

Research and Development of Science Learning Games: *DinoQuest Online* for the Discovery Science Center

Final Report

June 2007

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Report Summary

This document represents the final report from the research project to investigate, develop, and deploy an online, Web-based science learning game environment, sponsored by the Discovery Science Center (DSC) in Santa Ana, CA. The resulting environment is called, *DinoQuest Online*, and it was conceived and realized as a complement to the interactive DinoQuest exhibit that was designed and installed at the DSC, and that has been open to the public since Summer 2006. The DinoQuest Online environment was delivered to DSC during 2006, and has undergone final refinements since that time, and is now publicly accessible on the Web starting from <http://www.dqonline.org>. DinoQuest Online and DinoQuest at DSC represent to our knowledge the first successful demonstration of a physically embodied, interactive game exhibit that is integrated and interoperating with an online game environment. This is the major result from this research project.

This report simply provides some key highlights and results for this project. Specifically, it provides four documents that describe or characterize the project at different stages of development, starting in late 2004 through early 2007.

The first document presents an overview and introduction to the project as conceived in late 2004. The second documents some early concepts and directions that were being initially investigated, as indicated in a news story that was published by the California Institute for Telecommunications and Information Technology (Calit2) at UCI. The third document represents a later news story also produced by Calit2 that highlights the initially delivered version of the DinoQuest Online science learning game environment and how it was designed to complement the DinoQuest exhibit that had just opened at the DSC. The fourth and last document represents a final overview of the DinoQuest Online environment as it now realized and experienced over the Web, including numerous computer game screen images that depict various moments of interactive game play and game play mechanisms. Furthermore, it is worth noting that the results and materials included in this fourth report have already

been presented at the Informal Science Education program office at the 1) National Science Foundation, 2) Game Developers Conference (San Francisco, CA), 3) Education Department at UCI, 4) Science and Innovation Board of the UC Office of the President, and 5) 2007 Games, Learning, and Society Conference (Madison, WI), as well as to many industry and academic visitors from California, the U.S. and elsewhere.

Finally, it is worth noting that discussions are now underway with international groups from Mexico and China (Shanghai) who are interested and eager to license and internationalize (i.e., provide domestic language versions) the DinoQuest Online environment in their respective countries. As such, we believe this research project has not only fulfill its research and development goals, but also has begun to contribute to a new way of providing and experiencing the world of science that is well-suited to young learners in Orange County and beyond.

Overall, many people contributed to the research, iterative design, and development of the DinoQuest Online environment. The fourth document identifies the contributors, though we apologize if there is anyone whom we have overlooked in acknowledging their contribution to the project. However, the final look of the game artwork and the implementation of the DinoQuest Online game engine and game play mechanisms are primarily due to the artistic and technical efforts of Alex Szeto. Calvin Lee also played a central role in programming the back-end database management and network services. Last, Robert Nideffer served as creative director (and part-time software developer), and Walt Scacchi served as producer of DinoQuest Online, as well as coordinating and co-directing the overall research project.

In closing, we welcome any questions or comments on the materials presented in this report, or about the DinoQuest Online science learning game environment.

UCI-DSC Dinosaur Science Learning Games

Walt Scacchi, Robert Nideffer, Celia Pearce
UCI Computer Game Culture and Technology
Laboratory
29 December 2004

Overview

- Project goals
- Design study 0.1
 - Two games
 - Standardized science learning resources
 - Back stories
 - Game play experiences
 - User interfaces
 - Player registrations

Two games

- Dinosaur treasure hunt (K-3, 1-2 centered)
 - Locate, find, observe/interact, match/piece together/discovery *puzzle game*
 - Multi-level (K-3) game play and learning tasks
- Dinosaur quest (4-6, 5-6 centered)
 - Locate, find, observe/interact, piece together *role-playing, time machine game*
 - Multi-level (4-6) game play and learning tasks

Dinosaur treasure hunt

- Puzzle examples
 - “*What am I?*” given (visual) features of different dinosaurs in different settings, determine what (kind of) dinosaur I am
 - “*Fossil hunter*” given a list of dinosaur pieces, pictures or clues, can you find them on site?
 - “*Am I a dinosaur?*” given (visual) features of modern animals/birds, can you determine who may be related to dinosaurs

Dinosaur quest

- Time frames for a time machine
 - *Momentary* – e.g., allosaurus encounters a sauropod (predator-prey relationship)
 - *Adaptive* – e.g., changes in size and features of a pterosaur (gets smaller, more agile)
 - *Epochal* – e.g., plate tectonics segregate dinosaurs species give rise to adaptation across epochs (cretaceous vs. jurassic)
- Game play roles (next)

Dinosaur quest

- *Dinosaur*: sauropods vs. allosaurs; surviving (seeking food/prey, feeding, moving about, avoid danger, defending oneself/brood), adapting and evolving
- *Dinosaur life scientist*: looking for evidence of survival and adaptation biomechanisms
- *Geologist*: examining how plate tectonics affects dinosaur over $>100M$ years
- *(Paleo)Ecologist*: mapping ecological patterns and arrangements over time

Science learning resources

- University of California Museum of Paleontology
- Discovery Channel/BBC *Walking with Dinosaurs*
- National Science Standards Matrix



Resources

Resources by state: National



Working on a fossil in the University of California Museum of Paleontology preparation lab.



Grad student Scott Nichols, making a gel in which he'll place amplified DNA for sequencing.



