Digital Libraries as Learning Environments
A Case for Enabling Digital Libraries

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Presentation Overview

- Use case scenario
- Research questions
- Development theory & framework
- Examples and current work
- Research methodology
- Evaluation
- Research Contributions
- Questions, comments, suggestions
A Digital Library Use Scenario

Emily, a high school student, has been assigned to write a report on “plate tectonics”. To start the report she goes to the DLESE (Digital Library for Earth System Education) web site and uses plate tectonics as a keyword to search for relevant resources. DLESE displays list of 10 resources out of 301 resources. Emily, looks into each resource and tries to make sense of the material to write a coherent report.
Emily’s Interactions with DLESE

What’s new at DLESE
- New DLESE 2005 Annual Meeting website and registration
- JCDL 2005 registration available - Joint Conference on Digital Libraries, June 7-11
- Core services highlights - March 2005
- DLESE 2004 Annual Report to National Science Foundation (NSF)
- Track progress of the Quality process on the Wiki
- New resources & reviews
- Rating DLESE resources

Resource of interest
The Earth Exploration Toolbook exists to support the educational community. The Toolbook provides resources that can be used in an educational context.

Each chapter in the Toolbook provides a sample activity that can be used in the classroom. The activity is designed for grades 5-12 and includes an undergraduate college level.

View previously featured resources of interest.
Submit an interesting Earth system site.

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Emily’s Interactions with DLESE cont…

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Research Questions

• In what ways educational DLs can support learning?

• What technological infrastructure and system practices are essential for these educational DLs?

• How should interfaces be designed to make educational DLs effective?
Enabling Digital Library: A Definition

Enabling digital libraries are characterized by the interactions that provide processes and representations that enable a learner to grasp a higher level of understanding related to her task / information requirements / learning needs.
Learning Theory for Educational Digital Libraries (LEDL)

- It is based on task centric conversational learning theory (Pask 1975, Laurillard 1993)
- A dialogue takes place between a learner and digital library
  - Task and Information Types
  - Learner and digital library as participants
  - Iterative nature of interactions
  - Conceptualization
  - The discourse
  - Operators
  - Process
  - The domain
  - Assessment
LEDL Framework

Task Transformation
Conceptualization/Reconceptualization

- Information Types
- Assessment
- Discourse
- Domain
- Process
- Operators / Conceptualization
- Message Encoding/Decoding

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## Digital Library Design and Development Framework

<table>
<thead>
<tr>
<th>LEDL Framework</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Interface Design</td>
</tr>
<tr>
<td></td>
<td>Functional Design</td>
</tr>
<tr>
<td></td>
<td>Data and metadata</td>
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<td>Computer Systems and Networks</td>
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(Adapted from Arms, 2000)
Some Implications for Current Educational Digital Library Design

- Workflow processes
- Collection Building
- Human resources
- Interfaces
- Metadata/cataloging
- What approach is suitable for constructing enabling digital Libraries?

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Examples & Current Work

Benchmarks
The solid crust of the earth, including both the continents and the ocean basins, consists of separate plates that ride on a denser, hot, gradually deformable layer of the earth. The crustيتcontinents move very slowly, grinding against one another in some places, pulling apart in other places. Oceanic plates may ride under continental plates, sinking deep into the earth. The surface layers of these plates may fold, forming mountain ranges.

Physical Features of the Oceans (title provided or enhanced by cataloger)
http://www.mum.edu/departments/education/earth/12/index.html
This Classroom Connection lesson plan covers physical features of oceans such as currents, seafloor spreading, ocean basins, the ocean's landscape, and the origin of the oceans. The site provides goals, objectives, an outline, time required, materials, activities, and classroom ideas for the lesson. The Classroom Connections address content with an activity approach while the focus is on cognitive level. The major motivation is to employ instructional strategies that bring the students physically and mentally into touch with the science they are studying. [Full description]

Layers of the Earth (title provided or enhanced by cataloger)
http://www.mum.edu/departments/education/earth/12/index.html
This Classroom Connection lesson plan teaches students to identify the layers of the Earth, including the crust, mantle, and core. The site provides goals, objectives, an outline, time required, materials, activities, and classroom ideas for the lesson. The Classroom Connections address content with an activity approach while incorporating themes necessary to keep the activity at a higher cognitive level. The major motivation is to employ instructional strategies that bring the students physically and mentally into touch with the science they are studying. [Full description]

What is a Ground Water Aquifer?
http://www.epa.gov/region4/region4train/groundwater2.htm

Ocean Floor plates may slide under continental plates, sinking deep into the earth.

The earth’s interior contains a denser, hot, gradually deformable layer of earth.

The slow movements of material within the earth results from heat flowing out.

The solid crust of the earth includes the continents and the ocean.

Earthquakes often occur along the boundaries of plates between colliding.

The interior of the earth is...
Examples & Current Work

- Task centered design methodology for designing conceptual browsing interfaces
- Service based architecture
- Evaluation for usability and appropriateness of service
- Evaluation for conceptual changes
Research Methodology & Future Work

- Develop 1-2 prototype of enabling digital libraries based on LEDL framework
- I will use task centered design approach
  - Pick a conceptualization of learning e.g. inquiry based learning
  - Develop rich learning scenarios and tasks by engaging with teachers and students
  - Identify task complexity dimensions and the LEDL framework components that address them
  - A small set of scaffolds for developing enabling digital libraries
  - Develop infrastructure for making these scaffolds available to a digital libraries e.g. web services
  - Inform design and LEDL framework using conversational analysis method (Norman et al 1991)
Why use Conversational Analysis

• *Definition*: Conversational analysis examines production and recognition of systematic interactional structures

• It informs design by
  – Analysis of user actions and talks
  – Analysis of domain specific knowledge
  – Software evaluation
Evaluation

• Evaluate the learning effectiveness of the prototype compared to conventional educational digital library interface
  – Verbal protocols
  – Teachback

• Evaluate the usability and usefulness of web service
  – Programming walkthrough
Anticipated Research Contributions

- A methodology for developing enabling digital library
- Technical infrastructure and workflow practices for enabling digital libraries
- Identification and development of effective user interfaces for enabling digital libraries
Thank you

Questions, Comments, Suggestions

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