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Global Services

A Blended Approach to Adaptive Learning

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Present Day Learning

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- **Today's learning landscape hasn't changed in years**
  - One size fits all
    - Group paced and instructor led "Training-centric"
  - Expensive to operate
    - Higher costs associated with full time instructor staff and infrastructure

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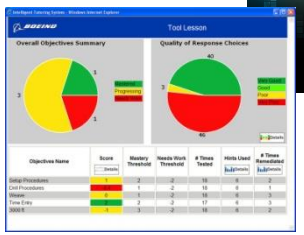
Future Learning

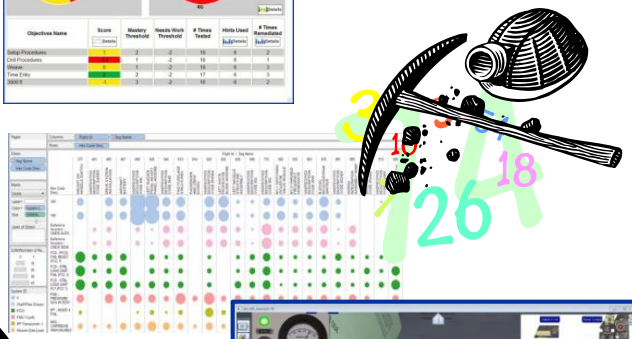
Requires a Paradigm Shift

Custom-Fitting of Instruction
- Self-paced and student led
- "User-centric"

Less expensive to operate
- Fewer instructors required, training at point of need, not all training needs to be completed in schoolhouse

Providing:
- Careful Measurement
- Instant Insight
- Direct Correlation of
  - Actions
  - Consequences
  - Performance
  - Competency





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ARL/Boeing CRADA

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Year 1

- Work to understand the adaptive training capabilities of the Boeing ITS and the GIFT architecture
- Determine an approach to integrate these two adaptive learning capabilities
- Demonstrate the viability of this concept through the development of an integrated adaptive prototype
- Define experimental design for Year 2 effectiveness study

Year 2

- Conduct an effectiveness study to quantify the benefits of the adaptive capability
- Analyze study data

Year 3

- Implement suggested architectural changes based on study data

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Generalized Intelligent Framework for Tutoring (GIFT)

A free, modular, open-source tutoring architecture to:

- capture best tutoring practices and support rapid authoring, reuse and interoperability of ITSs
- lower costs and entry skills needed to author ITSs
- enhance the adaptiveness of ITSs to support self-regulated learning (SRL)

- **ontology**
- **tools**
- **methods**
- **standards**
- **exemplars**

Powered By GIFT
Generalized Intelligent Framework for Tutoring
www.GIFTtutoring.org

- Automated Authoring
- Automated Instruction
- Accurate Learner Modeling
- Accurate Domain Modeling
- Evaluation Tools

Adaptive Training Systems

- Adaptive
- Affordable
- Effective

- Gritty
- Flexible
- Collaborative
- Critical Thinkers

BOEING ITS Overview

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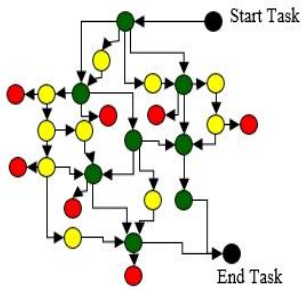
An Intelligent Tutoring capability that models the student and expert-level solutions to training exercises in order to provide personalized, task-specific instruction

Expert Model

- Allows system to solve problems
- Approach
  - ✓ Model solution paths
  - ✓ Encode rationales for and implications of actions

Student Model

- Estimates student's understanding
- Approach
  - ✓ Maintain dynamic profile of proficiency scores against learning objectives



Instructional Model

- Allows system to implement interventions
- Approach
  - ✓ Manage sequence/selection of training activities
  - ✓ Manage hints and feedback on actions
  - ✓ Summarize performance

- Real-time student performance tracking on multiple learning objectives
- On-demand lesson help
- Customized feedback
- Within-lesson remediation
- Personalized learning experience