Undergrad volunteer Martha Middlebrooks, plastering a block containing the bones of Zephyrosaurus.

[Top of List](#)

Collecting and Legalities (showing 1 of 1 listings)

[Fossils and Public Lands](#): Information about collecting fossils on public lands from the American Geological Institute.

[Top of List](#)

Resources/Maps (showing 3 of 4 listings)

[Cretaceous Rocks](#): A page from the Tapestry of Time and Terrain map site, produced by the USGS, that illustrates the exposures of Cretaceous rocks in the United States. The site includes additional links and information.

[Geologic Maps: What are you standing on?](#): This site offers an explanation of what geologic maps portray and how they are made.

[The Paleomap Project](#): This site offers illustrations of the plate tectonic development of the ocean basins and continents, as well as the changing distribution of land and sea, during the past 1100 million years.

[More Maps](#)

Resources/Courses and Lectures (showing 1 of 1 listings)

[The Virtual Paleobotany Lab](#): Developed as an on-line lab manual at the University of California, Berkeley, this lab covers the evolution of plants through geologic time.

In Prehistoric
Life:

- Beasts
- Cavemen
- Dinosaurs
- Chronology
- Fact files
- Dig deeper
- Dinosaur den
- Dinosaur worlds
- How do we know?
- Science focus
- TV series
- Monsters We Met
- Wild New World

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Dinosaurs



Highlights



One lump or two?

How many asteroids did it take to wipe out the dinosaurs?

This Horizon was shown 7 October

[Investigate extinction theories](#)



Dinosaurs and Duplicity

Days That Shook the World recalls the very first dinosaur fossil find in 1824.



Seamonsters adventure

Can you survive the seven deadliest seas of all time in this game? Take the plunge!

[Bringing dinos to life](#)

In Dinosaurs

► **Chronology**

The story of dinosaur history from 220 million years ago to extinction...



► **Fact Files**

Detailed profiles of all your favourite dinos, from T-Rex to Pteranodon...



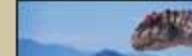
► **Dig Deeper**

Answers to the burning questions resulting from dinosaur research...



► **Dinosaur Den**

Interactive dino fun, with E-postcards, loads of games, screensavers...



► **Dinosaur Worlds**

Take an audio-visual tour around the



**Description**

We know from **fossil evidence** that dinosaurs laid eggs, but did mother *Allosaurus* stay around the nest after laying her eggs to look after the young? Have a look at the **evidence** yourself, and then make up your own mind. How you decide now will affect your life as Big Al. So - do you think a female *Allosaurus* would stay to protect her new offspring? Yes No

Play Level 1**The Menu**

Pause

Restart Level

Restart Game

Fact Files

Quit

AI's Stats**Level:** 1**Score:** 0**Weight:** 0.2kg**Energy:** 100%**Fitness:** 100%



Name of Activity	Suggested Grade Level			Content Standards								Other Content
	K-4	5-8	9-12	A	B	C	D	E	F	G	H	
Building a Topo Model		✓	✓	✓					✓			Math
Climate Analysis Using Forams		✓	✓	✓	✓		✓	✓	✓			Math
Determining Ages Of Rocks...		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Math
Dino Facts		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Dinosaur Body Structure	✓			✓	✓	✓	✓	✓	✓			
Dinosaur Names	✓	✓							✓	✓	✓	Eng/Art
Findasaurus	✓	✓		✓	✓		✓	✓	✓	✓	✓	
Fossilization and Adaptation	✓	✓		✓	✓		✓	✓	✓	✓	✓	Eng/Art
Inferring Ancient Environments		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	Math/Geog
Interpreting Paleoenvironments				✓	✓	✓	✓	✓	✓	✓		Math/Geog
Island Biogeography				✓	✓	✓	✓	✓	✓	✓		Math/Geog
Model Of Sea Floor Spreading		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Monster Math	✓	✓		✓		✓	✓	✓	✓			Math
Paleo Cookie Dig	✓			✓	✓			✓	✓	✓	✓	Math
Round Rocks	✓	✓	✓	✓	✓	✓	✓	✓	✓			
Sequencing Time — What Came 1st?	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	
Submarine Mountains		✓	✓	✓	✓	✓			✓			
Tennis Shoe Detectives	✓			✓	✓		✓	✓	✓			Eng
Tracking Global Climate Change		✓	✓	✓	✓	✓	✓	✓	✓	✓		Math/Geog
Two Kinds Of Dinosaurs	✓			✓			✓		✓			
Where Can I See the Sea		✓		✓	✓		✓	✓	✓		✓	
Who's On First?		✓	✓	✓	✓	✓	✓	✓	✓			

Back stories

- Dinosaur treasure hunt: “*The Three Dinosaurs*” a traversal/adventure game that blends Goldilocks and Three Little Pigs
- Dinosaur quest: “*The Dinosaur Time Machine*” is an adventure recreation game that blends role playing in different time frames (from momentary to epochal)

Game play experiences

- First encounter: requires exposure to training tutorial/game overview
- Return visit: to “level up” to more challenging game play and learning tasks
- Single user vs. classroom users
 - Single user may start with PC for tutorial
 - Classroom may start with shared (large-screen) tutorial/overview
- Game play anchored in physical exhibit walk-flow patterns (minimize walking crossovers)

User interfaces

- Game system *usability* (usage experience) is critical
- Multiple and hierarchical UI's
 - Top level offer tutorial, help, background, "play game", "the making of...", etc.
 - Each top level may then offer one or more sub-levels of task specific user interfaces
 - Game play can offer both full online experience (virtual walkthrough) and multi-level game play
 - UIs may be multi-lingual (English, Spanish, Korean)
 - In-game text/narratives distinct from visual content or game play sequencing to accommodate internationalization

Player registrations

- “First-visit” players are registered for a single session only; no personal data collected. Game play identifier is reusable by other players.
- “return-visit” players are able to explore deeper realms of game play; requires minimal persistent personal data. Game play identifier is unique.
- “contributors” are players who are able to create/modify game content for use by other players; requires persistent personal data and unique identifier.

