Interactive Scenario-Based Training:

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Battelle

Background

- **Problem**:
  - Much instruction focuses only on the most elementary level of abstraction: knowledge of facts (*procedural* knowledge).
  - Complex cognitive performance (e.g., information analysis; investigations requiring observations/evidence collection; decision making under stress) is strongly influenced by biases, habits, and limitations that should be addressed in training.
  - This requires higher level, more abstract learning and skill development.

Context for discussion: Benjamin Bloom's taxonomy* for the level of abstraction of learning content

- **Knowledge:** terminology, specific facts (e.g., identify, as in objective tests)
- **Comprehension**: understand meaning (e.g., summarize, give examples, generalize)
- **Application**: use knowledge in new situation (e.g., transfer of learning, instruct, predict)
- **Analysis**: break down into component parts (e.g., make inferences, discriminate)
- **Synthesis**: creatively apply knowledge/skills to produce a new or original whole
- **Evaluation**: judge the value of material (e.g., compare/contrast, critique)

*Bloom, B.S. (Ed.) (1956) *Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain*. New York ; Toronto: Longmans, Green. See also http://faculty.washington.edu/krumme/guides/bloom.html

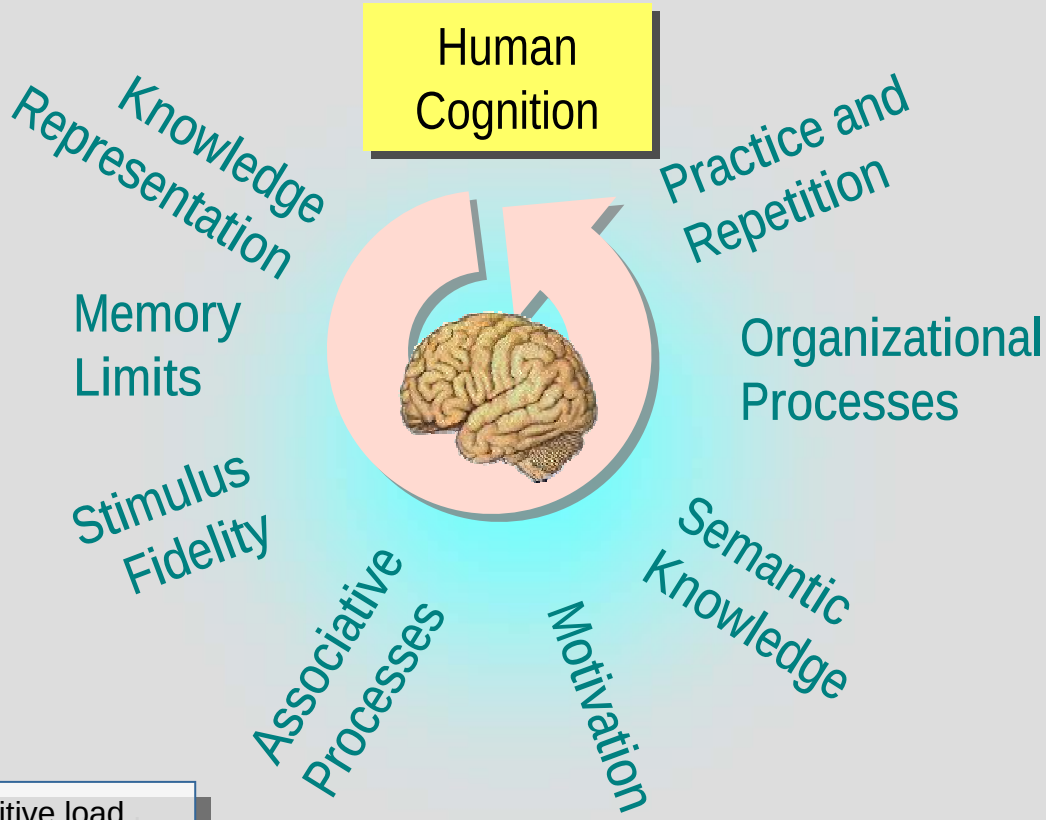
Innovative e-Learning Approach

PNNL has developed cognitive-based e-Learning solutions using two active learning paradigms:

- Interactive, scenario-based training
  - Applies cognitive principles to learner-centered training
  - Compels the learner to organize and structure responses to problems
  - Engages the learner using practical exercises that transfer to real-world activities
- Guided-discovery learning
  - An innovative form of experiential learning
  - Provides coaching and support while learners work on realistic problems adapted from actual work settings (scenarios)
  - As the learner gains knowledge, skill and understanding, the level of coaching is reduced.

Training Philosophy Based on Cognitive Principles

- Stimulate semantic knowledge
- Manage the learner's cognitive load
- Immerse the learner in problem-centered activities
- Emphasize interactive experiences
- Provide frequent and varied practice