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Approach

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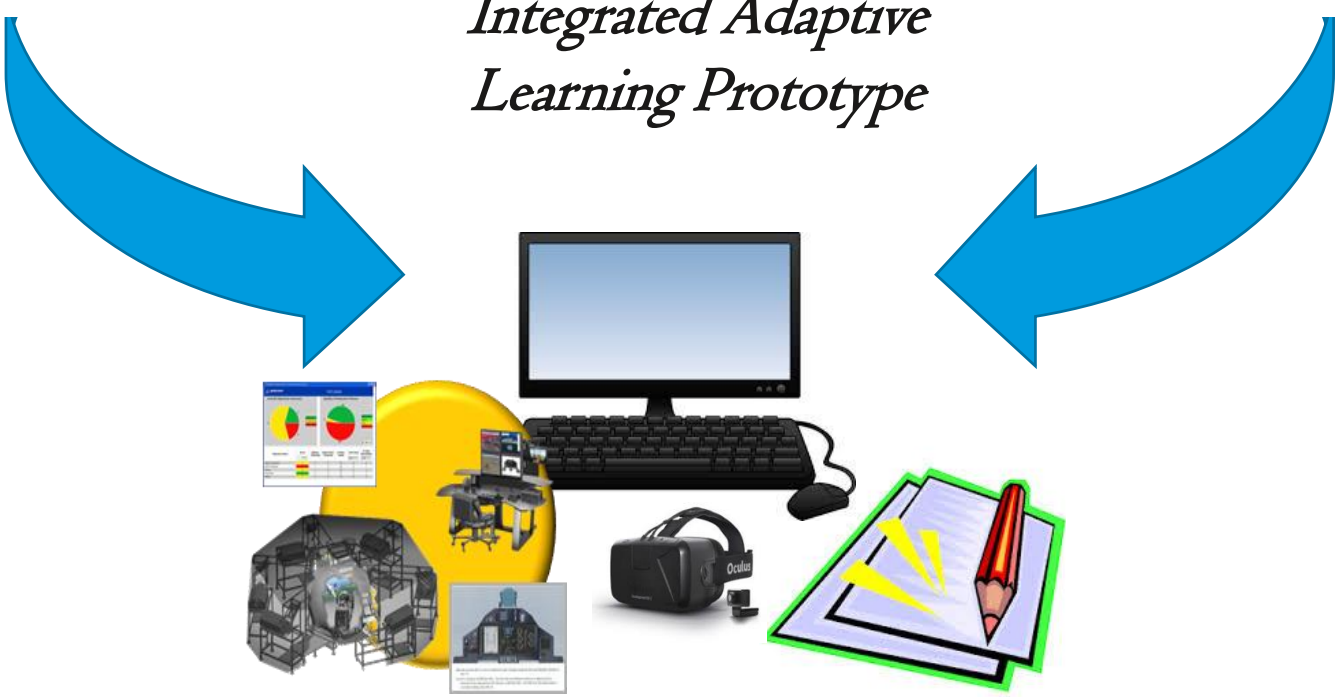
BOEING ITS

Integrated Adaptive Learning Prototype



Combines aspects of both adaptive learning approaches into a blended personalized experience

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Training Task Environment

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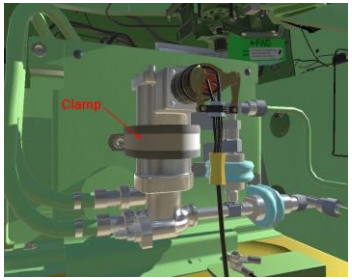
P-8 Windshield Washer Pump Fault Diagnosis and Repair

GIFT Learning Concepts

Electrical Safety

Multimeter Use



Fault Diagnosis Procedures

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Integrated Prototype Overview

