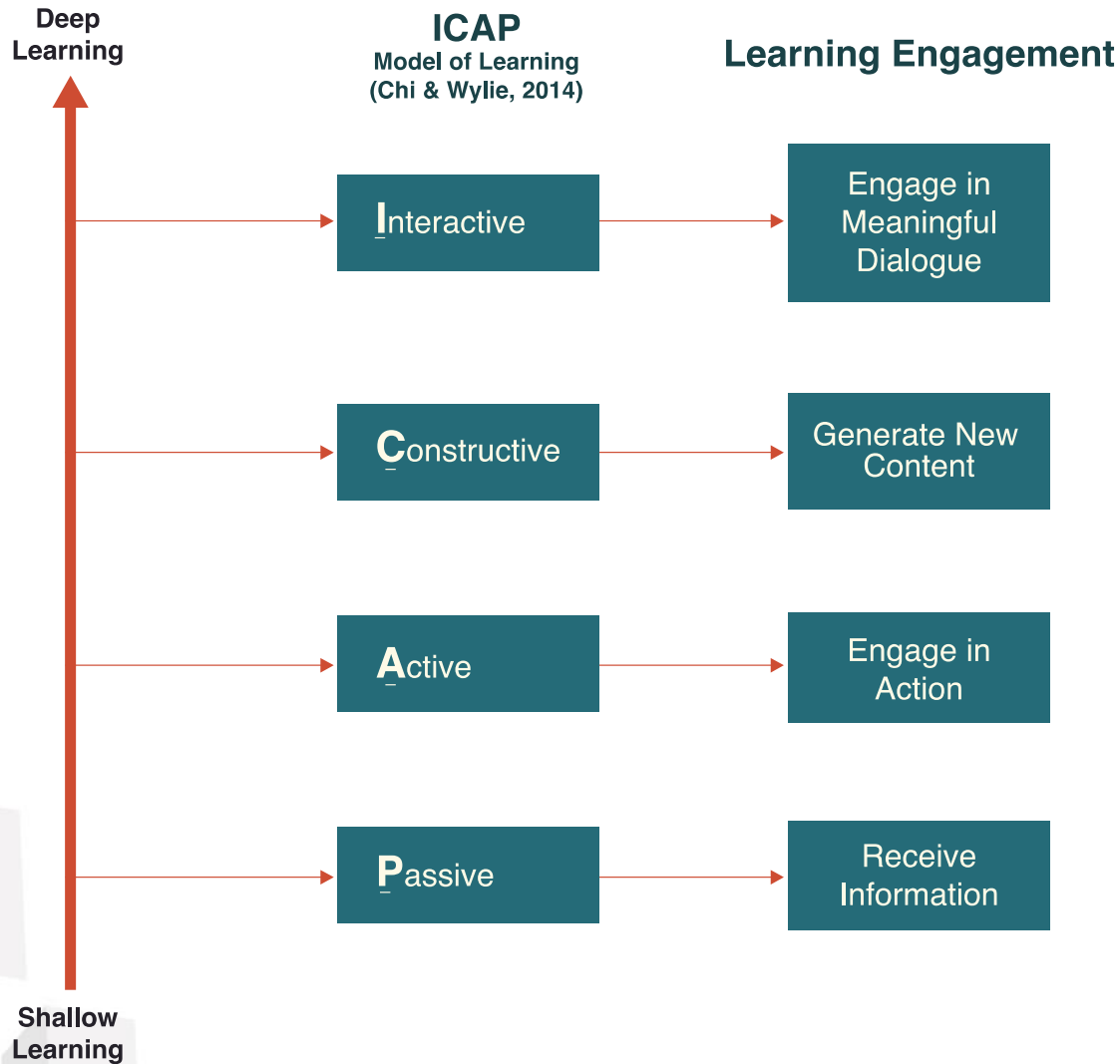


# Generalized Instructional Strategies for COIN Training



- High-level instructional strategies
  - Single-topic coaching
  - Multi-concept review
  - Feedback on unproductive learning behaviors
  
- ICAP-inspired remediation strategies (Chi, 2009)
  - Constructive
  - Active
  - Passive

# ICAP Framework



# Research Objectives



- **Objective 1:** Devise adaptive hypermedia-based COIN training environment in GIFT to serve as a testbed for data-driven tutorial planning.
- **Objective 2:** Induce ICAP-inspired pedagogical strategies for feedback and remediation from learner training data.
- **Objective 3:** Evaluate RL-based tutorial planning models in run-time adaptive hypermedia-based training course.