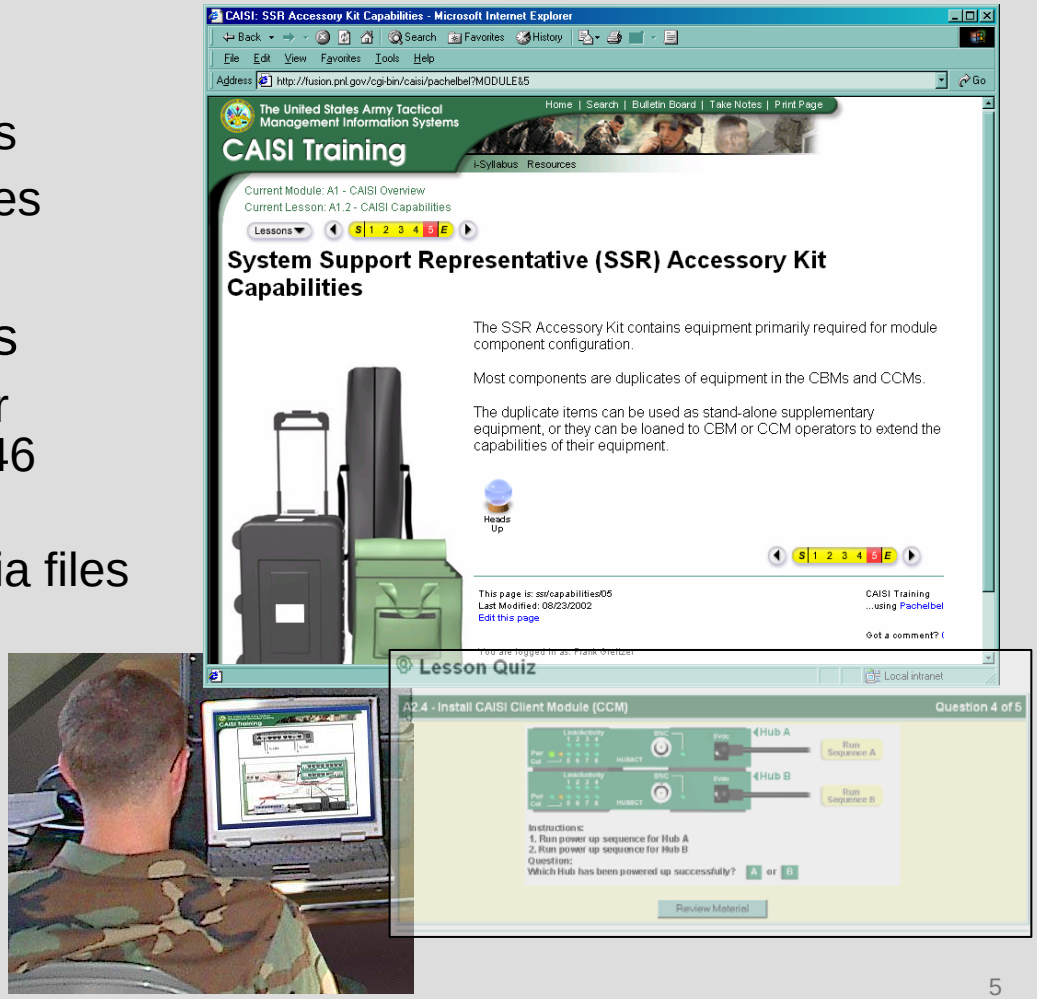


Challenge is to manage cognitive load
- Control difficulty
- Build from simple to complex
- Use part-task strategy
- Provide coaching

Interactive Scenario e-Learning Example

CAISI (US Army)—Combat System Support Automated Information System Interface

- Training required for set-up, operation and maintenance
  - Level I (orientation): 5 modules
  - Level II (advanced): 18 modules
- Multimedia/Interactive Features
  - 257 rendered images (static or animated) constructed from 146 individual 3-D models
  - 45 movie/interactive multimedia files
  - 25 interactive “Checkpoints”
  - Integrated exercise tests major learning objectives, including troubleshooting scenarios

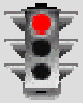


Building Blocks for Interactive, Scenario-based Training

Interaction Elements

Did You Know?