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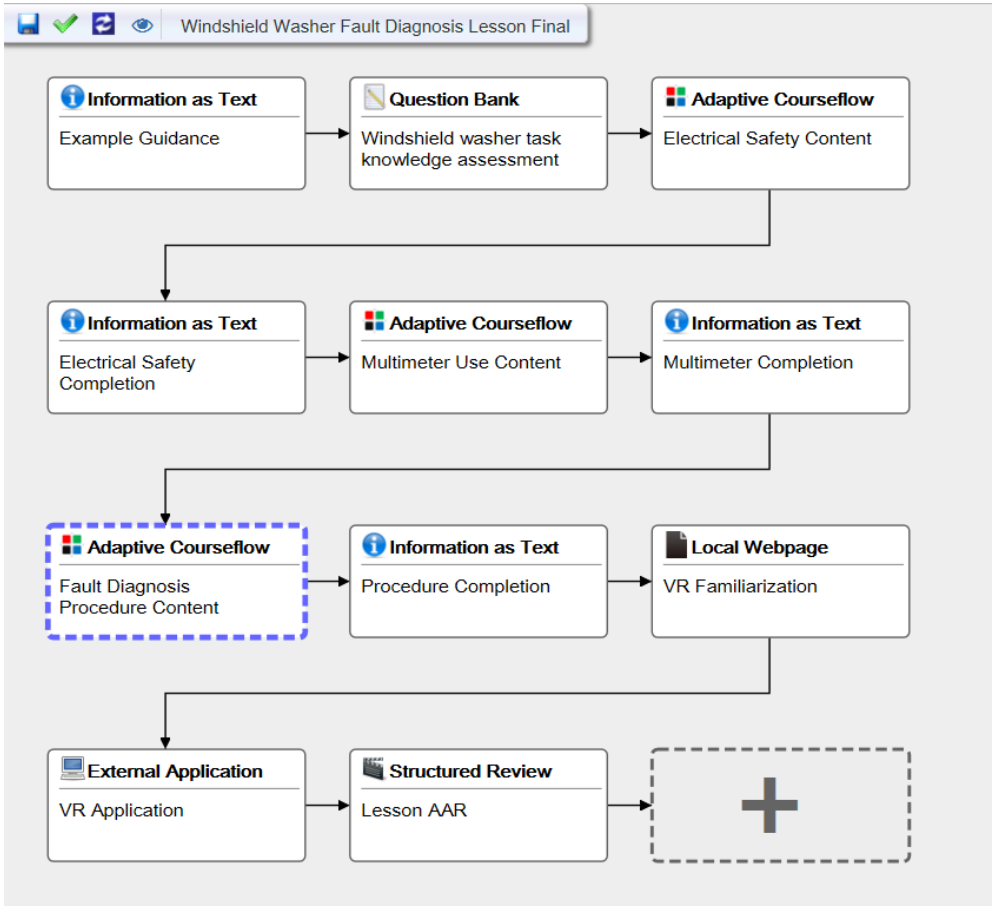

GIFT Functionality

- Lesson Flow
- Knowledge Assessment
- Adaptive Courseflow Modules
- Underlying EMAP Concept Sequencing (Merrill's Component Display Theory)
  - Rules
  - Examples
  - Recall
  - Practice

BOEING ITS Functionality

- Tailored Practice within each Adaptive Courseflow Module
- Final Practice Module within External Virtual Reality Environment

Scoring and lesson sequencing flowed seamlessly between the two environments

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Integrated Prototype Overview

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Immersive VR Environment for final task performance

- Automatically launched by GIFT
- Students provided with tutorial on interaction within VR
- Performance within VR practice environment is scored and student receives pass/fail grade
- Grades and completion sent back to GIFT

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Integrated Prototype Overview

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- Plans to evaluate adaptive training approaches are in work
- Evaluation using West Point Cadets
- Differing ITS Methods
  - GIFT alone with EMAP personalization
  - Boeing alone using focused ITS interactions
  - Blended GIFT/Boeing Prototype leveraging both pedagogical methods
- Prior Knowledge
  - High knowledge
  - Low knowledge
- Potential to consider additional personalization methods
  - Motivation
  - Feedback

Notional Experimental Design		Prior-Knowledge	
		High	Low
ITS Methods	GIFT Alone	X	X
	Boeing Alone	X	X
	GIFT/Boeing	X	X

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Conclusions and Lessons Learned

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Lessons Learned

- Similarities in approaches to optimization of learning experience by adapting to student strengths/weaknesses
- Differences in how performance assessment was used to adapt lesson
- Able to merge the two approaches into a lesson that was seamless from the student perspective
    - GIFT for initial knowledge assessment and lesson sequencing
    - Boeing ITS for within-module assessments and practice, detailed remediation
    - Interfaced with external Unity-based application

Challenges

- Different approaches to student assessment and adaptivity
- Long-term student record persistence needed in GIFT
- Cannot remediate back to adaptive learning module within a lesson once mastered
- No GIFT standard for external application communication – custom gateway creation
- Usability issues: bugs, size limitations, proxy conflicts, authoring documentation
- Technology obsolescence of lesson content

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