How can we describe and use digital learning materials more effectively?

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Question: How can we better use and describe learning material?
Question: How can we better use and describe learning material?
Hypothesis: By providing sufficient metadata.
Why do we use metadata in E-Learning Systems?

- **E-Learning Systems** or Learning Management Systems (LMS) deliver learning material to learner’s, to achieve a pedagogical goal.
- **Metadata** used describes Learning Objects (learning material).
- Metadata helps people and **computers** find learning appropriate material more easily.
- Since the current focus of e-learning systems is personalization through adaptation, machines need consistent and abundant metadata over which to reason.
Learning Object Repositories Research Network (LORNET)

Theme 1  Interoperability of Learning Object Repositories - *Simon Fraser University and l’École Polytechnique de Montréal*

Theme 2  Learning Objects Design and Aggregation - *Distance University of the University of Quebec at Montreal (TELUQ)*

Theme 3  **Active and Adaptive Learning Objects - University of Saskatchewan**

Theme 4  Object Mining and Knowledge Extraction - *University of Waterloo*

Theme 5  Creation, Search and Distribution of Complex Multimedia Learning Objects - *University of Ottawa*

Theme 6  Telelearning Operating System - *l’École Polytechnique de Montréal and TELUQ*
Learning Object Repositories with Learning Objects but no metadata. (ie. PALOMA - TELUQ, CAREO - Prov. of Alberta; LOM based)

Learning Objects with metadata but metadata is insufficient. (ie. Merlot)

But we haven’t quite given up on learning objects yet.

Perhaps we require too much for metadata and metadata authors?

Perhaps we need more metadata authors?
Two approaches for solving metadata

1. Improve the process human created metadata - my research.
2. Create and use metadata automatically - The Ecological Approach.
The Ecological Approach

- Motivates a process for reasoning over learner interactions.
- Focuses on using purpose and context coupled with complex learner modeling to describe learning objects.
- Wengang Liu investigating data mining.
KESP Overview

- Summer of 2006 in Dublin, Ireland
- Knowledge Economy Skills Passport
- Consortium of 5 of the most prominent Irish e-learning companies
- Create an e-learning solution to retrain the Irish workforce for the new economy
KESP Organizations

1. Intuition - Content
2. Electric Paper - Content
3. Servecast - Video
4. WBT Systems - LMS - Top Class
5. Intel - silent partner
6. National College of Ireland - curriculum and research
KESP Research

- Under Supervision of Prof. Peter Brusilovsky and Prof. Stefan Weibelzahl
- Overall goal was to perform industry targeted research
Under Supervision of Prof. Peter Brusilovsky and Prof. Stefan Weibelzahl

Overall goal was to perform industry targeted research

... a few problems
Research Performed

1. Standard based approach for user event tracing - SCORM
2. Protocols and architecture for distributed adaptive content
3. Social and collaborative software for e-learning
Protocols and architecture

(Student Modeling Server)  
(Portal)  
(Activity Server)  
(Value-adding Service)  

(Brusilovsky, WWW 2004)
What are the problems with metadata standards?

- Remember the empty repositories. Empty sets of human created metadata.
- Learning Object Metadata Standard - IEEE LOM
- 250 randomly chosen learning objects only half of them used 1/3 of the LOM fields. (Friesen 2004)
Many vendors expressed little or no interest in developing products that were required to support a set of meta-data with over 80 elements... [and the] burden to support 80+ meta-data elements on the first iteration of a product is too great for most vendors to choose to bear. (Anderson and Wason, 2003)
Two nice technologies

We will contrast two approaches for metadata creation, both with desirable and undesirable characteristics.

1. **Collaborative tagging**, in which metadata creation is easy but not machine consumable.

2. **Ontologies**, in which metadata is machine consumable but too difficult to author.
So what is Collaborative Tagging?

Collaborative Tagging:

- A Web 2.0 technique
- Seen in practice on websites like: flickr.com, del.icio.us, and CiteULike.org
- Uses simple keywords (tags) for creating **human consumable** metadata. (tagging)
- Each keyword is not only an annotation but a **vote** for the tag to be recommended to others for the same resource.
- Possibly a useful cognitive tool for learners in e-learning.
A demo of the OATS system was given, in its place are some screen shots.
Human-Computer Interaction is a fairly new area of Computer Science. Its focus is on how to make systems that are useful, useable, appealing, and intuitive for people. It recognizes that computers need to meet the needs of humans and should be designed with this primary goal in mind. The design process becomes human-centered rather than machine-centered. This may seem like an obvious goal, but all too often the user interface is added on towards the end of a project, once the system has been designed and built. By this point, the interface focuses on giving access to the already built system, rather than focusing on what would be most useful, useable, appealing, and intuitive for humans.

Imagine a machine is built to sort socks - you put in an armful of socks, press several buttons that identify the different types of socks, and folded pairs of socks come out the other end. Sure, the machine has a purpose; people can adapt their laundry routine and learn to use the sock-sorter. But now people have to make sure...
What's the problem?

Collaborative Tagging

Enter Ontologies
Summary of Research Experiences

What's the problem?