Heads-Up


Check Point

Interactive Quizzes

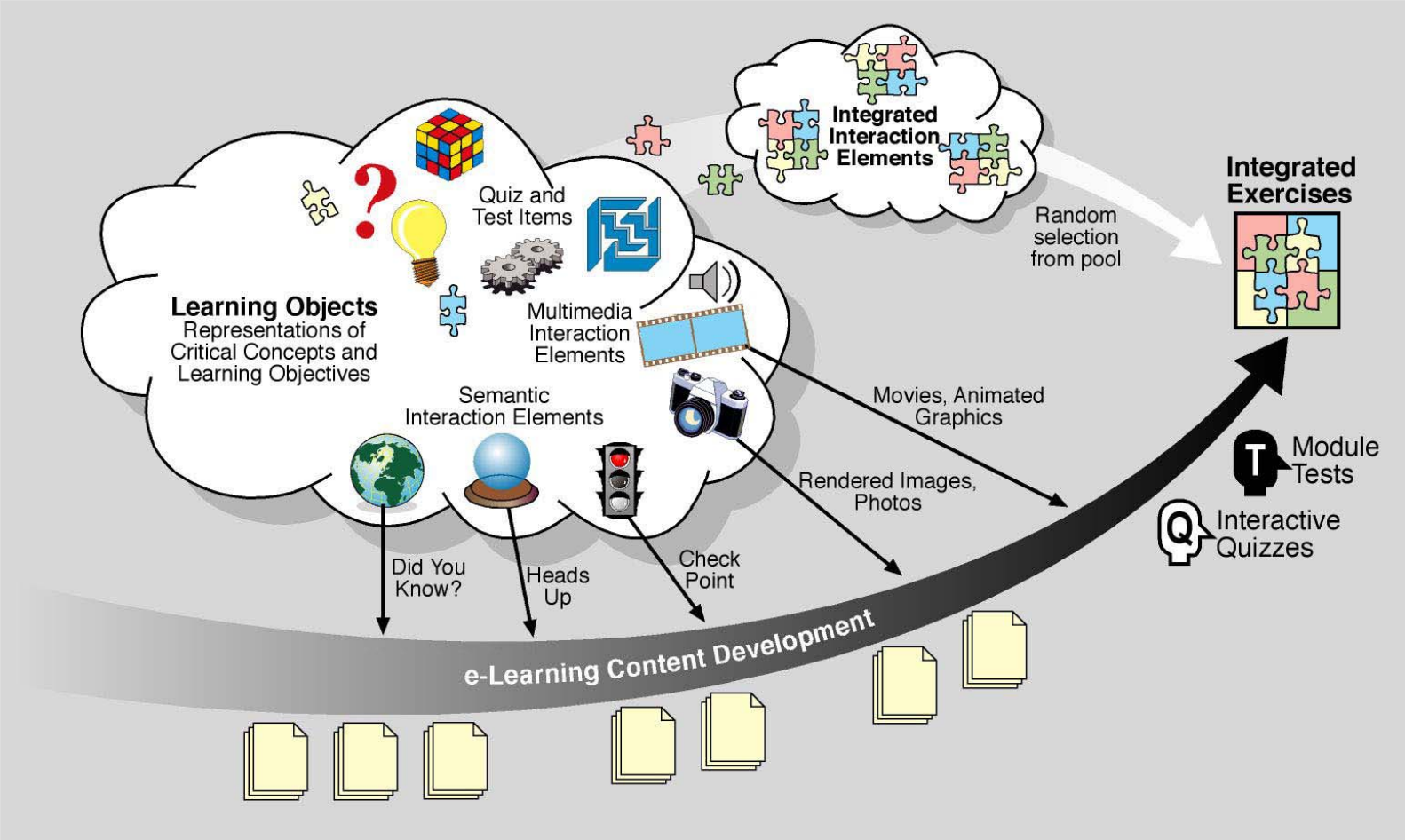
Module Tests

Integrated Exercises

- Allow learners to check their understanding
- Guide student practice with “worked” examples
- Also used in Lesson Quizzes and Module Tests
- Building blocks for integrated, practical scenarios

When we define learning objectives for these interaction elements, they become learning objects.

Conceptual Framework for Cognitive-based *e*-Learning



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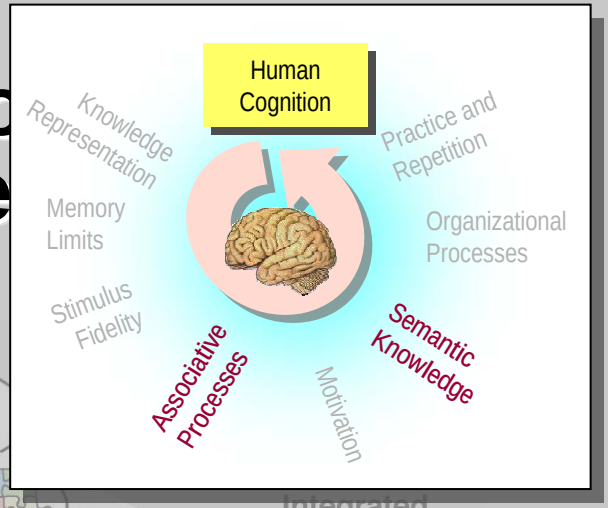
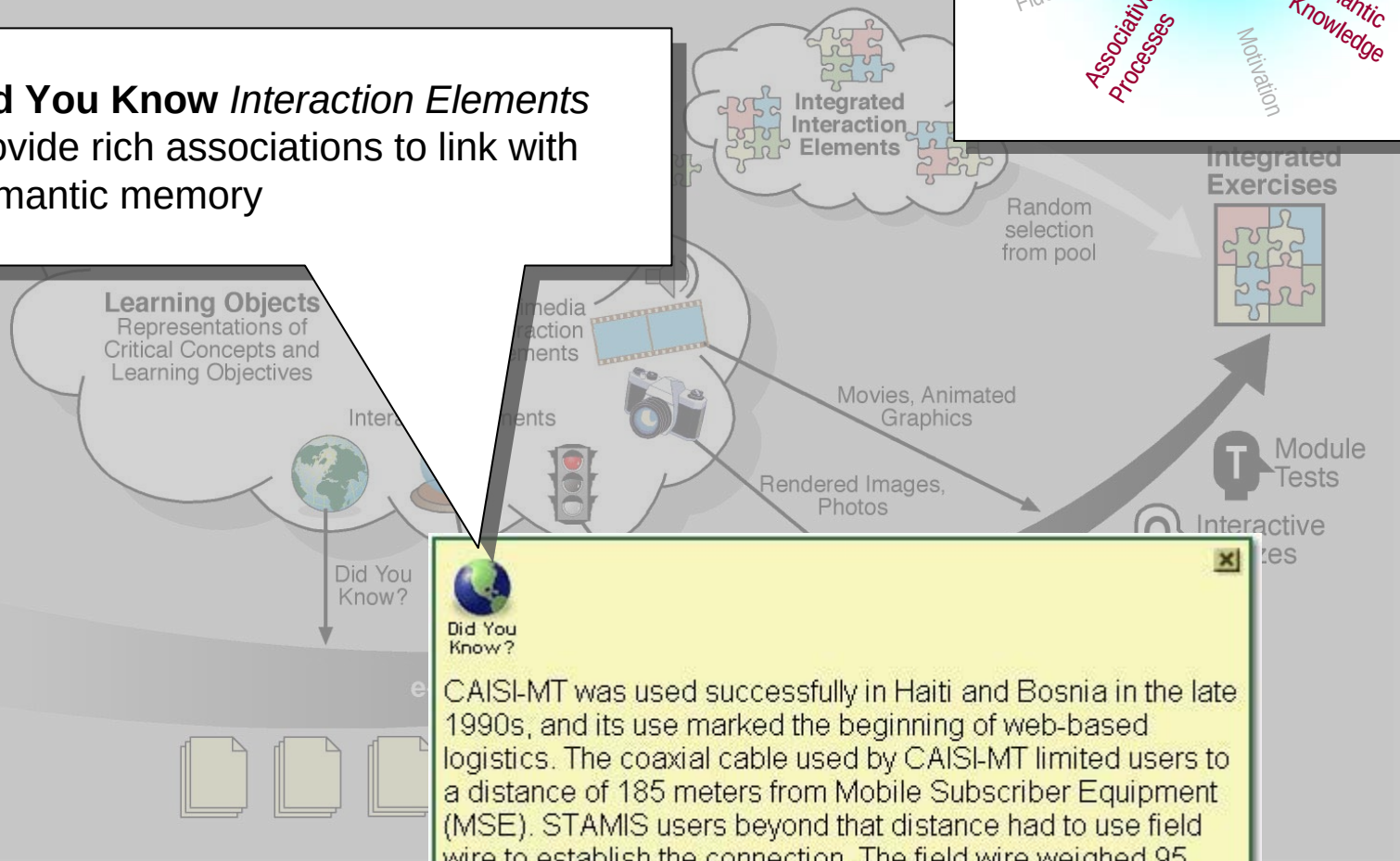


