Innovations in Informal Science Education: DinoQuest & DinoQuest Online

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Fast Facts about Discovery Science Center

- Located in Santa Ana, California
- 80,000 Sq. Ft.

At the Center:
- 386,000 annual visitors
- 82,000 annual field trip visitors from schools

In the Schools:
- 120,000 annual students in science outreach programs

Budget: $6,000,000   Earned Income: 82%  Contributed Income: 18%
Inspire Youth of Today into Fields of Science

Science Adventure Quests

• Blending Video Game Culture and Physical Exhibits
• Putting Visitors into a Science Adventure Video Game
• $7 Million Expansion at DSC
• Dinosaur Themed
Goals

Create a physical exhibit that blends:
- Natural History Museum Collection,
- Science Center Hands-on Exhibits,
- Video Game Culture,
- Science research “collaboratories”

Create a Cyberinfrastructure for distance learning over the internet.

Engaging and explaining CA Science Education Standards.

Create electronic tracking ability for better evaluation capabilities.

Workforce Development,
- Introducing scientific and engineering role models,
- Exposure to careers by role playing.

Create a mechanism that continues to drive visitors between a brick & mortar science center and the internet multiple times.

Increase repeat usage of science center exhibits and increase visitation.

Create a replicatable and sustainable model.
The IR Transmitter!

- Picking up information throughout the dig site.
- Tracking visitor’s success on missions.

IR transmitter and sensor network technology from Creative Kingdoms, Inc.
Technology:
Embedded Sensors and Transmitter Activation
Students enter into an area where they will select their Infrared Research Transmitter for the Dino Quest.

In the registration and training area they will login to the Quest computer system to create a unique, grade specific ID for themselves and learn more about the exhibit and how to use their research transmitter.

Students will then enter the Co-Laboratory where they will select one of six Research Missions and continue their transmitter training.

Quest Stations are located throughout the exhibit and assist students in learning and successfully navigating through their research mission.

Research Missions: These are educational challenges that align with the Life Sciences curriculum within the California Science Content Standards at a grade specific level. An example would be a 1st grade student learning about comparative anatomy.

Adventures: Are student rewards after three successful research missions have been completed. They are a more complex challenge that requires the student to apply the science knowledge learned and engage them in thinking and problem solving—science literacy.
Go to Field Station and Select a Mission

8 Educational Missions:
- Aimed at California Science Education Standards for grades K-6
- Mission topics: Predator / Prey, Trace Fossils, Anatomy, Habitats, Identification
- Each mission focuses on a different collaboratory and field of science
- Missions selected, tracked, and completed at networked multi-media kiosks
DinoQuest Research Team and Collaboratories:
Diverse Science Role Models (ethnicity, age, gender)
Role play (see oneself as a scientist)

After selecting a mission, head out to the dig site!
Role play (see oneself as a scientist)

Search dig site and identify objects in the mission.

Computer and sensor network automatically tracks your success.
Video Game Mechanics

Upload data collected to collaboratories via on-site networked kiosks

- Earn Research Points for each item found.
- Obtain fossils with encoded DNA as reward for completing each mission.

Ability to save data and come back another day.
Online Science Learning Games

• Distance learning,
• Expands on science topics,
• More in-depth science missions,
• Earn points and Dino DNA by completing missions.
DinoQuest Online (released in late September)

- Log in with password online or from DSC
- Go to each collaboratory

- Same scientists as DinoQuest at DSC
- Expand upon science education standards in each lab
Multiple Science Learning Games: Dinosaur Dig Field Site Collab Game

- Different objectives for each game.
Multiple Science Learning Games: Science Education Content

Backbones and Ribs

Vertebrae provide structure for the animal and are divided into sections depending on where they are located along the back. Thoracic vertebrae are in the chest area and provide attachment points for the ribs. Ribs make up a bony case that protects many important internal organs, such as the heart and lungs. Bony projections on the vertebrae are attachment points for muscles. The Apatosaurus, being more massive, had larger processes on its vertebrae than the Allosaurus. Many of the larger dinosaurs, such as Apatosaurus and Allosaurus also had “belly ribs,” called gastralia, that were not attached to the backbone or the other ribs. The purpose of the “belly ribs” are not specifically known.

In 1987, amateur paleontologist Stan Sacrison discovered "Stan," a T-rex embedded in the Hell Creek Formation in South Dakota. 199 fossilized bones were recovered, including the best preserved and most complete T-rex skull ever found. Stan’s bones showed evidence of healed injuries: broken ribs and vertebrae, damaged facial bones, and a large hole in the back of its skull.
Multiple Science Learning Games: Zoology/Systems Collab Game

- Build a working digestive system out of available organs and “connectors”
- Move Oxygen and CO2 through a cardio-pulmonary system
Multiple Science Learning Games: Ecology/Habitat Collab Game

- Gain points by matching prey/predator and food chain relations via *Tetris*-like game play

*It's dinner time for the herbivores, I see. Good thinking, those plants won't be taking up all the space anymore! Let's take some of the half-eaten ferns back to the lab for analysis.*
Multiple Science Learning Games: Biomechanical Collab Mini Games

- Mass and balance
- Proportion and speed
- Matching anatomical structures to diet
Multiple Science Learning Games:
Resource Interaction Collab Game

MyLab - shows missions completed both online and at the Science Center.