Player registrations

- Backend system may utilize “course topic and learning management system”
 - Each game section organized as a “topic”
 - Topics can be added, updated, removed, commented
 - Players registered to topics played (i.e., course subjects taken/completed)
 - System can accommodate player messaging (synchronous (IM), asynchronous (Discussion forum))



[Newsroom](#) > [Web Article](#)

UCI Game Culture and Technology Lab Drives Dinosaur Discovery

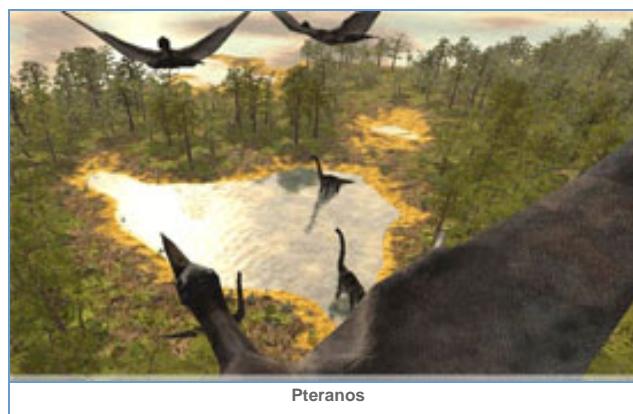
03.09.05 – Dinosaurs may be extinct, but they're providing powerful fossil fuel for science education programs. The Discovery Science Center in Santa Ana, Calif. will launch a \$3.5 million dinosaur exhibit later this year, complete with a 120-foot-long, 26-foot-high Argentinosaurus and a 40-foot-long, 12-foot-high T. Rex. Behind the scenes, the exhibit will incorporate gaming platforms developed by Calit2's UCI Game Culture and Technology Lab. The goal: to teach kids life science, physiology, anatomy, archeology, paleontology and more in an exciting, fun-filled environment.

Robert Nideffer, game lab director and UCI associate professor of studio art and informatics, sees the collaboration as a perfect fit. "Kids love dinosaurs and they love games. When you combine those things in innovative ways to teach kids, it's a win-win situation."

The Discovery Science Center agrees. The museum is supporting the effort with a \$300,000 grant. Nideffer and Walt Scacchi, from UCI's Institute for Software Research, who together wrote the proposal, are the lead PIs developing the novel gaming platforms for use in the exhibit.

"The challenge of designing science learning games that combine scientific knowledge from the research horizon with computer game technologies for a fun-filled game is an exciting and under-explored outreach opportunity," says Scacchi.

The creative technology will link the physical installation space at the museum to an online environment. Children will begin the "quest-based" experience by swiping an ID card or obtaining an RFID bracelet – the details are still in the design phase – that will identify them and track their progress.



Pteranos



T-Rex roams the jungle in a
Discovery Science Center sketch

They will then embark on specific tasks – searching for dinosaur bones to build a skeleton, for example, at the center – then complete the tasks online when they return to their classrooms. "Establishing this relationship between the physical installation space and some kind of net-based or Web-based representation is one of the things the Discovery Science Center found very appealing," says Nideffer. "It involves custom infrastructure development that's really at the cutting edge of research. Because of our affiliation with Calit2, we're in a better position to do that kind of thing than just about anybody."

The tracking system will allow the children not only to resume their individual work online, but to augment it. "If a child finds a certain bone at the museum and adds it to his skeleton, that event could trigger the transmission of a piece of data to a server that's tied to that particular kid," Nideffer explains. "So when he goes home or back to the classroom and logs onto the Web, he might see a virtual version of his quest, in which he could continue building the skeleton." When the child finishes assembling the skeleton, the software could potentially animate the dinosaur, leading to an ongoing story online.

The quests for older children will differ from those for the younger kids, opening the door to age-appropriate learning opportunities.