Did You Know *Interaction Elements* provide rich associations to link with semantic memory



Did You Know?

CAISI-MT was used successfully in Haiti and Bosnia in the late 1990s, and its use marked the beginning of web-based logistics. The coaxial cable used by CAISI-MT limited users to a distance of 185 meters from Mobile Subscriber Equipment (MSE). STAMIS users beyond that distance had to use field wire to establish the connection. The field wire weighed 95 pounds per mile and limited transmission to extremely slow speeds.

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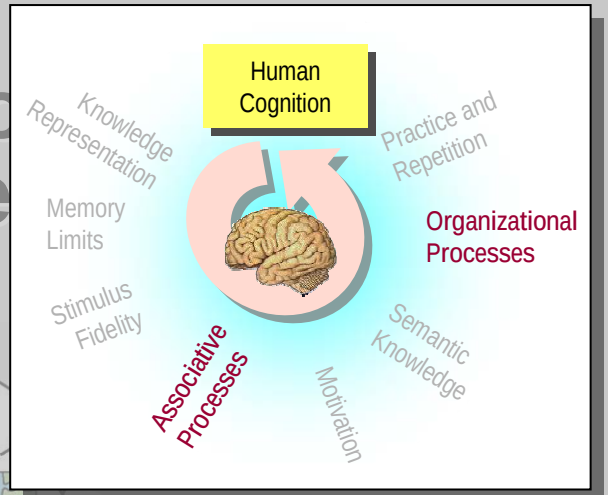

