


The Learning
Network
with CAPA

Online


The Learning*Online* Network with CAPA
- A Cross-Institutional
Learning Content Management System
Gerd Kortemeyer
Michigan State University
Computer Based Learning in Science
Conference
Cyprus, 2003

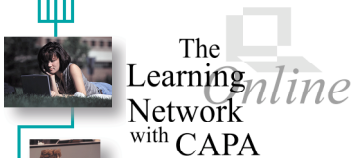


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Some of the History

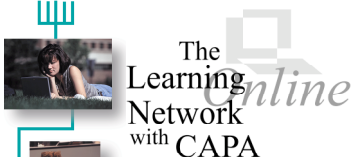
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1992 CAPA


- Started by Ed Kashy et al. in Cyclotron
- Individualized assessment system for science and math
- Immediate feedback, multiple tries - mastery based
- Used paper copies of assignments and terminal input
- X-Windows problem editing
- Got Web student interface in 95


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1997 LectureOnline


- Started by Wolfgang Bauer, Walt Benenson, Gary Westfall, and Gerd Kortemeyer in Cyclotron
- Learning content management and individualized assessment system for science and math
- Sharing of content between courses
- Completely web-based interface


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1999 LON-CAPA


- The Learning *Online* Network with CAPA
- Collaboration of CAPA and *LectureOnline* groups
- “The best of both worlds”
- Sharing of content between courses and institutions
- Reusability of content on different levels of granularity
- Distributed and Scalable

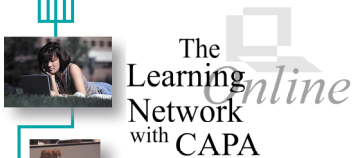
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LON-CAPA Today


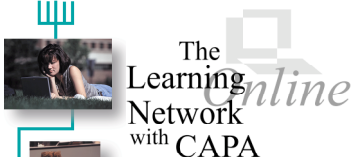
- Attracted National Science Foundation Information Technology Research grant “Investigation of a Model for Online Resource Creation and Sharing in Educational Settings” (more later)
- Has over 20 partner institutions (more later)
- Useful and usable for “casual” (non-”power”) faculty user outside science and math
- LON-CAPA is a full-featured course management system
- Software platform has GNU General Public License and is free of licensing fees
- ComputerWorld 21st Century Achievement Award

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Today LON-CAPA is used ...

- With material written by faculty teaching course or “re-used” from other faculty
- For homework in addition to “traditional” lecture and textbook
- Hybrid with “traditional” lecture, homework and textbook online
- Completely “virtual” courses
- AP courses
- Prelab quizzes
- In-class exercises

Cross-Institutional



The Learning Network with CAPA Online

Distributed Server Network

- LON-CAPA is built as a geographically distributed network of constantly connected servers


The diagram illustrates a distributed server network. A central green circle labeled "Network" is connected to several blue server racks and yellow server cabinets. These servers are distributed across different geographical locations, as indicated by the background images of a classroom, a woman at a laptop, a man at a desk, and a woman in a field. The network is shown as a complex web of connections between these distributed servers.

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Logical Domains

- The network is logically divided into domains such as “MSU”, “FSU” or “Publisher X”
- Domains limit the flow of user information
- Domains can limit access to content resources
- Domains limit the extent of user privileges

The diagram illustrates logical domains within a network. It shows a central network structure with various domains represented by different icons and colors, such as a blue server rack, a yellow server cabinet, and a green server rack. The domains are shown as distinct parts of the network, each with its own set of servers and users. The network is shown as a complex web of connections between these domains.



Authentication

- Any user in the network can log into any machine in the network
- Example: Michigan State University user logs into server at North Dakota State University

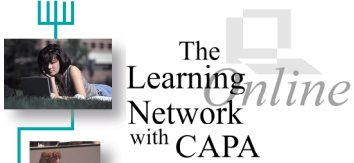
User Authentication

User Name:

Password:

Domain:

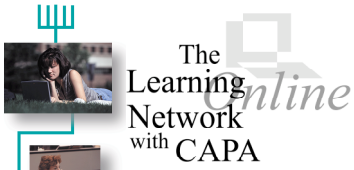
Domain: ndsu
 Server: ndsul1 (library)
 Load: 0 percent