DinoSphere – will allow building of your own Dinosaur with DNA collected from missions.

Go back online or to Science Center to obtain different DNA by completing more missions!
Evaluation Potential

DinoQuest and DinoQuest Online allow for the following evaluations:

*Player Centered*: scores and missions completed identify progress and provide feedback in context.

*Exhibit Centered*: ability to test content comprehension by player quiz upon completing mission.

*Independent Evaluation*: to ask which method is best and why: physical exhibit, online learning games, or both?
Cyberinfrastructure for Science Centers

Tier 1: Individual player connection: your internet connection at home.
Tier 2: Local institutional player connection: library, science center, school.
Tier 3: Regional science center provides local exhibit content connected online.
Tier 4: “Gateway” science centers provide open interfaces and content.
Tier 5: Science Center Grid: Massive Multiplayer Online Science Learning Games
Cyberinfrastructure allows for:

- *Networked Science Centers* across the U.S. (and beyond).

- Can be applied in multiple scientific, technological, or engineering domains.

- Can be further developed and expanded with open source software components, infrastructure, and open content.
Thank You!

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Backup Slides
Project Contributors

• **DSC** – Janet Yamaguchi (VP Education), JoeAnna Jenkins (CFO), Kellee Preston (VP Operations), Leslie Perovich (VP Marketing), Creative Kingdoms Inc., and others

• **UCI** – Robert Nideffer (creative director), Alex Szeto (game programming and art), Calvin Lee (database programming), Celia Pearce (design contributions)
Discovery Science Center Partners and Sponsors

- Ingram Micro
- IBM
- First American Corporation
- Orange County Department of Education
- State of California
- Capital Group
- California State Fullerton, Education Department
- Wiengart Foundation
- 3M Corporation
- Google
- Children’s Hospital of Orange County
- UCI Game Lab
- UCI Center for Graphics, Visualization and Imaging Technology
- California Institute for Telecommunications and Information Technology: (Calit2) at UCI-UCSD
- and others

For further information, see [http://discoverycube.org](http://discoverycube.org)
UCI Game Lab Partners and Sponsors

- California Institute for Telecommunications and Information Technology: Calit2 at UCI-UCSD
- San Diego Supercomputer Center (SDSC) at UCSD
- UCI Center for Graphics, Visualization and Imaging Technology
- UCI Institute for Software Research
- UCI Arts, Computation, and Engineering (ACE) Program
- UCSD Experimental Game Lab
- Calit2 ACTION Laboratory
- Discovery Science Center, Santa Ana, CA
- Global Center for Research and Development, Daegu, Korea
- National Science Foundation
- Sun Microsystems
- UC Humanities Research Institute
- and others

For further information, see http://ucgamelab.net
Candidate expansions for DSC and beyond:

**SLG Enhancements**

**Challenge the Professor**
Additional software content to evaluate individual accomplishment and understanding

**DinoQuest Comic Book Creator**
Interactively builds comic book of your personal science mission tasks (enhances writing skills)

**DinoSphere Online**
Create your own dinosaur: Make dinos with DNA

**MMOSLG**
Massive Multiplayer Online Science Learning Game

**Local Enhancements**

**Challenge the Professor**
Additional software content to evaluate effectiveness of physical/online exhibits

**DinoSphere at DSC**
See your creations in actual size and interact with them

**Dinos II (Pterodon Flight School)**
Additional Missions

**Environmental Ranger Training Station**
Additional Science Domains
• Expanded science domains covering water, air, and the environment
• Expanded cyberinfrastructure with additional online science learning games
• Exposure to additional science careers and fields
July 1 – July 23 Attendance

- 2004: 25,000
- 2005: 20,000
- 2006: 35,000

38% Increase over ’04
72% Increase over ’05
July 1 – July 23 Revenues

- **Total**
  - 2004: $150,000
  - 2005: $200,000
  - 2006: $300,000

- **Admissions Revenue**
  - 2004: $50,000
  - 2005: $100,000
  - 2006: $150,000

- **Memberships**
  - 2004: $50,000
  - 2005: $100,000
  - 2006: $150,000

- **Store**
  - 2004: $25,000
  - 2005: $50,000
  - 2006: $75,000

**Increase Over 2004**
- Total: 95%
- Admissions Revenue: 69%
- Memberships: 235%
- Store: 114%