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# Course Map



Course Map

Chapter 1:  
Introduction to  
COIN

1.1 Identifying  
Center of  
Gravity

1.2 Defining IPB

1.3 COIN & HN  
Security

1.1.1 COIN  
Combo

1.2.1 IPB

1.3.1 COIN  
Success

1.1.2 COIN  
Shift

1.2.2 IPB  
Features

1.3.2 COIN Non  
Kinetic

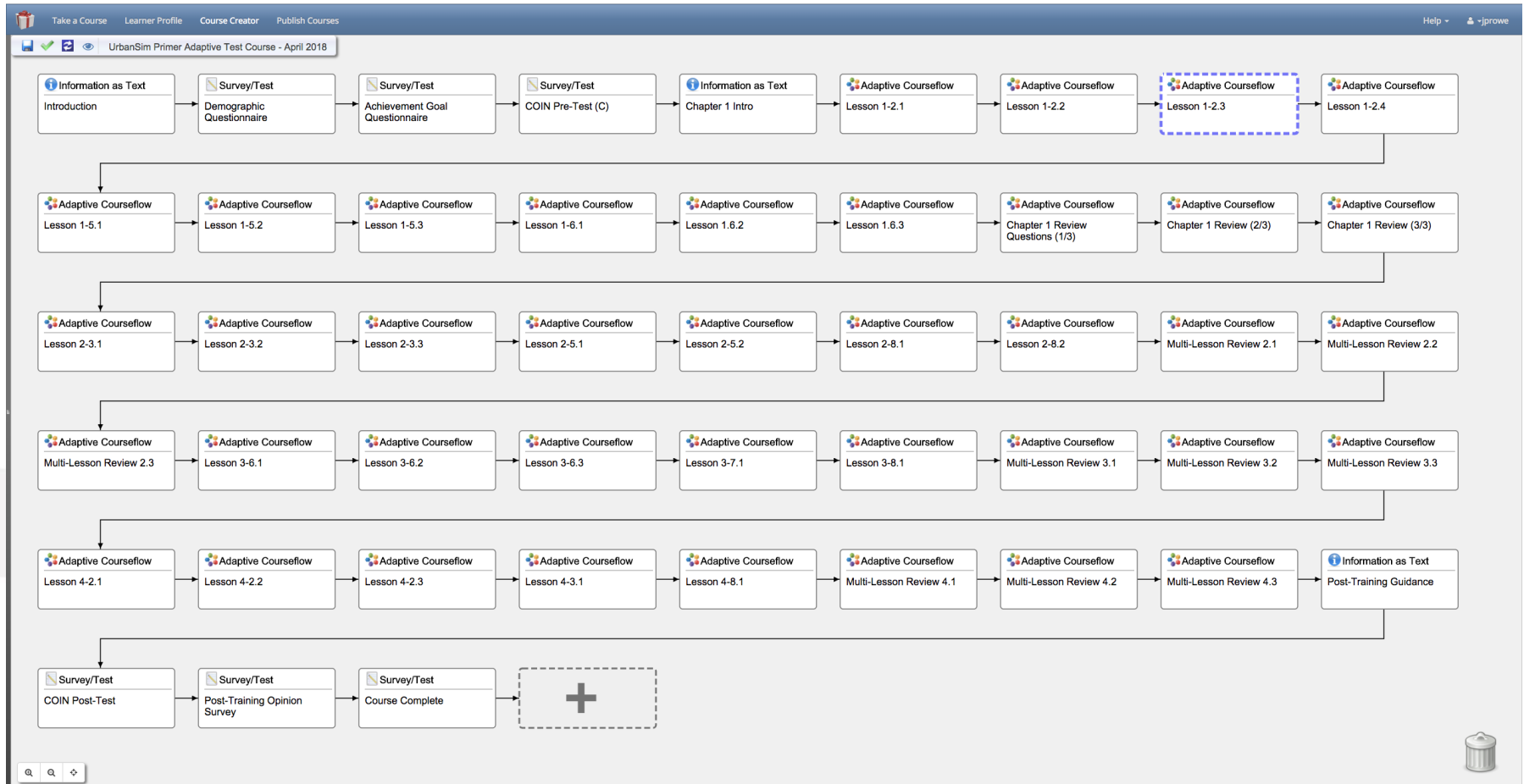
1.1.3 Center of  
Gravity

1.2.3 Human  
Terrain

1.3.3 COIN  
Progress

1.1.4 COIN  
Support

# Course Overview



# Demo Video



Introduction



## Welcome to the Training Course!

In this course, you will learn foundational concepts about mission command for counterinsurgency (COIN) operations.

The course includes a series of short videos that discuss COIN theory and doctrine, quiz questions, and remediation activities.

Before you get started, we'd like you to answer a few questions.

To begin, please click the arrow above.



# Outline



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# EMAP: Engine for Management of Adaptive Pedagogy



**Content Type**

Rules

Recall

Example

Practice

**Presentation Type**

- Merrill's Component Display Theory
- Implemented with adaptive course-flow objects
- Training activities are procedurally sequenced based on learner performance

# Adaptive Courseflow for UrbanSim Primer



Content Type

Rules



Recall

Q1: Which are used by COIN operations? (Pick 3)  
A. Stability operations  
B. Offensive operations  
C. Defensive operations  
D. Virtual operations

Example



Practice



Presentation Type

- **Example Quadrant:**  
UrbanSim Primer lesson videos
- **Recall Quadrant:**  
Multiple-choice embedded assessments
- Not currently using Rules or Practice Quadrants

# ICAP-Enhanced EMAP



Content Type

Rules



Recall

Q1: Which are used by COIN operations? (Pick 3)  
A. Stability operations  
B. Offensive operations  
C. Defensive operations  
D. Virtual operations

Example



Practice



Remediation

Presentation Type

# ICAP-Enhanced EMAP

Content Type

Rules



Recall

Q1: Which are used by COIN operations? (Pick 3)  
A. Stability operations  
B. Offensive operations  
C. Defensive operations  
D. Virtual operations

