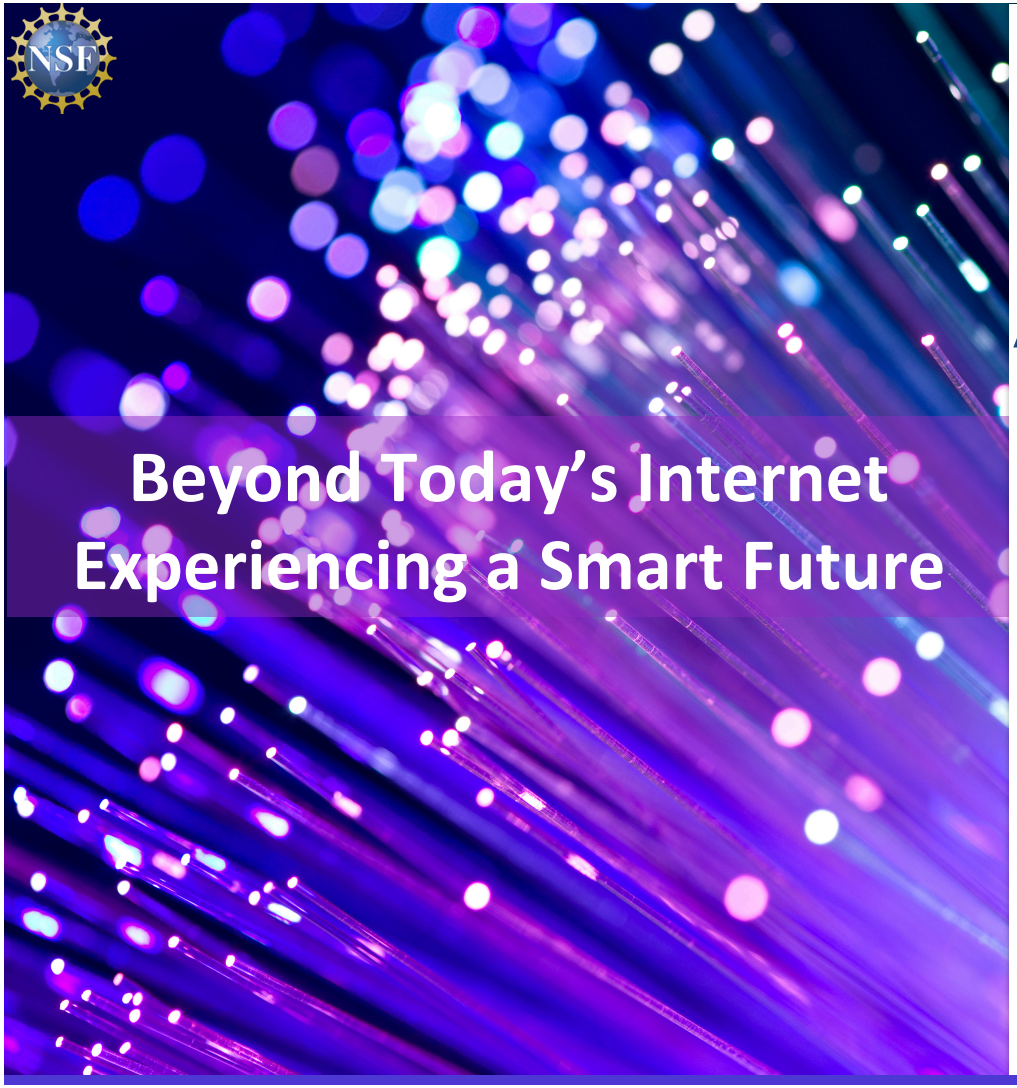


A Glimpse into the Future of STEM Education

Leslye Arsht – StandardsWork, Inc.
Mark Torpey – Lockheed Martin
Robert Chadwick– ADL Labs
Vicraj Thomas - BBN GPO

Leslye Arsht

Vicraj Thomas

Robert Chadwick

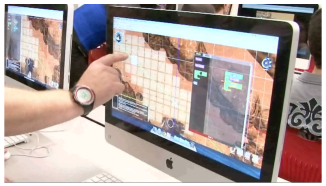
Mark Torpey

GENI and US Ignite: STEM Initiatives

K-12

PlanIT: SimCIty like game set in students' own city

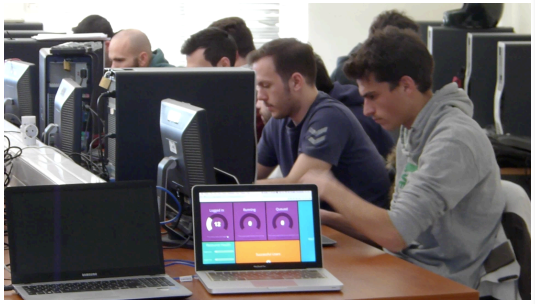
Bringing scientific instruments into the classroom virtually