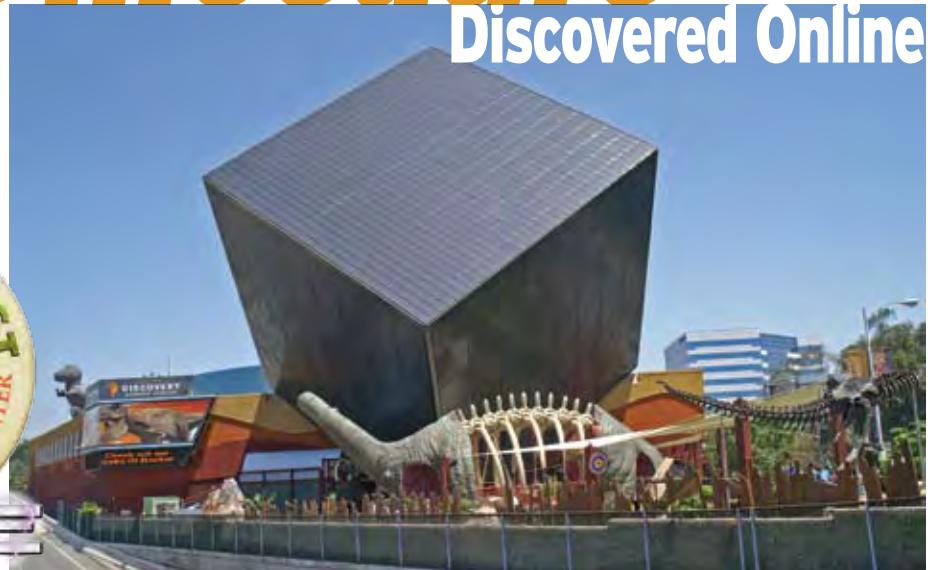
In addition, kids will be able to link to related information on the Web that will enhance their learning experience. Eventually, Nideffer, and collaborators Scacchi and Celia Pearce , Calit2's new media arts research and external relations manager, envision the creation of a three-dimensional, multi-user game environment. "This would be dependent on the availability of future funding," says Nideffer, "but the game could incorporate these creatures running around, interacting with each other, and teaching the children about adaptation to their environment and earth system sciences. You could even let kids genetically engineer their own dinosaurs, or change the climate conditions to see what would happen. The possibilities are endless."

Developing the gaming platform has not been without its challenges. According to Scacchi, there is an established body of knowledge about the ways people use networked computing systems in research, but comparatively little is known about how people use computers to play or how they learn from computer games. In addition, there are engineering challenges in designing hardware and software systems that deliver the learning/gaming experience in a child-friendly way. But, he says, the team has benefited from collaborating with the Discovery Science Center and is finding solutions to these challenges.

Scacchi hopes that science centers and museums will become established venues for disseminating research and academic advances, and that science-based learning games will become the effort's leading ambassador. "We are the innovators who are prepared to take chances in exploring and realizing these opportunities," he says.

Dinosaurs

Discovered Online



Visitors are flocking to Orange County's Discovery Science Center in Santa Ana, Calif. to experience Dino Quest, an interactive exhibit that brings to life prehistoric dinosaurs.

by Anna Lynn Spitzer

Recent studies have indicated that gaming can be a more effective approach to children's learning than classroom lectures...

They can walk inside a giant two-story tall Argentinosaurus, view life-size models to explore the heart and digestive systems, and manipulate parts of the dinosaur to learn how body systems work. The encounters with prehistoric creatures don't have to end, however, when guests leave the center. An interactive, online version of Dino Quest, developed by the Game Culture and Technology Lab at Calit2@ UCI allows the learning process to continue at home or school.

Infrastructure Allows Integration

Aligned with California science education standards for grades K-6, the \$5.5 million physical exhibit combines an interactive search for information with life-sized models to encourage hands-on learning. Recent studies have indicated that gaming can be a more effective approach to children's learning than classroom lectures, and drill-and-practice assignments. In fact, says Walt Scacchi, senior scientist at UCI's Institute for Software Research, games will increasingly compete with

traditional educational methods.

Dino Quest Online, which will debut this fall, not only allows visitors to continue studying dinosaurs and their life systems, but to jump in at home where they left off at the exhibit.

Visitors to the science center presentation become "research assistants," receiving transmitters that allow them to interact with Dino Quest Headquarters. As they solve challenges, the transmitter – aided by a network of sensors embedded in the exhibit – tracks each player's progress, allowing him/her to continue online or in a subsequent visit to the center.

"We designed a network information infrastructure to tie these two systems together," says Scacchi. "The objective was to achieve seamless integration of the physical exhibit and the online world."

Unique Expertise Benefits Collaboration

The UCI/DSC partnership began in late 2004, when Scacchi and Robert Nideffer, associate professor of studio art and informatics, submitted a proposal to Discovery Science Center. "Kids



Girls search for fossils in the shadow of a giant dinosaur. Their progress is charted and they can begin the online game where they left off at the venue.

Previous page: Life-size dinosaurs greet visitors to the Discovery Science Center's Dino Quest exhibit.

love dinosaurs and games. When you combine them in innovative ways, it's a win-win situation," says Nideffer.

DSC funded the online game with a \$300,000 grant, and Nideffer and Scacchi developed a series of prototypes. "We put a lot of work into designing the game and game infrastructure," says Scacchi.



The free online game can be played by anyone with an Internet connection and Flash capability. It's not imperative that players visit the DSC first, but those who do get a richer online experience.

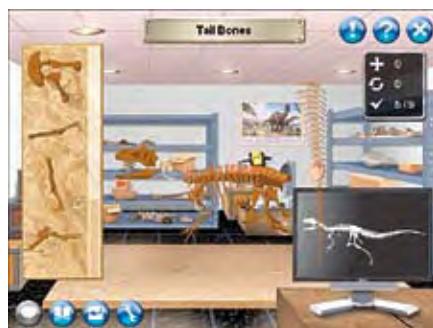
The collaboration has been mutually beneficial. "The Discovery Science Center understands the California State Science Content Standards and what works with teaching kids, but they've never done online games before," says Scacchi. "The main goal of the collaboration was to take advantage of each other's expertise."

That sentiment was echoed by Joe Adams, DSC president. "We liked the breadth of what Calit2 and the

Game Lab brought to the project," he says. "They're in the know about game development, what's unique and different, and they understood what we wanted to accomplish."