Example



Practice

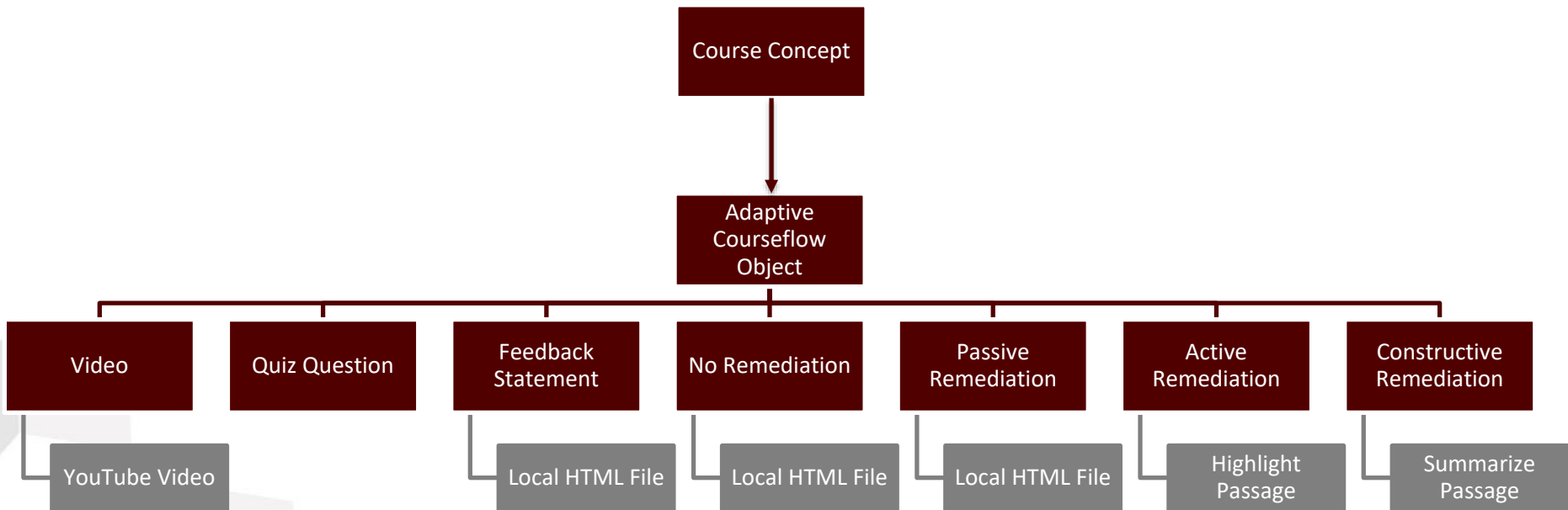


Remediation



Presentation Type

# Authoring Adaptive Courseflow Content



# Remediation Quadrant



The screenshot displays the Course Creator interface for 'UrbanSim Primer Adaptive Test Course - April 2018 - Form B'. The main area shows a flowchart of course objects, including Adaptive Courseflow lessons, Chapter 1 Review Questions, Multi-Lesson Review, and a Survey/Test for COIN Post-Test (b). The right-hand panel is open to the 'Remediation Phase' configuration for a selected course concept. A red box highlights a message: 'No Remediation phase content was found for the selected course concept(s)'. Other settings include 'Set Allowed Attempts' set to 3 and 'Practice Phase (optional)' with 'Add practice phase' unchecked.

Course Properties

- Description
- Concepts
- Course Cover Image
- History
- Advanced

Course Objects

- Media

Remaining Space: 96 MB

UrbanSim Primer Adaptive Test Course - April 2018 - Form B

Adaptive Courseflow Lesson 1-5.2 → Adaptive Courseflow Lesson 1-5.3 → Adaptive Courseflow Lesson 1-6.1 → Adaptive Courseflow Lesson 1.6.2 → Adaptive Courseflow Lesson 1.6.3

Adaptive Courseflow Chapter 1 Review Questions (1/3) → Adaptive Courseflow Chapter 1 Review (2/3) → Adaptive Courseflow Chapter 1 Review (3/3) → Adaptive Courseflow Lesson 2-3.1 → Adaptive Courseflow Lesson 2-3.2

Adaptive Courseflow Lesson 2-3.3 → Adaptive Courseflow Lesson 2-5.1 → Adaptive Courseflow Lesson 2-5.2 → Adaptive Courseflow Lesson 2-8.1 → Adaptive Courseflow Lesson 2-8.2