Authorization

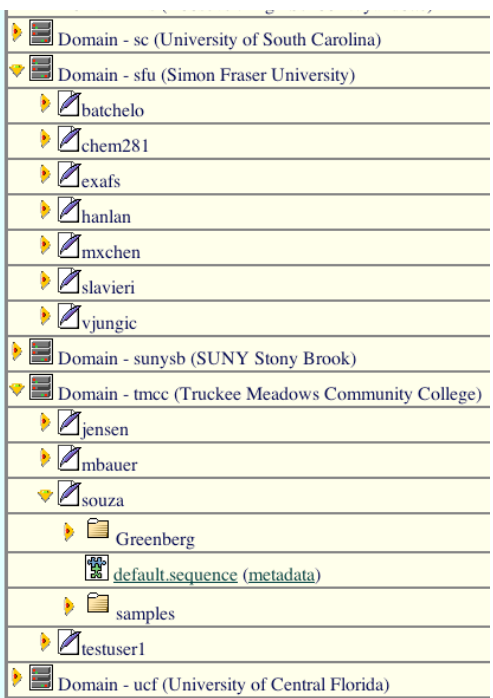
- Any LON-CAPA user can have roles for any domain.
- Example: Michigan State University faculty is Course Coordinator for a course at North Dakota State University

	Coordinator		Domain:msu	
Select	Course Coordinator	Course	LBS 271 Fall 2002 Domain:msu	
Select	Course Coordinator	Course	Physics 252 Domain:ndsu	
Select	Course Coordinator	Course	phy234b Spring 2003 Domain:physnet	
Select	Domain Coordinator	Domain	msu	Tue Jul 25 08:3 2000
Select	Domain Coordinator	Domain	physnet	Mon Oct 21 10:28:48 2002
Select	Instructor	Course	LBS 118, sections 1 & 2 - Fall 2002 Domain:msu	Wed Oct 23 07:41:05 2002

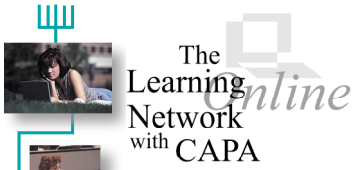


Virtual Filesystem

- The shared content repository appears as one virtual filesystem

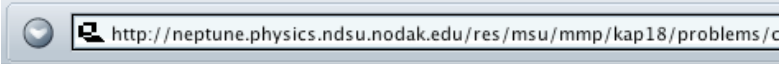


Domain - sc (University of South Carolina)
Domain - sfu (Simon Fraser University)
batchelo
chem281
exafs
hanlan
mxchen
slavieri
vjungic
Domain - sunysb (SUNY Stony Brook)
Domain - tmcc (Truckee Meadows Community College)
jensen
mbauer
souza
Greenberg
default.sequence (metadata)
samples
testuser1
Domain - ucf (University of Central Florida)



URLs

- All resources have persistent system-wide URLs
- Any server in network can serve any resource
- Automated content replication and update mechanism in background (transparent to user)
- Example: North Dakota State University serves URL from author “mmp” at Michigan State University



<http://neptune.physics.ndsu.nodak.edu/res/msu/mmp/kap18/problems/cd>

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Resource Assembly

- Pages can be constructed from fragments and other pages
- Sequences can be constructed from fragments, pages, and other sequences
- Courses point to (top-level) sequences
- Maps at every level are simply other content resources

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Resource Assembly

- Graphical resource assembly tool (RAT) to construct maps
- Working on branching based on conditions using performance data, course data, and preferences
- Individualized curriculum

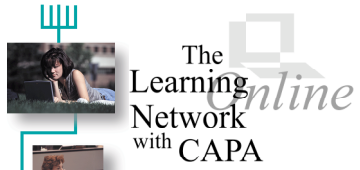


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Individualized Assessment


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“Individualized Assessment”

- Individualized problems: different numbers, different graphs, different options, ...
- “Classical” online homework elements: multiple choice, option response, mix-and-match, string, etc
- “STEM” elements: numerical, multicomponent numerical, physical units, symbolic math, individualized simulations
- Free combination of the above elements
- Adaptive immediate feedback
- Multiple attempts - mastery based



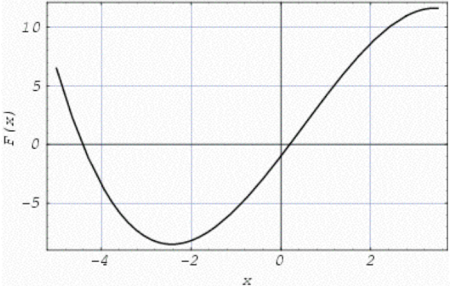


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•Example: Individualized graph, numerical answer

“Individualized Assessment”

Using graphical methods, determine at 2.0 the value of the derivative of function $F(x)$ plotted in the graph below.



