Using Digital Libraries to Build Educational Communities: The Chemistry Collective

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Goal: Build a DL Community to improve conceptual understanding in chemistry using simulations and scenario-based learning.

Effective online curriculum development typically requires a team of learning scientists, learning technologists and domain experts working in close proximity (tight coupling). Our goal is to us DL structures to support remote, asynchronous collaboration within a community that, together, possesses the necessary three types of expertise (loose coupling).

Digital Library Supporting Architecture:

Learning Scientists: Provide pedagogical and assessment guidance by organizing the collection around a conceptual structure of the domain, providing assessment tools, and participating in community discussions.

Learning Technologists: Contribute simulations, data visualization tools and multimedia components that can be assembled by non-programmers.

Instructors and curriculum developers: Contribute domain and pedagogical expertise by testing student activities in their classrooms and using authoring tools to modify or create activities by assembling simulation, virtual lab and multimedia components from the collection.

Interactive Content
These technologies help the community meet what we have identified as the two main learning challenges in chemistry instruction:

- Helping students connect the notational and algebraic procedures of the course to authentic chemistry (Virtual Lab)
- Helping students see the utility of chemistry in the world around them (Scenario Collections)

Virtual Lab
This is a flexible networked chemical laboratory simulation that allows students to select from hundreds of standard chemical reagents and combine them in any way they see fit — providing them with an opportunity to interact with chemical systems in a manner that would not be possible with paper-and-pencil activities. This includes allowing them to design and carry out their own experiments.

Problem Authoring Tool
Allows curriculum developers to create activities for the virtual lab by:

- depositing assignments in the DL collection
- providing HTML problem descriptions
- configuring the interface to make specific laboratory equipment available
- providing HTML, problem descriptions
- modifying and maintaining interactive content.

Scenario Collections
Modifiable collection of scenario-based learning activities that embed the procedural and conceptual knowledge of the course in contexts that highlight the utility of that knowledge. Some examples are shown below:

1. Mixed Reception Murder Mystery Scenario
2. Groundwater Contamination by Arsenic in Bangladesh
3. Ozone Scenario on Kinetics
4. Mission to Mars Thermochemistry Activity

Benefits

Local benefits
- Targets a particular, domain-specific, educational challenge and intervention strategy, that of promoting qualitative learning in introductory college and high school chemistry courses.
- Takes full advantage of the power of digital content to address educational challenges, through a combination of simulations and multimedia.
- Takes advantage of the ability to organize content in multiple ways as a means to promote and organize educational change.
- Allows for iterative improvement of the content based on classroom experiences and measured learning outcomes.

Benefits to NSDL as a whole
- The creation and demonstration of a digital library architecture that supports community authorship, modification and maintenance of interactive content.
- A portfolio of experiences and assessment studies on which to build.

Research Questions
We are monitoring the community building process to create a portfolio of assessment studies that address the following questions:

- What are the principal benefits and barriers that influence potential community members decisions to participate in the collection?
- Which Digital Library structures are most effective at supporting a community of users and authors working together to address specific educational challenges?

For more information about this project or about creating collections and communities to meet challenges in education, please visit http://www.chemcollective.org or email info@chemcollective.org