Adaptive Courseflow Multi-Lesson Review 2.1 → Adaptive Courseflow Multi-Lesson Review 2.2 → Adaptive Courseflow Multi-Lesson Review 2.3 → Adaptive Courseflow Lesson 3-6.1 → Adaptive Courseflow Lesson 3-6.2

Adaptive Courseflow Lesson 3-6.3 → Adaptive Courseflow Lesson 3-7.1 → Adaptive Courseflow Lesson 3-8.1 → Adaptive Courseflow Multi-Lesson Review 3.1 → Adaptive Courseflow Multi-Lesson Review 3.2

Adaptive Courseflow Multi-Lesson Review 3.3 → Adaptive Courseflow Lesson 4-2.1 → Adaptive Courseflow Lesson 4-2.2 → Adaptive Courseflow Lesson 4-2.3 → Adaptive Courseflow Lesson 4-3.1

Adaptive Courseflow Lesson 4-8.1 → Adaptive Courseflow Multi-Lesson Review 4.1 → Adaptive Courseflow Multi-Lesson Review 4.2 → Adaptive Courseflow Multi-Lesson Review 4.3 → Information as Text Post-Training Guidance

Survey/Test COIN Post-Test (b) → Survey/Test Post-Training Opinion Survey → Survey/Test Course Complete → Adaptive Courseflow New Course Object

Remediation Phase

- Exclude Rule/Example Content
- Remediation Content Files

No Remediation phase content was found for the selected course concept(s).

Practice Phase (optional)

- Add practice phase

Options

# Add Remediation Content



## Add Remediation Content

A horizontal menu of content types for remediation. The "Local Webpage" option is highlighted with a red border.

- Slide Show
- Power Point
- PDF
- Local Webpage**
- Local Image
- Web Address
- YouTube Video
- Highlight Passage
- Summarize Passage

### Metadata\*

#### Concepts:

- 1-2.1-coin-combo
- 1-2.2-coin-shift
- 1-2.3-center-gravity
- 1-2.4-support-coin
- 1-5.1-ipb-includes
- 1-5.2-iob-features

#### Attributes:

Please select a checked concept to view the attributes assigned to it.