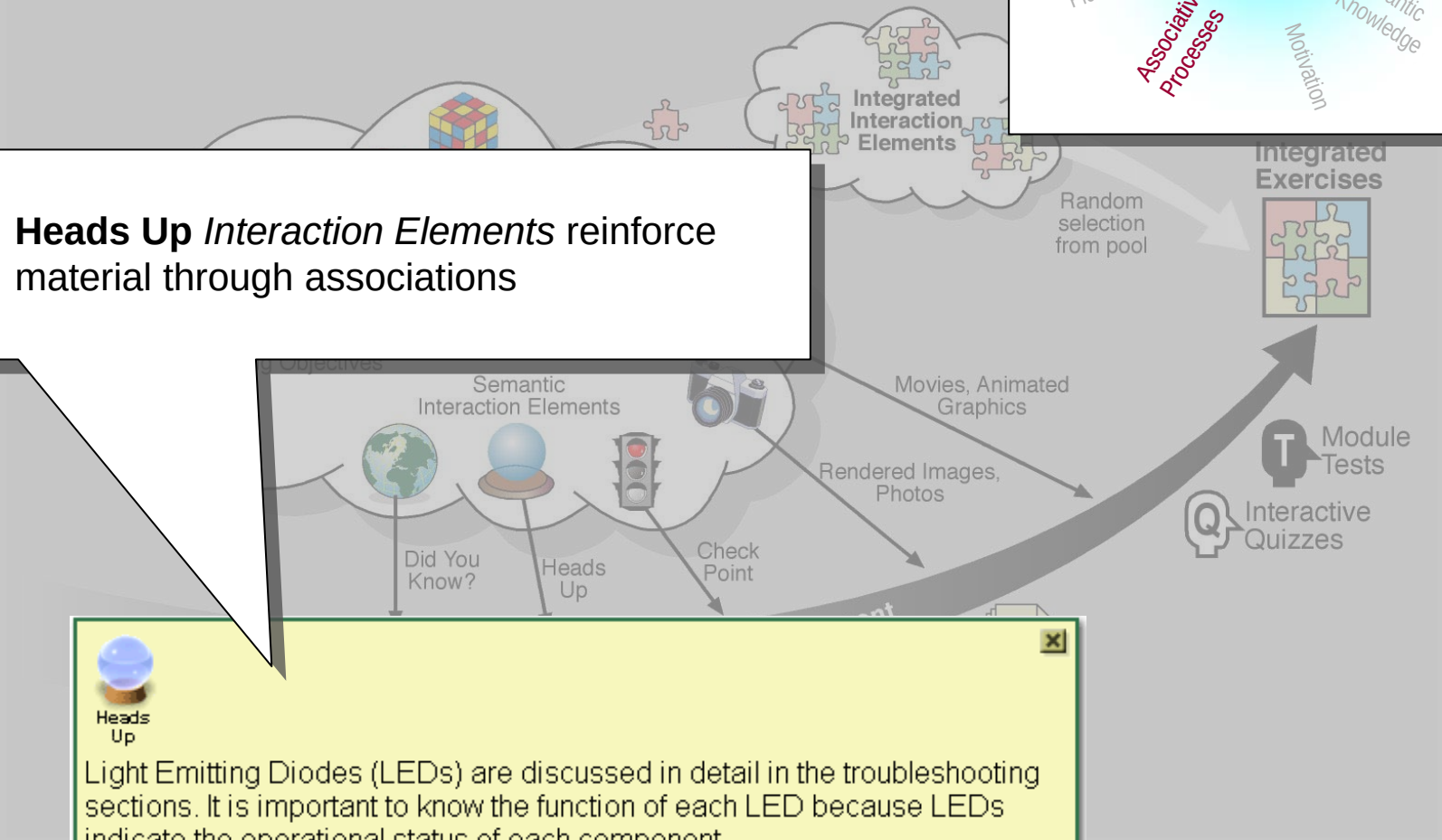

Heads Up *Interaction Elements* reinforce material through associations

Heads Up

Light Emitting Diodes (LEDs) are discussed in detail in the troubleshooting sections. It is important to know the function of each LED because LEDs indicate the operational status of each component.

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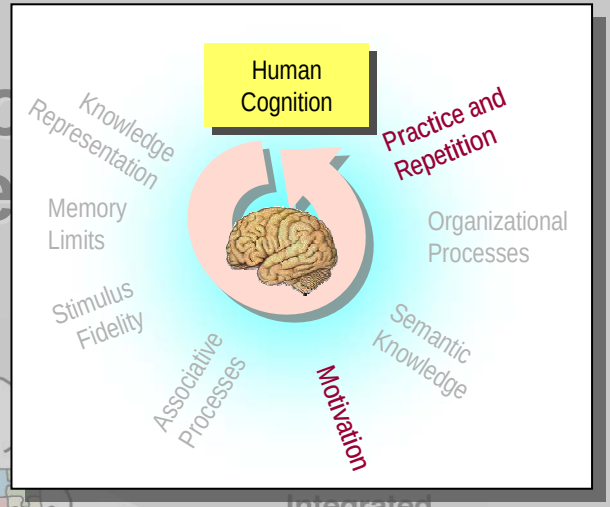
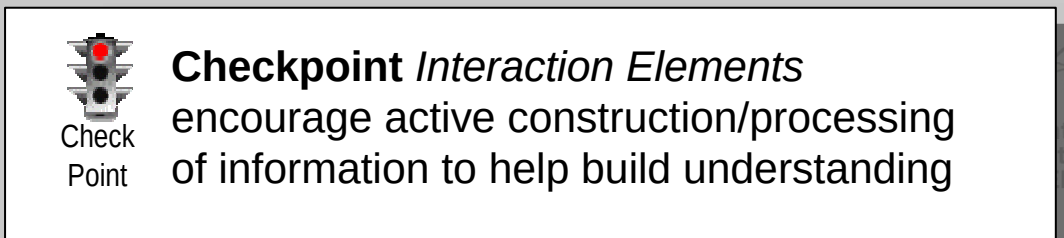
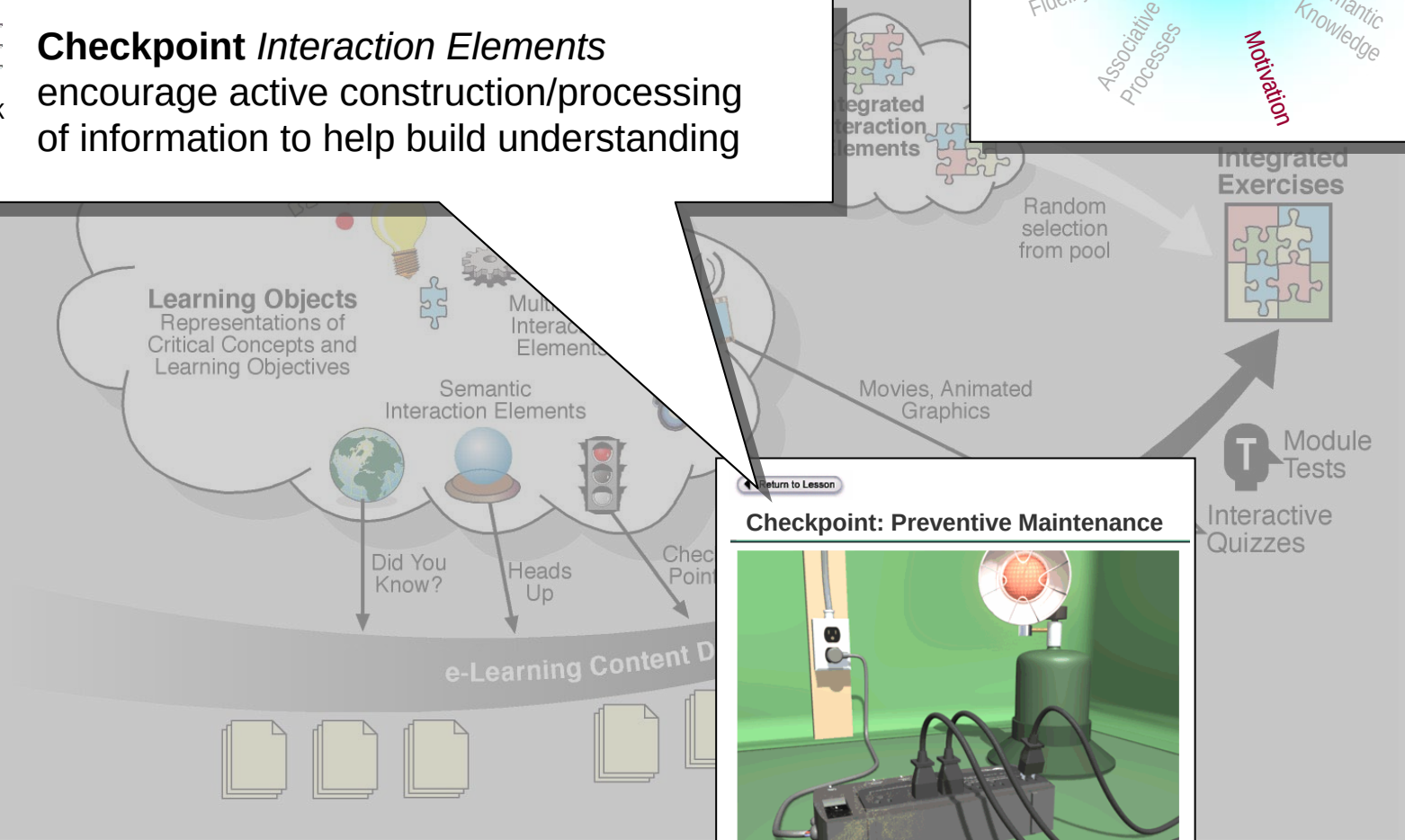
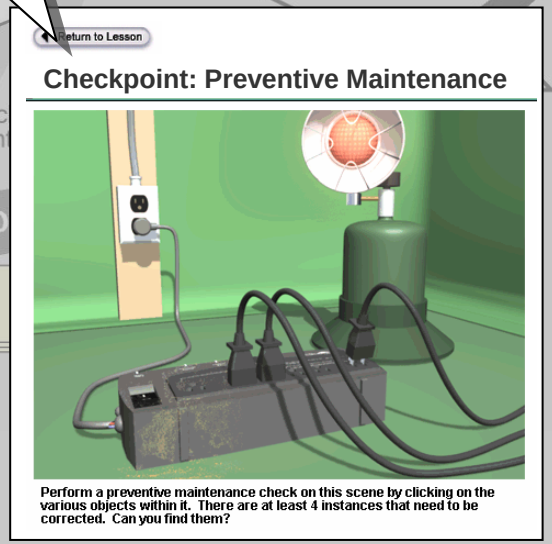