Immersive 3D environments for problem solving

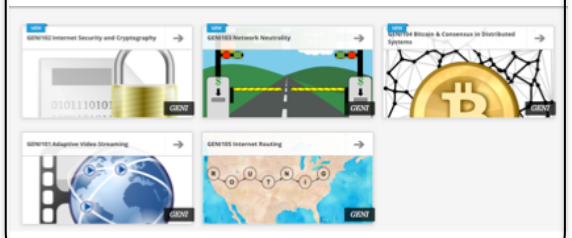
Grad/Undergrad

GENI as a remote, virtual lab for networking, distributed systems and cloud computing classes



Community

GENI based Massive Open Online Courses (MOOCs) for the masses



3D Immersive Environment: The Mars Game

K-12

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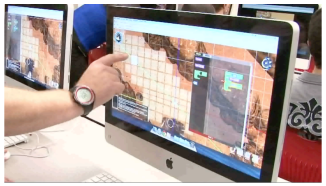
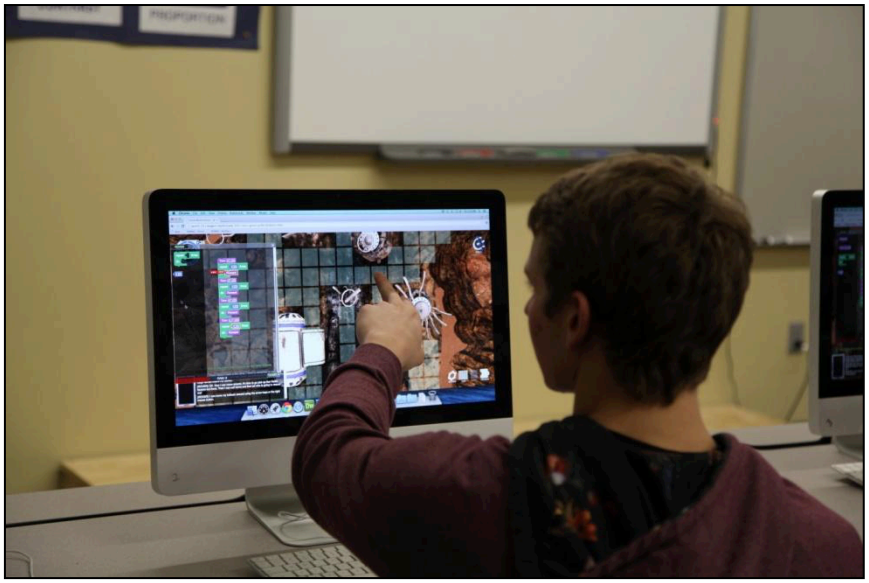


Immersive 3D environments for problem solving

- Demo: Mars Game
  - Teach math and programming at the high-school level
- Demo leaders
  - Leslye Arsht, Education Innovator
  - Mark Torpey and Rob Chadwick, Game Architects
  - Dr. Barbara Freeman, Lead Researcher

Mars Rover Game

Mars Rover Game



Hypothesis and Goal of Pilot Study

HYPOTHESIS

Games can be used to effectively impart STEM knowledge. Inherent in the hypothesis is the belief that directly engaging students as players immersed in the game-play will help students learn better.

GOAL

Evaluate if the Mars game prototype is:

[Engaging] *It is immersive.*

[Effective] *Learning happens in the areas of mathematics and programing.*

[**STEM:** To capture the importance of math and programing to the fields of engineering and career pathways.]