Learning for All Ages

User-friendliness was another consideration. "Everything has to be experienced in ways that utilize little or no text," says Scacchi. "Part of the target audience is kids in kindergarten, first and second grades, and maybe even some pre-readers. You can't expect them to read instructions before they start to play." Another challenge was making the online game appeal to different age groups or skill levels. The solution was to allow more capable users to attempt more difficult tasks that require using knowledge acquired at earlier game levels.



Visitors to Dino Quest Online begin by retrieving a message from the game's message center. It's here they meet "Professor Digwell," who tells them what

research missions they need to complete.

Players begin in the dig pit, where they learn how to play the game and dig up dinosaur fossil bones. From there, they can visit the ecology lab to learn about prey-predator and food-chain relationships among dinosaurs; or to the reconstruction lab, where they try to assemble fossil bones into dinosaur skeletons.

Carefully Crafted Characters

To guarantee cohesiveness, the physical exhibit and online game share a back story, introductory scenes and characters. The diverse characters were carefully designed to communicate the universality of science and learning through collaboration. "Since we can reach a global audience with the online game, we thought carefully about how the characters were depicted in terms of gender balance, nationality, expertise and collaboration," Scacchi says.

The success of the UCI/DSC collaboration is paving the way for additional partnerships, according to Janet Yamaguchi, vice president of education at the science center. Future exhibits that may be tied to online games include those on the water cycle and space exploration. "Students can learn more at a conceptual level through the game format," she says. "It is a really compelling learning environment."



interface

A photograph of two surveillance cameras in a library setting. In the foreground, a Linksys Wireless-G PTZ Internet Camera with Audio is mounted on a tripod, facing the viewer. Its lens reflects the surrounding environment. Behind it, another camera is mounted on a stand, also facing forward. The background is filled with shelves stacked high with books.

California Institute for
Telecommunications
and Information
Technology



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University of California, Irvine

Technology
to the ResCUE



Innovations in Web-Based Informal Science Education: *DinoQuest Online*

Robert Nideffer, University of California, Irvine, UCGame Lab, Studio Arts Dept.
Walt Scacchi: University of California, Irvine, *UCGame Lab*, Institute for Software Research

Science Learning Games

- Distance learning via Web,
- Expands on science topics,
- Based on CA Science Education Standards
- In-depth science missions that complement DinoQuest exhibit at Discovery Science Center
- Earn points and Dino DNA by completing missions.



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)

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>

DinoQuest Online (released in late September)

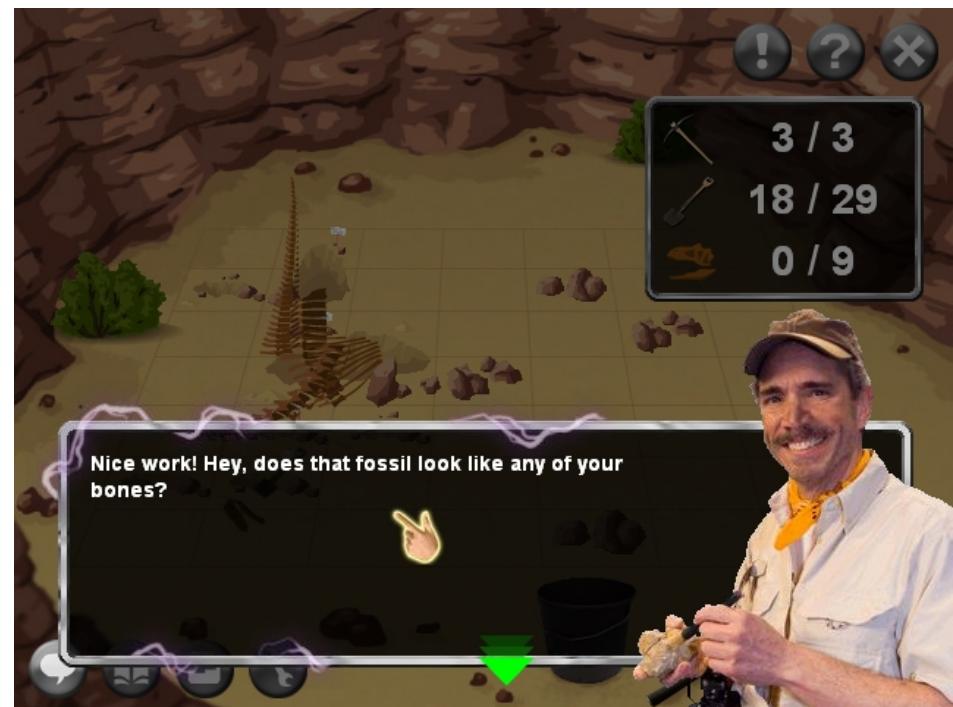


- Log in with password online or from DSC
- Go to each collaboratory



- 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

The screenshot shows a game interface with a parchment-like background. At the top, there are three icons: an exclamation mark, a question mark, and a close button (X). Below the title, there is a large blue circular button with a white X. The main title "Backbones and Ribs" is centered at the top of the parchment. The text below the title describes the function and structure of vertebrae and ribs, mentioning the Apatosaurus and Allosaurus. On the left side of the parchment, there is a circular logo with the text "DINO QUEST ONLINE". On the right side, there is a magnifying glass icon. At the bottom of the parchment, there are four small circular icons representing different game functions.