# Add Remediation Content



## Add Remediation Content

Slide Show   Power Point   PDF   Local Webpage   Local Image   Web Address   YouTube Video   **Highlight Passage**   Summarize Passage

### Metadata\*

#### Concepts:

- 1-2.1-coin-combo
- 1-2.2-coin-shift
- 1-2.3-center-gravity
- 1-2.4-support-coin
- 1-5.1-ipb-includes
- 1-5.2-iob-features

#### Attributes:

Please select a checked concept to view the attributes assigned to it.



# Add Remediation Content



## Add Remediation Content

Slide Show   Power Point   PDF   Local Webpage   Local Image   Web Address   YouTube Video   Highlight Passage   **Summarize Passage**

### Metadata\*

#### Concepts:

- 1-2.1-coin-combo
- 1-2.2-coin-shift
- 1-2.3-center-gravity
- 1-2.4-support-coin
- 1-5.1-ipb-includes
- 1-5.2-iob-features

#### Attributes:

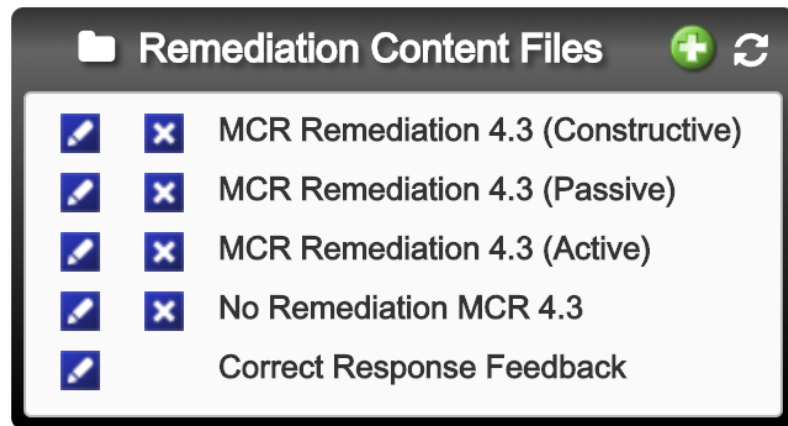
Please select a checked concept to view the attributes assigned to it.

# Remediation Quadrant



Remediation Phase [?](#)

Exclude Rule/Example Content



- Remediation quadrant shows complete list of remediation assets linked to course object
- Files names created by course author
- Course authors can delete and edit content files

# Outline



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# Best Practices



- Develop an **instructional design map** that organizes the training into **terminal** and **enabling learning objectives**.
- Develop an **external prototype** of the course prior to constructing the full course in GIFT.
- Conduct **iterative rounds of pilot testing** between development cycles.

# Authoring Enhancement Recommendations



- Advanced **previewing capabilities** for remediation phase would improve authoring efficiency.
- Enhancements related to **viewing and managing media** files and course assets would further reduce authoring time.

# Outline



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# Conclusion



- Data-driven tutorial planning shows significant promise for creating effective personalized learning experiences.
- ICAP-inspired enhancements to GIFT enable rich feedback and remediation in adaptive training environments.
- We have designed and developed an adaptive hypermedia-based training course in GIFT that will serve as a testbed for data-driven tutorial planning with hundreds of trainees.

# Future Directions



- Collect a training corpus through the Amazon Mechanical Turk crowdsourcing platform to investigate RL-based tutorial planning.
- Induce control policies for adaptively personalizing remediation and feedback to individual learners.
- Integrate data-driven tutorial planning models into the run-time adaptive training course and evaluate their effectiveness.