Frank DiGiovanni

Director, Force Readiness and Training
Office of the Deputy Assistant Secretary of Defense

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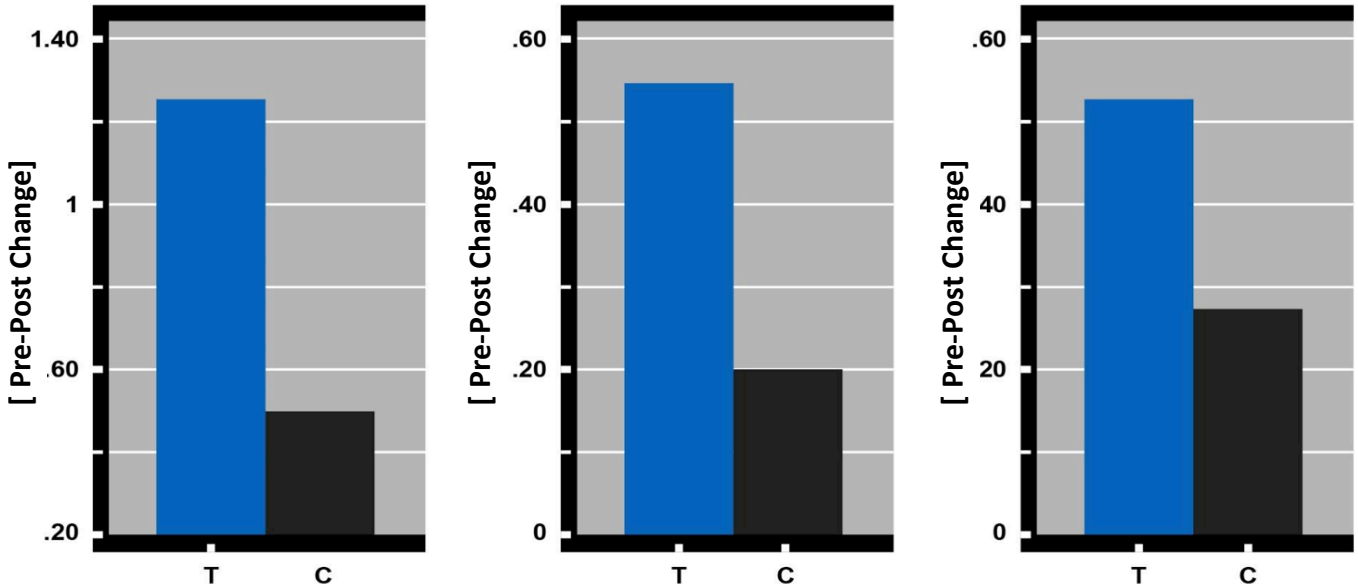
Pretest/Posttest Changes by Condition

Learning Outcomes

[T] Treatment: (N71) [C] Control: (N=69)

