Integrating Serious Games into Recruit Training

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Future Naval Capability (FNC)

Capable Manpower Program

Tools for Game-based Training and Assessment of Human Performance

- Virtual Environments for Ship and Shore Experiential Learning (VESSEL)
Project Team

**Team**

- BBN Technologies
- University of Central Florida
- Intelligent Decision Systems, Inc.
- Alion Science and Technology
- CHI Systems
- i.d.e.a.s. Learning
- Potomac Institute for Policy Studies

**Customer**

Naval Service Training Command
- Mr. Rodney Chapman,
  Chief Learning Officer (N9)

Office of Naval Research
- Ray Perez
- Amy Bolton
- William Krebs

**Partner**

UCLA CRESST
Recruit Training Command

- Great Lakes Naval Training Center
- 40,000 recruits per year
- 8 week curriculum
- Battle Stations 21
Address Game-Based Training Weaknesses

- Little empirical data supporting training effectiveness
- Insufficient attention to pedagogical design
- Lack of good performance measures
- Largely deficient in embedded assessment
- Lack of systematic methods for developing game-based training
- Low content re-use coupled with high product development and life cycle costs


Advance the Science of Game-Based Training

- Improve understanding – via empirical studies – of learning benefits of game features
- Improve understanding of the particular challenges in designing pedagogically effective games
  - Comprehensive model for game-based training
  - Guidelines for instructional designers
- Improve understanding of how performance assessments can be obtained within games and how games can be used as assessment instruments.
  [CRESST – Cognitive Readiness]

Cannon-Bowers & Bowers, 2007

Advance the Technology of Game-Based Training

- Improved authoring capabilities
  - Enable repeatable design methods with increased re-use of pedagogical logic
  - Embedded pedagogical design support
- Improve real-time instructional capabilities
  - Extensible pedagogical logic execution engine that is gaming platform independent
- Improve embedded assessment capabilities
  - Infrastructure for enhanced access to in-game performance data to support assessments
  - Enable plug-in assessment components

Advance the State of the Art of Game-Based Training in the Navy

- Develop deployable, open-source game-based trainers for recruits and Sailors
  - Embed science and technology advances
  - Validated learning benefits for recruits to support Battle Stations 21 preparation
- Demonstrate feasibility of technology for use in recruit training, technical schools and officer training

BS21 Performance Measurement and Execution Analysis Report, HPC-NSTC detachment (Feb 15, 2008)
Flooding Control Trainer

Demonstration
Instructional Methodology

- Optimally guided discovery within a game-based environment, progressing through levels of increasing challenge

Training Session

Before

Priming
High-level framing

Performance summary
Individual development plan

After

Naturalistic interactions in a virtual world
Performance-based feedback & guidance
Consequences of actions reinforced
Access to information

During
Instructional Progression

- Optimally guided discovery within a game-based environment, progressing through levels of increasing challenge

Game levels (Missions)

- Amount of scaffolding
- Complexity of situations
- Difficulty of learning objectives
- Severity of consequences

• Tensions
  - Game play vs Instruction
    - If and when to intervene instructionally
    - How much scaffolding?
  - Positive vs Negative Feedback
  - Immediate vs Delayed Feedback
  - Mastery vs Performance
  - How much narrative?
Study 1a. Usability

- **What question were we trying to answer?**
  - *Can recruits of all backgrounds use the game?*

- **How did we study it?**
  - *We conducted a usability study with 80 recruits at RTC Great Lakes. We used standardized usability measures to assess several aspects of game play.*

- **What did we find?**
  - *Usability results were very positive. There were no differences associated with any background variable.*
Overall Evaluation

Evaluation (9 = Highest)
Usability Ratings
Focus Group Comments

“In Battle Stations, you don’t get to navigate unless you are team leader so this really helps to learn that.”

“I re-tried the mission 2-3 times and the debrief summary really helped me figure out where I screwed up.”

“I think I learned to reiterate and understand more about communication, safety, and equipment. This gave me insight into what is expected of you.”

“We would have been more prepared for Battle Stations 21.”

“When I was in Battle Stations, I forgot certain things and this helped me learn to pay attention to details.”

“It would be fun to compete.”

“We had to do a lot of decision making.”

“It put a smile on my face. It was pretty fun.”

“You are having fun while learning.”

“It made me want to try and do better.”

“I would play this again because I could actually do it and I can’t play most video games.”
Study 1b: Pre-training Intervention

- What question were we trying to answer?
  - Can an educational intervention before game play improve the perceived effectiveness of the game?

- How did we study it?
  - Using the same sample as 1a, we compared the learner’s perception of effectiveness in a group that received a pre-game “refresher” training session compared to those that did not.

- What did we find?
  - Participants that received training reported that the system was more usable, and more likely to be an effective training approach.
Pre-game training improved in-game performance

![Bar chart showing performance improvement between trained and control groups. The trained group has significantly higher performance.](chart.png)
Study 2: Training Transfer

- What question were we trying to answer?
  - Do elements taught in the game transfer to the operational environment?

- How did we study it?
  - We have started a study at RTC Great Lakes comparing game-trained vs. non-trained participants in a Battle Stations 21 scenario.

- What did we find?
  - Preliminary data suggest that participants who received the game…
    1. Made fewer “critical errors”
    2. Made fewer communication errors
    3. Found the assigned compartment much faster
## Research Plan

### Pre-training Factors
- **Narrative Structure**: X X X
- **Pre-Training Attitude**: X X
- **Interventions**: X X

### Learner Characteristics
- **Prior Gaming**: X X X
- **Gender**: X X
- **Goal Orientation**: X X X

### Game Characteristics
- **Competition**: X X
- **Personalization**: X X X X

### Instructional Features
- **Worked examples**: X+
- **Scaffolding**: X+
- **Feedback**: X X X X X

### Validation Studies
- **Flooding control trainer**: X
VESSEL Infrastructure

Open-Source, Platform-Independent, Extensible, Reusable, Authored Instruction

DARWARS DTECS (Web Services) - Integrated

Performance Reports

Instructional Components (Plug-Ins)
- Assessor
- Assessor
- Pattern Analyzer
- Coating Model
- NavyPedia
  Didactic Content Help System (XML)

Instructional Runtime Engine (Java)
- Instructional Logic Engine Completed
- Plug-In Infrastructure Completed

Instructional Authoring Tool (Java)
- Instructional Representation Defined
  Initial Editor Completed
- UI Focus Groups: April 2009

Platform-specific Bridge

Observations

Control Actions

Flooding Control Trainer (Delta3D) - Integrated

Assessment Prototyping Environment (Truevision3D) Integration: May 2009

Integration Prototyping Environment (jMonkeyEngine) - Integrated

Recruit Training – GAMETECH 2009
Coming Events

- **Additional Flooding Control Trainer levels – May**
  - VESSEL Infrastructure
  - Tutorial level (Navigation)
  - Navypedia
  - Job aid (miniMap)

- **Full-scale validation study (N=30) – April**

- **New trainer, new domain – September**
  - Damage Control, Bridge Watch, CIC, …
Publications