# Acknowledgments



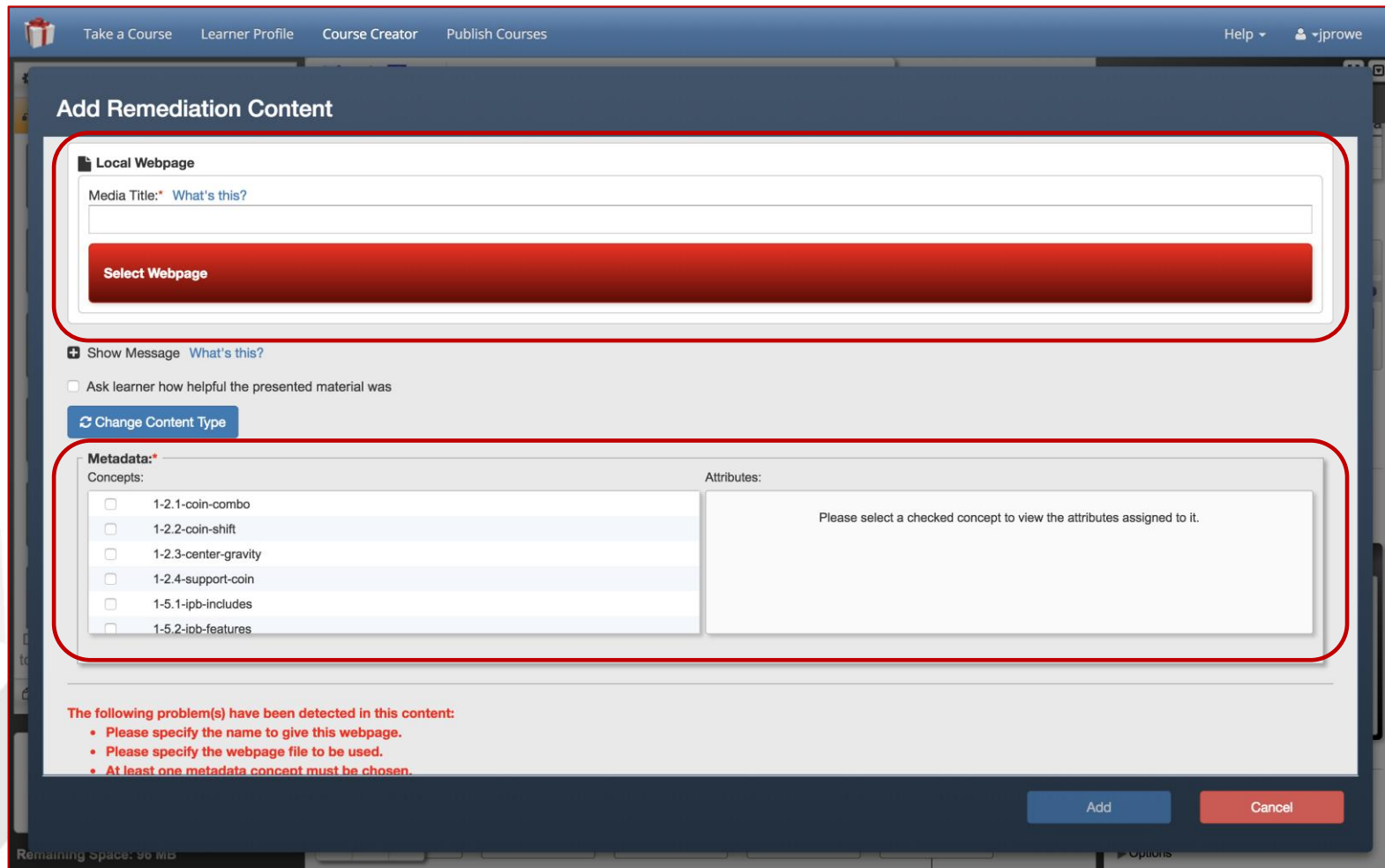
- Dignitas Technologies
- Institute for Creative Technologies
- Vanderbilt University
- NCSU Army ROTC Program



Support provided by the U.S. Army Research Laboratory under cooperative agreement W911NF-15-2-0030.



# Passive Remediation



Take a Course   Learner Profile   Course Creator   Publish Courses   Help   jprowe

## Add Remediation Content

**Local Webpage**

Media Title:\* What's this?