Backbones and Ribs

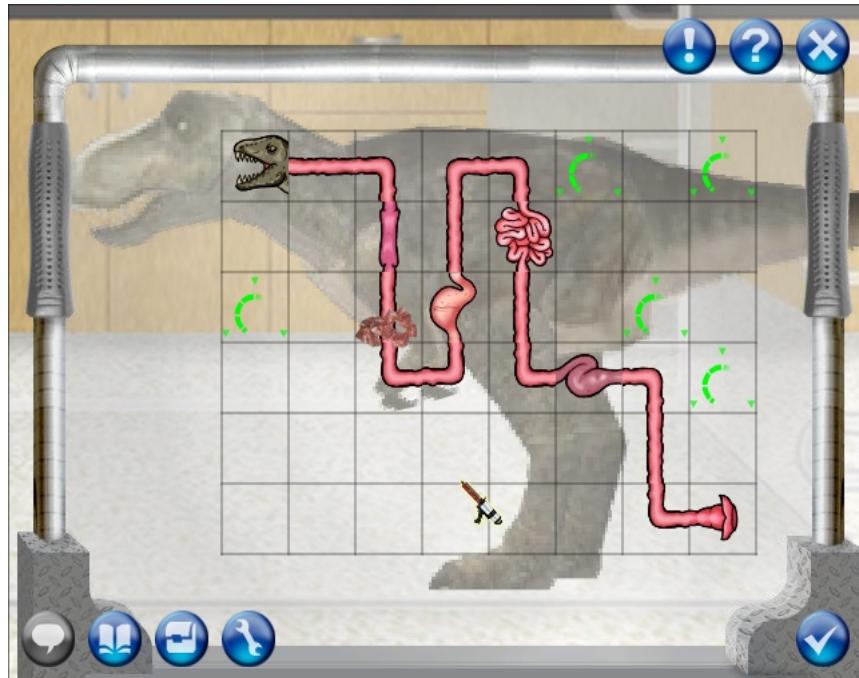
Vertebrae provide structure for the animal and are divided into sections depending on where they are located along the back. Thoracic vertebrae are in the chest area and provide attachment points for the ribs. Ribs make up a bony case that protects many important internal organs, such as the heart and 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.

The screenshot shows a game interface with a dark, textured background. In the center, there is a rectangular box containing text about the discovery of "Stan" the T-Rex. The text reads: "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." At the bottom right of the central box, there is a green button with the text "CLICK TO CONTINUE". On the left side of the screen, there are two small circular icons: one with a speech bubble and another with a book. On the right side, there is a hand cursor icon pointing towards the "CLICK TO CONTINUE" button.

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.

CLICK TO CONTINUE

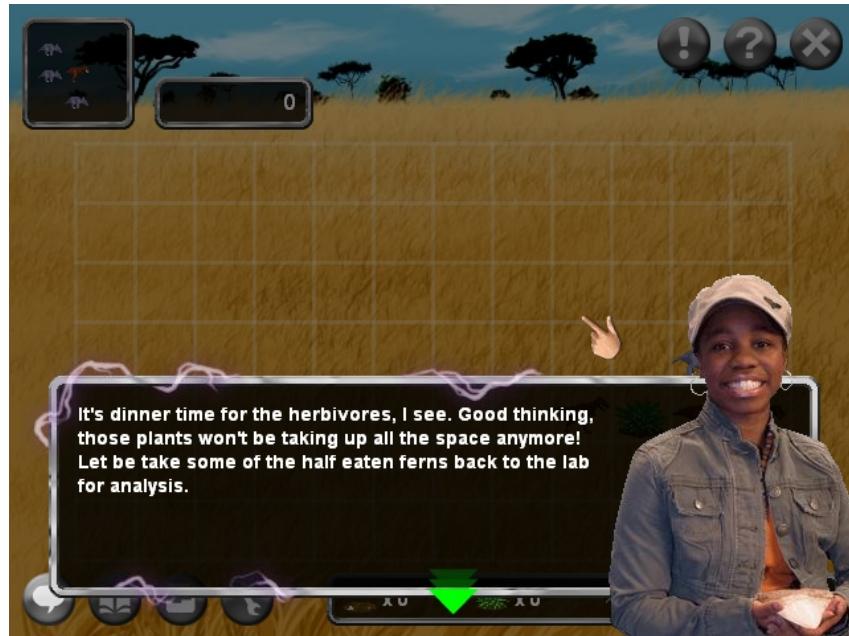
Multiple Science Learning Games: Zoology/Systems Collab Game



- 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

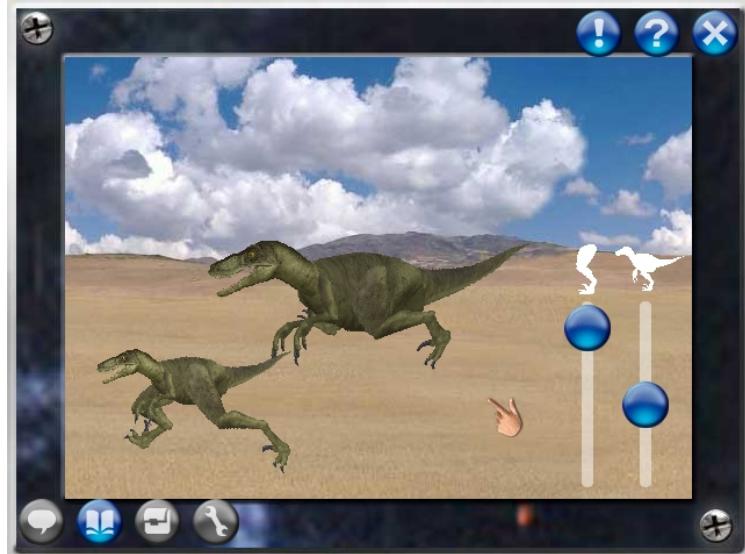


- Gain points by matching prey/predator and food chain relations via *Tetris*-like game play