Checkpoint *Interaction Elements* encourage active construction/processing of information to help build understanding





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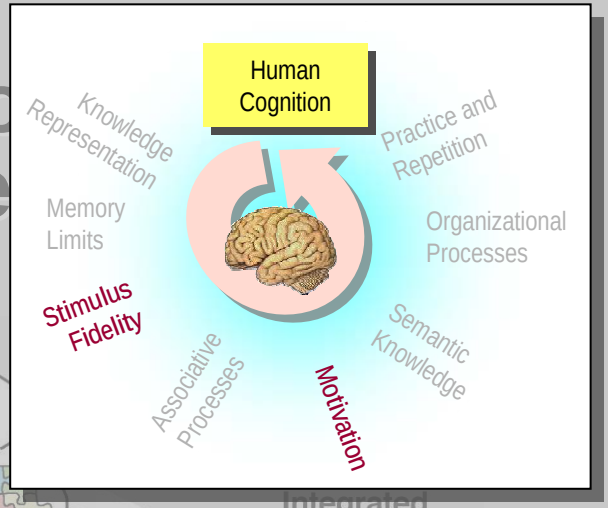
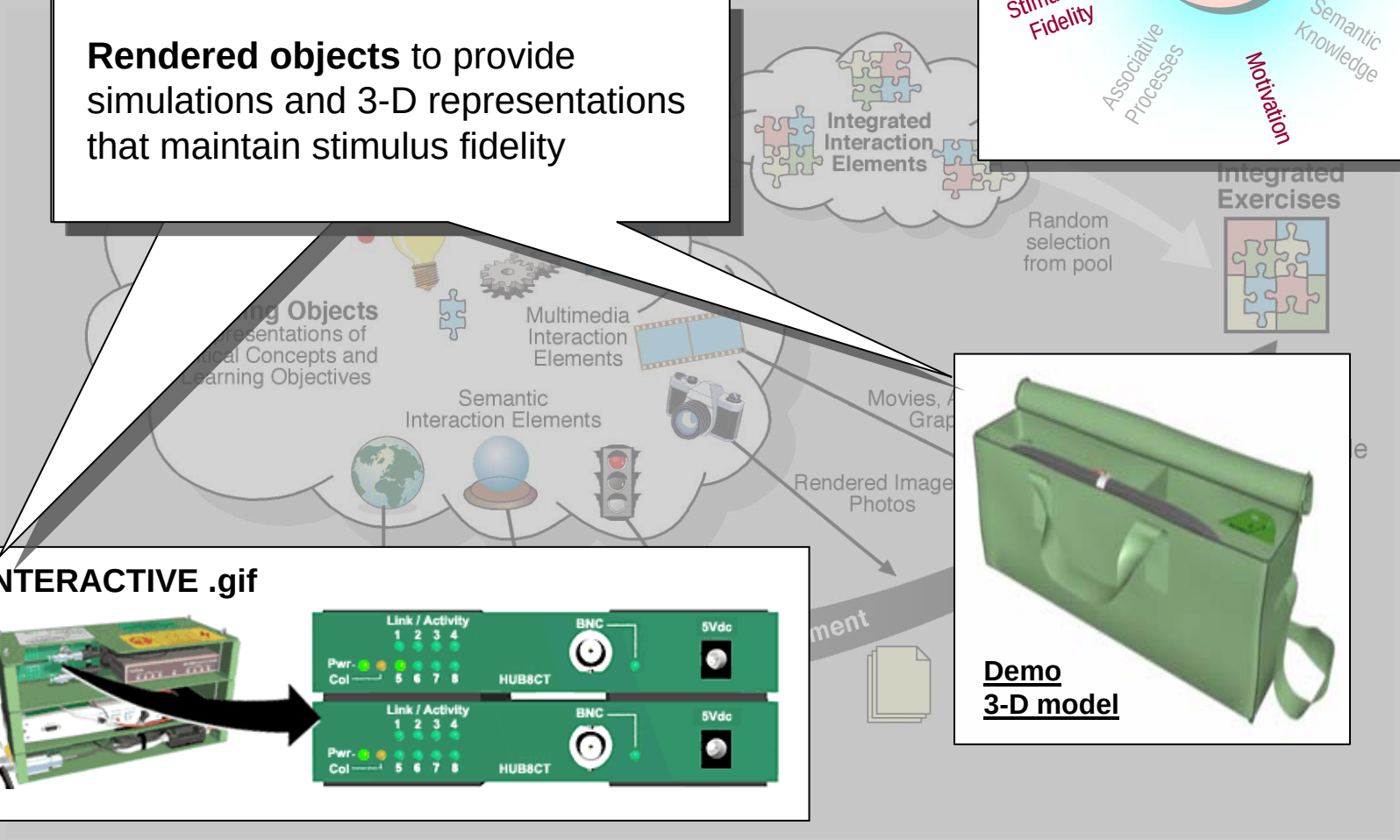