Select Webpage

**Show Message** What's this?

Ask learner how helpful the presented material was

Change Content Type

**Metadata:**

Concepts:	Attributes:
<input type="checkbox"/> 1-2.1-coin-combo	Please select a checked concept to view the attributes assigned to it.
<input type="checkbox"/> 1-2.2-coin-shift	
<input type="checkbox"/> 1-2.3-center-gravity	
<input type="checkbox"/> 1-2.4-support-coin	
<input type="checkbox"/> 1-5.1-ipb-includes	
<input type="checkbox"/> 1-5.2-lob-features	

The following problem(s) have been detected in this content:

- Please specify the name to give this webpage.
- Please specify the webpage file to be used.
- At least one metadata concept must be chosen.

Add   Cancel

Remaining space: 96 MB

# Active Remediation



Take a Course    Learner Profile    Course Creator    Publish Courses    Help ▾    jprowe

## Add Remediation Content

Highlight Passage

Title:\* What's this?

Enter any instructions that you want your learners to see here.

Enter the text from which you want learners to highlight passages here.

Expert Highlighting

To help you evaluate your understanding, here is some example highlighting generated by an expert:  
This is where you will be able to select the ideal passage to be highlighted.

Display an image  
 Ask learner to evaluate how well their response matches the ideal highlighting  
 Ask learner how helpful this question was

[Change Content Type](#)

Metadata:\*  
Concepts:

Remaining space: 96 MB

[Add](#)    [Cancel](#)

# Active Remediation



Take a Course    Learner Profile    Course Creator    Publish Courses    Help ▾    jprowe

## Metadata

Highlight Passage

Title: **What's this?**  
Remediation 4-2.1 (Active)

**INCORRECT.** You missed a question asking what is the crucial battleground for COIN.  
Please read the following passage about counterinsurgency operations from the video. Afterward, highlight the passage that best addresses the question you missed.

**COIN and HUMINT**  
As previously discussed, Human Terrain is the crucial battleground in COIN operations. This terrain includes human intelligence and knowledge of social networks, as well as cultural and ethnographical information. Because the human terrain changes constantly within the operating environment, it is yet another reason that intelligence gathering must be a systematic and continuous process.

**Expert Highlighting**  
To help you evaluate your understanding, here is some example highlighting generated by an expert:

**COIN and HUMINT**  
As previously discussed, **Human Terrain is the crucial battleground in COIN operations.** This terrain includes human intelligence and knowledge of social networks, as well as cultural and ethnographical information. Because the human terrain changes constantly within the operating environment, it is yet another reason that intelligence gathering must be a systematic and continuous process.

Please select how similar your answer is to the expert's answer.

Not similar	Moderately similar	Very similar
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Save and Close    Cancel

javascript:    Survey / Test    Survey / Test    Options

# Constructive Remediation



Take a Course    Learner Profile    Course Creator    Publish Courses    Help ▾    jprowe

## Add Remediation Content

**Summarize Passage**

Title: [What's this?](#)

Enter any instructions that you want your learners to see here.

Enter the text that you want learners to summarize here.

This is where learners will enter their summary.

**Expert Summary**

To help you evaluate your understanding, here is an example summary generated by an expert:

Enter your ideal summary here.

Display an image

Ask learner to evaluate how well their response matches the ideal summary

Ask learner how helpful this question was

[↻ Change Content Type](#)

**Metadata:**  
Concepts:

Remaining space: 96 MB

Options

Add    Cancel

# Constructive Remediation



Take a Course    Learner Profile    Course Creator    Publish Courses    Help ▾    jprowe

## Metadata

Data

☰ Summarize Passage

Title: [What's this?](#)

Remediation 4-2.1 (Constructive)

**INCORRECT.** You missed a question asking what is the crucial battleground for COIN.

Please read the following passage about counterinsurgency operations from the video. Afterward, write a brief (1-2 sentence) summary addressing the question you missed.

**COIN and HUMINT**

As previously discussed, Human Terrain is the crucial battleground in COIN operations. This terrain includes human intelligence and knowledge of social networks, as well as cultural and ethnographical information. Because the human terrain changes constantly within the operating environment, it is yet another reason that intelligence gathering must be a systematic and continuous process.

This is where learners will enter their summary.

**Expert Summary**

To help you evaluate your understanding, here is an example summary generated by an expert:

The crucial battleground for COIN is the human terrain.

Please select how similar your answer is to the expert's answer.

Not similar    Moderately similar    Very similar

Save and Close    Cancel

Remaining space: 90 MB    y/ Test    Survey/ Test    Survey/ Test    Options