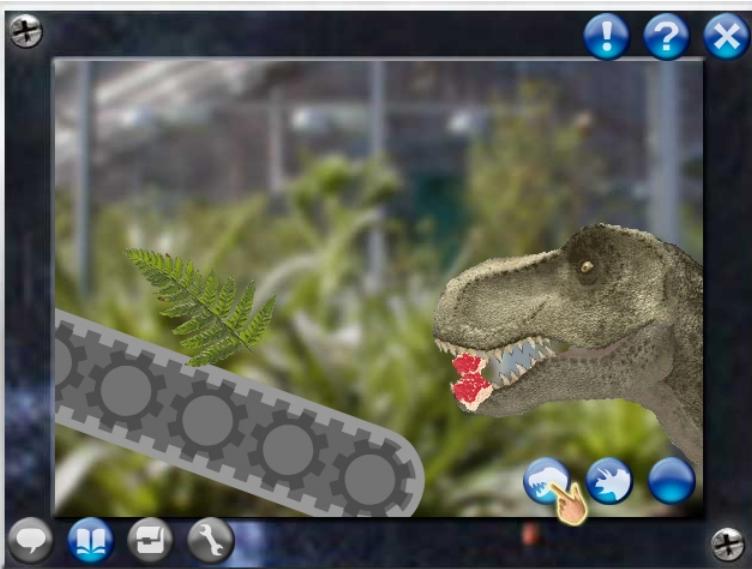
Multiple Science Learning Games: Biomechanical Collab Mini Games



- 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.

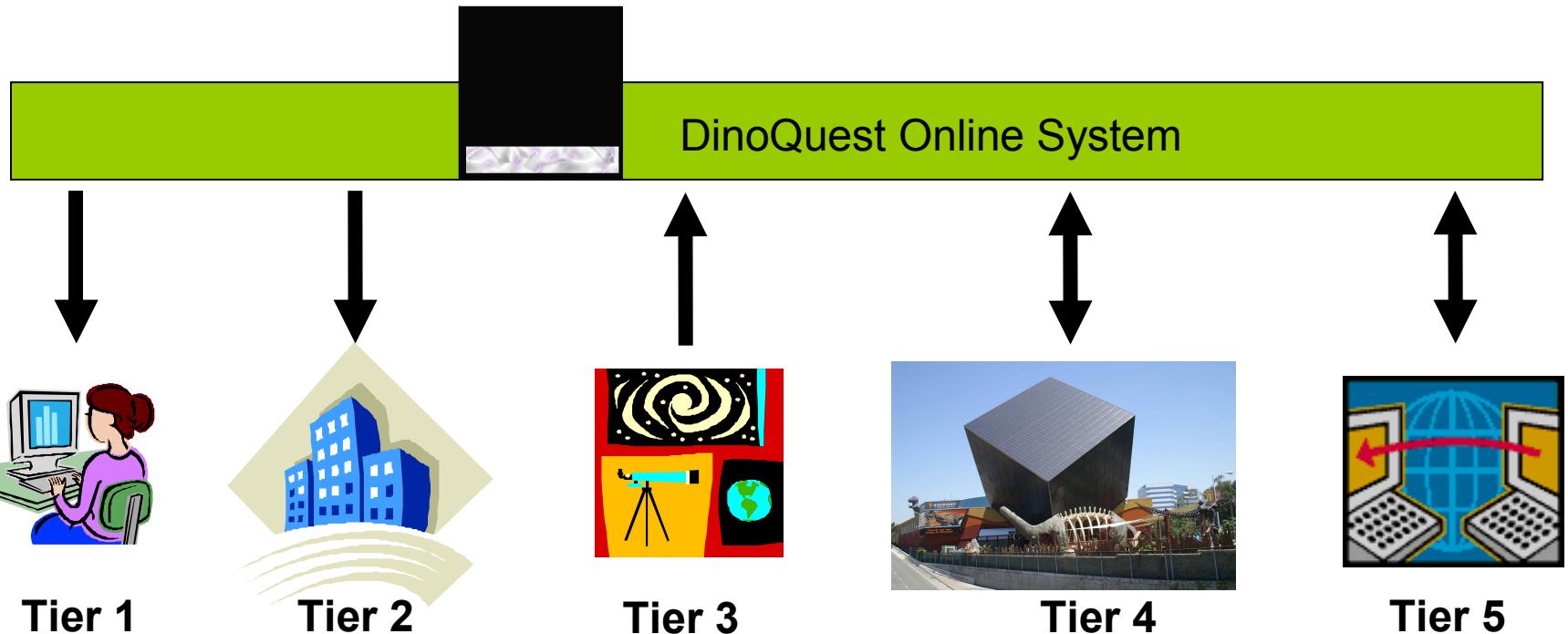
Exhibit Centered: ability to test content comprehension by player quiz upon completing mission.