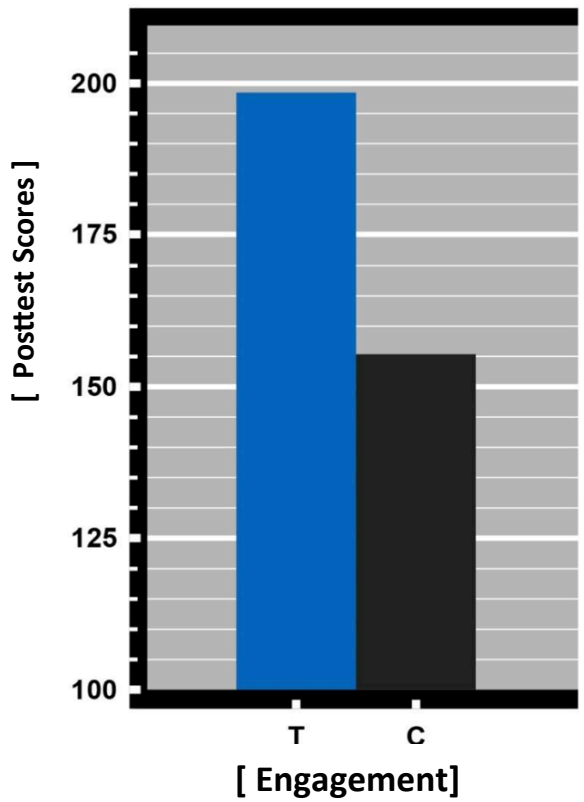


[BM Learning]
Score Range: 0-14

[Math]
Score Range: 0-11

[Programming]
Score Range: 0-3

Engagement Posttest Scores by Condition



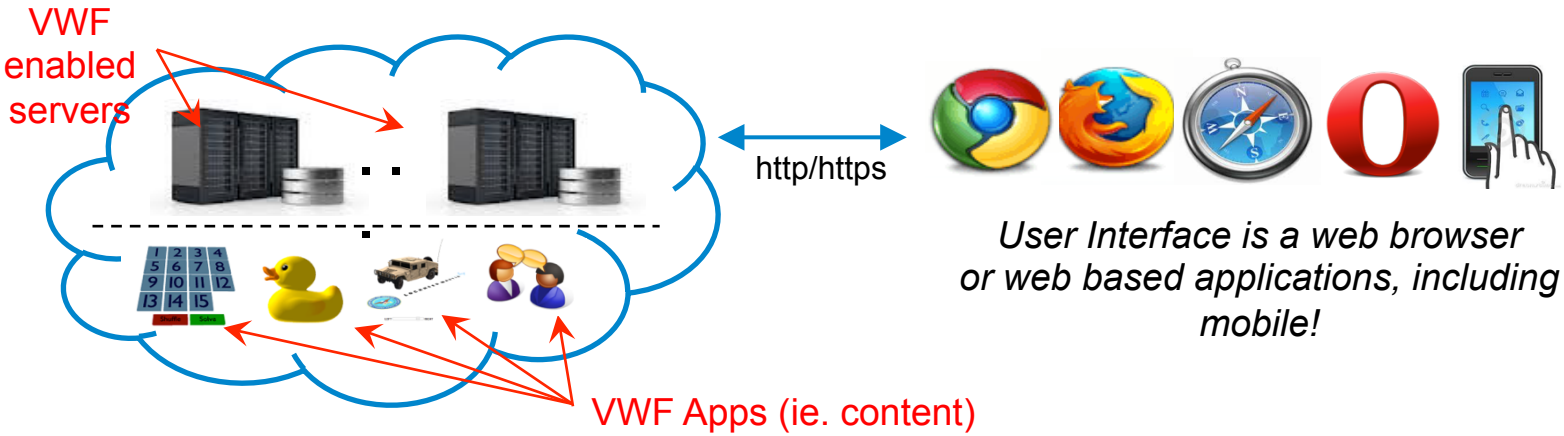
[T] Treatment: (*N*=69)

[C] Control: (*N*=68)

Score Range: 0-294

Live Demonstration

Virtual World Framework



- VWF is open source web server **software and a client framework** that ties together:
  - **HTML5** (next generation markup language of the web)
  - **WebGL** (high performance 3d graphics)
  - **WebSockets** (high-speed low-latency point-to-point networking)
  - **COLLADA** (3d model specification aids re-use and interoperability)
  - **ECMAscript 5** (aka JavaScript, the language of the web)
  - **XML, JSON,** and **YAML** (world definition and data transfer)
  - **WebRTC** (real-time communications using webcams)

VWF + Mars Game

Zero install:

- no privileges or plugins required

Open Source:

- source code is available via GitHub

Past focus was a single player experience.

Current / ongoing focus adds more game-play, more learning content, and some collaboration.

Future focus includes multiplayer collaboration, as well as more learner/tutor collaboration.

VWF + Mars Game + GENI

- GENI enables a “locavore” approach to support our distributed (and eventually collaborative) studies, maximizing the user experience
  - Can quickly instantiate game servers close to the study participants
  - Can scale up or down with more resources as needed
  - Enables thin client applications
- VWF applications are sensitive to network latency and bandwidth
  - Constant network communications between the clients and server, and between clients and clients

Study Testimonials

Dr. Barbara Freeman, Lead Researcher, Mars Game
Graduate School of Education
University of California, Berkeley

School Principal and Teachers

For More Information

- Tutorial: *Building Virtual Environment Experiences with the Virtual World Framework;* **Wednesday 1:30-3:30**

- http://virtual.wf
- http://themarsgame.com
- https://github.com/virtual-world-framework/mars-game

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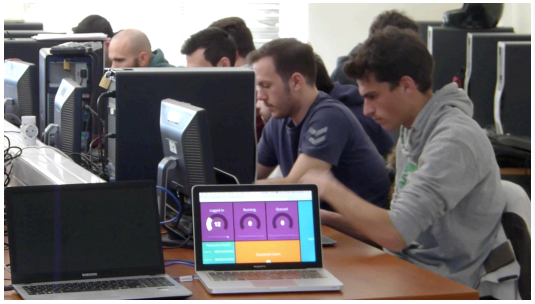
robert.chadwick.ctr@adlnet.gov