Rendered objects to provide simulations and 3-D representations that maintain stimulus fidelity



INTERACTIVE .gif

Demo
3-D model

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Example—Excerpt from CAISI Integrated Exercise

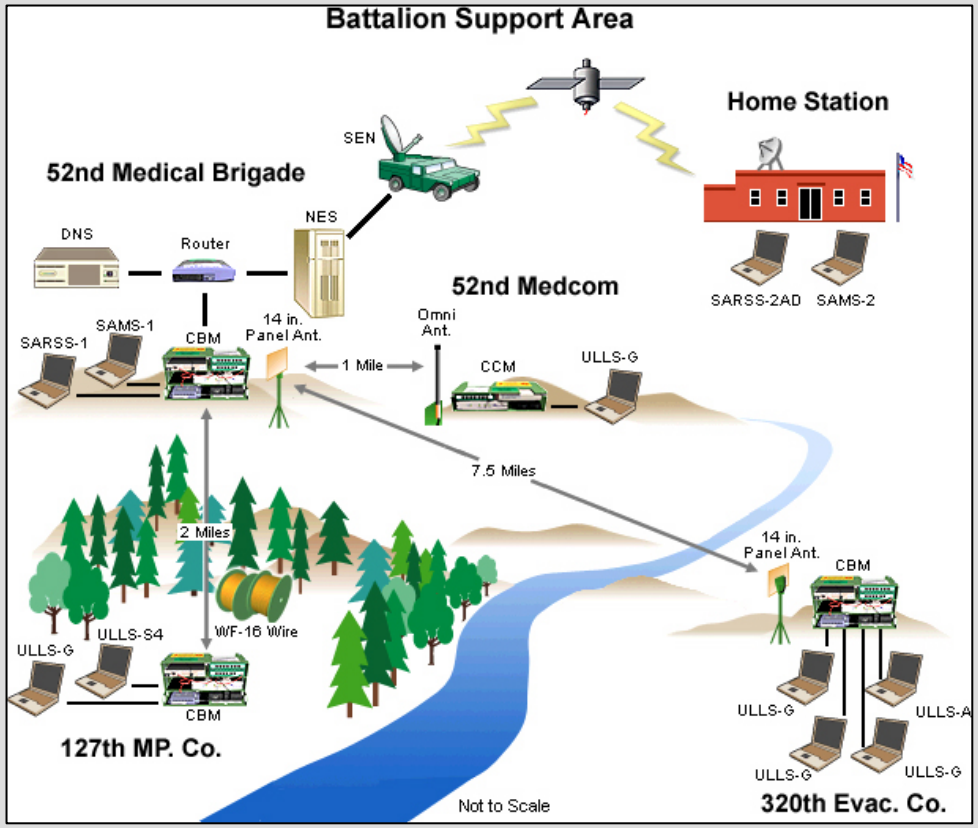
Troubleshooting: Restore Connectivity Between STAMIS Systems

Problem: STAMIS users located at the 127th MP Company report that they are not able to send data to the STAMIS system located at the 52nd Medical Brigade Battalion Support Area (BSA).

Action: Troubleshoot the problem and restore network connectivity between STAMIS systems.

Given: Existing terrain map and locations of units, CAISI equipment, and STAMIS systems.

Once you have inspected the equipment at various locations and conducted necessary troubleshooting, you should arrive at a conclusion about the cause of the problem. Please indicate the specific cause of the problem.