Challenge the Professor

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.

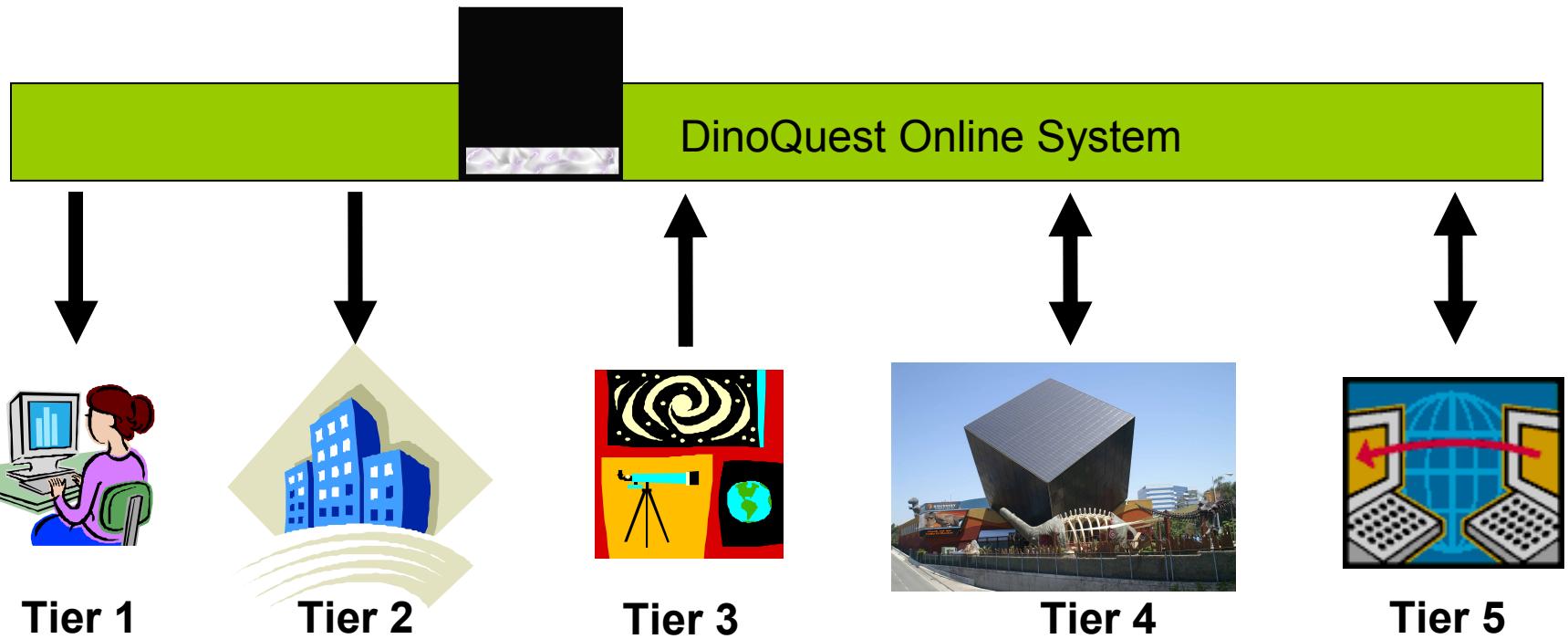
Tier 2: Local institutional player connection: library, science center, school.

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

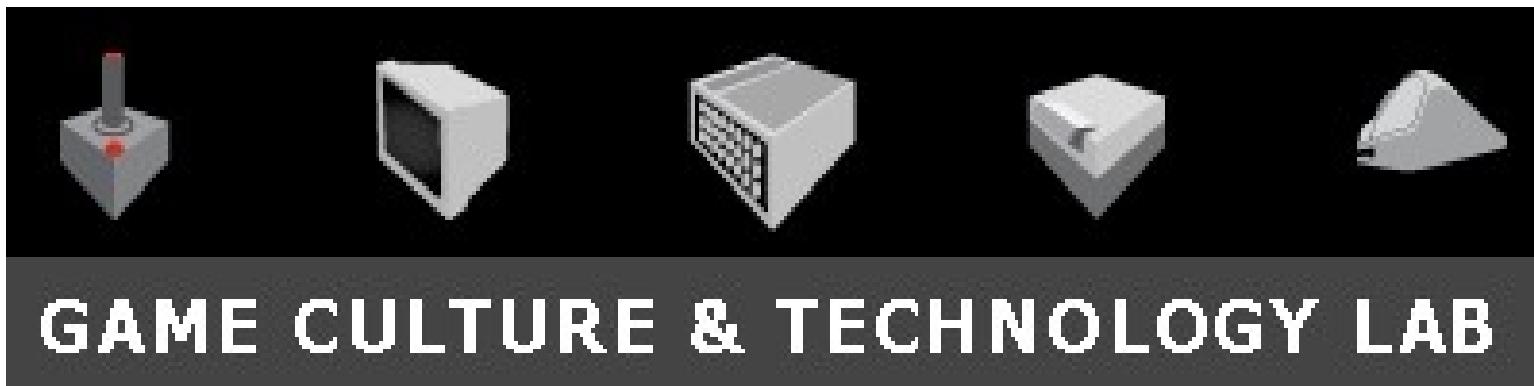
Cyberinfrastructure for Science Centers



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 w/open source software components, infrastructure, and open content.

Thank You!



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