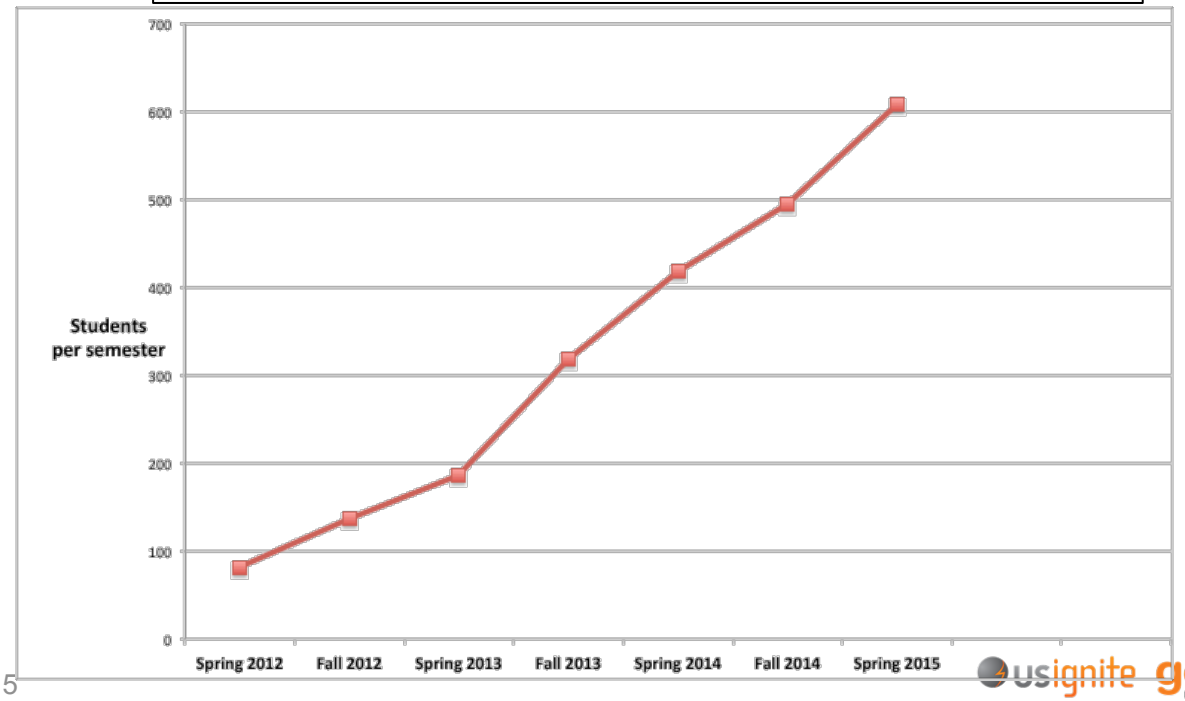
GENI as a Remote Virtual Lab

Grad/Undergrad

GENI as a remote, virtual lab for networking, distributed systems and cloud computing classes

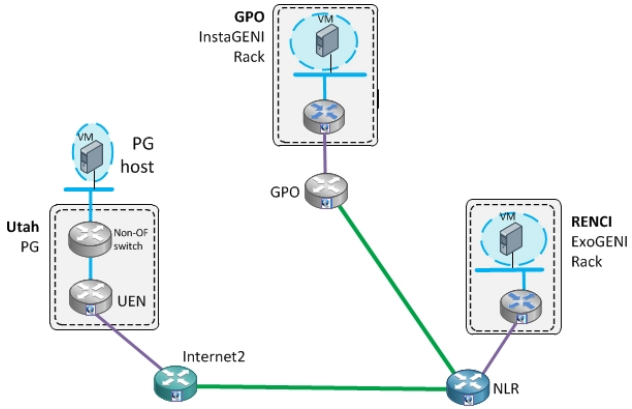


- Over 2100 students trained!
- 40 different instructors
- Over 600 students this semester!



GENI: Benefits to Instructors and Students

- Instructors: No need to acquire and maintain expensive lab facilities
  - Students: 24x7 access from almost anywhere
- Students: Experience lab exercises not previously possible
  - Especially true for wireless networking
- Students and instructors: Access to expensive and uncommon resources
  - 4G wireless base stations, long haul network links, programmable switches
- Shared community resource
  - Community developed course modules
  - Community supported mailing lists



GENI and US Ignite: Community STEM Initiatives

Community

GENI based Massive Open Online Courses (MOOCs) for the masses

NYU POLYTECHNIC SCHOOL OF ENGINEERING

- For the lay person…
- …with hands-on experimentation
  - No programming skills needed!
- Modules
  - Internet routing
  - Adaptive video streaming
  - Net neutrality
  - Internet security
  - Distributed consensus in Bitcoin

http://hyperion.poly.edu

Educator and Student Testimonials