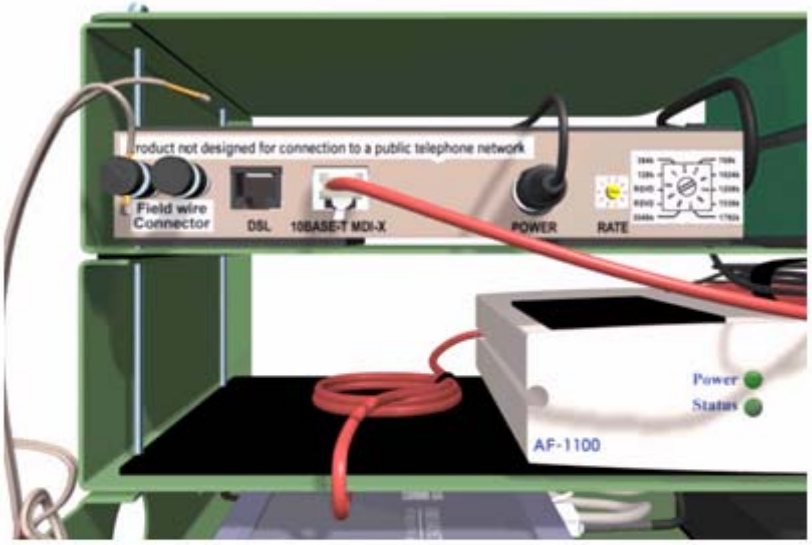


Example—Excerpt from CAISI Integrated Exercise (Continued)

Integrated Exercise:

Submitting answer to Troubleshooting Problem

- Student navigates freely to investigate/inspect hardware
- When the problem is identified, the answer is entered by filling in three fields:
  - Equipment with fault
  - Location of equipment
  - Problem that needs to be corrected



Found the problem?

When you're ready to answer, complete the sentence below and click "Submit Answer."

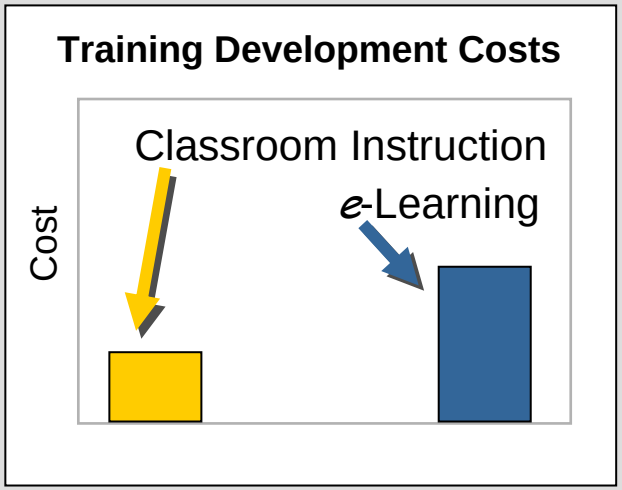
The WF-16 Field Wire at the 127th MP Company is Disconnected

Submit Answer

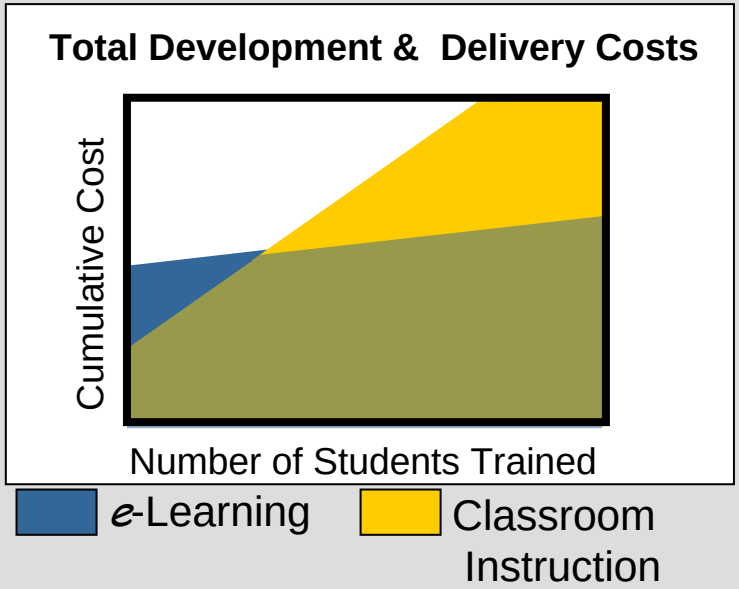
PNNL Learning Management Tools

- Pachelbel: Powerful e-Learning Development, Management, and Delivery System
  - Content development/editing tools provide reusable templates, interactions and materials
  - Adaptable content and delivery format tailored to learner roles
  - Tracking of learner's progress and transcript maintenance
  - Enhanced reporting features
  - Secure training delivery, back and forth through firewalls
  - Synchronous and asynchronous features
  - Web-based, standalone, and hybrid approaches to distributed learning accommodates multiple delivery platforms/environments
  - Export course material to reference version on CD
  - SCORM 1.2 conformant LMS, LCMS

Economic Comparison: Classroom Instruction vs. *e*-Learning



Classroom Instruction has *lower* development cost than ***e*-Learning**



But…

***e*-Learning's** *lower* delivery cost helps to make it's overall cost competitive.

- Economic benefit (Return on Investment) of *e*-Learning increases with number of students
- Advantage of distributed learning shows up relatively quickly as the number of students increases
  - Lower cost to deliver
  - Can train more students in a shorter time

Conclusions

This research thrust area illustrates the application of cognitive principles to student-centered, interactive scenario-based *e*-Learning.

- This innovative R&D has identified important research problems in an active area of research within government as well as potential industry clients or collaborators
- The training concepts may be applied to enhance instruction that is delivered in a classroom setting
- *e*-Learning is a cost-effect training method for delivering instruction to a large, distributed population of students in a relatively short time.

Contact Information

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