Submit All Answers

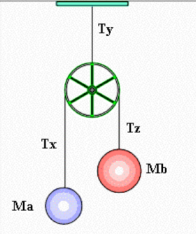


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•Example: Individualized labels, options


“Individualized Assessment”

A [frictionless, massless](#) pulley is attached to the ceiling, in a gravity field $g = 9.81 \text{ m/s}^2$. Mass Mb is greater than mass Ma. The tensions T_x , T_y , T_z , and the constant g are magnitudes. (For each statement select 'True', 'False', 'Greater than', 'Less than', 'Equal to'.) [Motion of Masses on a Pulley](#).



Ty is ... $T_z + T_x$.
 T_z is ... $(M_b)g$.
 The center-of-mass accelerates.
 $(M_a)g + (M_b)g$ is ... T_y .
 The magnitude of the acceleration of Ma is ... the magnitude of the acceleration of Mb.
 T_x is ... T_z .

Submit All Answers

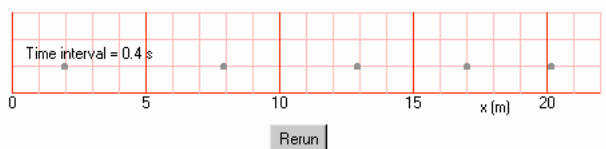


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“Individualized Assessment”


•Example: Multicomponent numerical with individualized animation

You were driving along the highway when you spotted a police officer. You brake to slow down at a constant rate. Your position at a time interval of 0.40 s is plotted along x . (a) Find the initial velocity before you apply the brakes. (b) Find your acceleration.



(a)

(b)



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External User Community

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Status: Installations in “Production Cluster”

High Schools

- Mio AuSable High School - Mio, Michigan
- Charlotte High School - Charlotte, Michigan
- Fowlerville High School - Fowlerville, Michigan
- Theodore Roosevelt High School - Wyandotte, Michigan
- Lansing School District
- East Lansing Public Schools

Community Colleges

- Westshore Community College - Scottsville, Michigan
- Truckee Meadows Community College - Reno, Nevada





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Status: Installations in “Production Cluster”

Universities (department level)

- Ohio University
- SUNY Stony Brook
- Florida State University
- University of South Carolina
- George Washington University
- University of Central Florida
- Michigan State University
- University of Delaware
- North Dakota State University
- University of Wisconsin - Stevens Point

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Status: Installations in “Production Cluster”

Outside United States

- Simon Fraser University - Vancouver, Canada
- University of Halle - Halle, Germany
- University of Oldenburg - Oldenburg, Germany
- Selwyn House School, Canada


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The Learning Network with CAPA *Online*

The NSF ITR Grant Project



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The Learning Network with CAPA *Online*

The Project

- “Investigation of a Model for Online Resource Creation and Sharing in Education Settings”
- Uses LON-CAPA as model system
- Five year project, \$2.1M, funded by the National Science Foundation Information Technology Research Program

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The Learning Network with CAPA *Online*

The Project: Research Goals


- Open source code development concept for Instructional Management System
- Pooling online educational resources between departments, colleges, universities and schools
- Business models for “trading” such resources on small level of granularity
- Business models for services and support
- Metrics for resource quality and effectiveness
- Curriculum adaptivity to learner types and remediation needs

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The Learning Network with CAPA *Online* “Economy of Scale”

- Content:** System more attractive the more content is online
- Code base:** GNU GPL, system improvements from larger development community
- Support:** mechanisms for peer-to-peer support
- Training:** mechanisms for peer-to-peer training

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The Learning Network with CAPA *Online* On the web ...

www.lon-capa.org
help.lon-capa.org
bugs.lon-capa.org
[mail.lon-capa.org](mailto:mail@lon-capa.org)
install.lon-capa.org