Collaborative Tagging

Enter Ontologies

Collaborative Tagging

Collaborative Tagging is a method that allows users to organize and search information by assigning tags to content. Many websites like Delicious, Twitter, and Digg use this approach to make content more accessible and easier to find. However, a major challenge with this system is that it is not intuitive for people to use. It recognizes that computers need to be designed to talk to each other, but human-computer interaction is still a challenge. The research aims to combine the approaches of tag-based and ontology-based systems to provide a better user experience.

CommonFolks - Combining the Approaches

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University of Leeds, September 2006
the interface focuses on giving access to the already built system, which is most useful for people who habitually donate clothing for...
Tag Categories

My Tags ▼
Below are the tags you have used.

hci (3) ▼
Search for hci
View Pages you've tagged with hci ▼
  • What is HCI?
  • Importance of User Interfaces and HCI

View Highlights you've tagged with hci ▼
A vast array of computer-based systems surrounds us: stand-alone and networked personal computer systems, websites, safety-critical systems and embedded systems on page: Importance of User Interfaces and HCI
What's the problem?
Collaborative Tagging
Enter Ontologies

Tag Categories

My Tags

Community Tags

Below are the 10 most popular tags used.

- hci (43)
- interesting (11)
- definition (8)
- computer (7)
- important (7)
- study (7)
- boring (6)
- history (5)
- overview (5)
- experience (4)
- limitations (4)
What's the problem?
Collaborative Tagging
Enter Ontologies
Summary of Research Experiences
Metadata
CommonFolks - Combining the Approaches

What's the problem?
Collaborative Tagging
Enter Ontologies

Search
what are you looking for?
- Pages
- Notes
- Tags

hci example
search

pages found must contain
- all of the tags listed above
- at least one of the tags listed above

Search Results
Below are the pages which contain tags based on the above search criteria.

What is HCI
Score: 13 Tags: hci example
http://ihelp.usask.x3/packages/436/WhatIsHCI/HCI

View this page
**Search**
what are you looking for?
- Pages
- Notes
- Tags

example

notes found must
- contain the text like above
- must have a title like above

**Search Results**
Below are the notes which match the above search criteria.

Yeah this example is cool... I wish I had

What is HCI posted publicly by smith on
Wed, Aug 30, 2006 02:44 PM

I really like this example.

What is HCI posted publicly by scott on
**Summary of Research Experiences**

**Metadata**

**CommonFolks - Combining the Approaches**

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**What's the problem?**

**Collaborative Tagging**

**Enter Ontologies**

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### Search

**what are you looking for?**

- Pages
- Notes
- Tags

**computer science**

**Search Results**

Below are the tags which are most commonly found with the tags you provided.

- hci (3)
- field (1)
- area (1)
- goals (1)
- part (1)
- definition (1)
What is HCI

Human-Computer Interaction is a fairly new area of Computer Science. Its focus is on how to make systems that are useful, useable, appealing, and intuitive for people. It recognizes that computers need to meet the needs of humans and should be designed with this primary goal in mind. The design process becomes human-centered rather than machine-centered. This may seem like an
Pros of Collaborative Tagging

The pros:

+ Simple to use because of: easy tools, no rules and uses natural language.
+ Promotes a type of collective intelligence through community consensus.
+ Provides user support.
+ Opens the door for more people to become metadata creators (shown by its popularity).
Cons of Collaborative Tagging

The cons hinder the ability of this being an applicable solution for learning material metadata.

- Not machine consumable, since tag semantics in the users; only useful for humans.
- As breadth becomes large, users must create order for their tags.
- Meta noise: out of context and/or bad tags can emerge.

Hot tags

In the last 24 hours
sydneymidweekflickr15, sflickr, day21, sflickr0406, photoaday, goodfriday
furryfriday, iowacity, themeoftheweek, april13, musician2, happyfurryfriday, azzurro, musician1, caltrain, canoneos350d
What are ontologies?

- Ontologies describe concepts, the properties of concepts, and the relationships between concepts.
- They provide machine consumable knowledge representation over which to reason.
- The key approach to achieving the Semantic Web.
- The focus of learning material metadata research.
Ontologies: Still not a solution for creating metadata

While ontologies give a method to add machine consumable semantics they are too difficult.

- Ontologies, even with good tools, require some expert knowledge.
- Machine consumable labels may be misinterpreted by metadata creators and consumers.
- Standardized domain ontologies are rigid and don’t meet the needs of all end-uses.
Can we combine everything we know into a new approach?

Recall:

- Ontologies create machine consumable info but are too difficult and rigid for metadata creators.
- Collaborative tagging techniques create human consumable metadata but are not machines consumable because of the lack of semantics and rules.
- What is the missing link?
The missing link.

“... del.icio.us has no idea what the tags mean. The tag overlap is in the system, but the tag semantics are in the users. This is not a way to inject linguistic meaning into the machine.” - Clay Shirky
Hypothesis:

Collaborative tagging can be employed, with an English language ontology, to make metadata creation fast, easy, and machine consumable.
WordNet is a natural language ontology based on human lexical memory.

Sense 1
hat, chapeau, lid

=> headdress, headgear
   => clothing, article of clothing, vesture, wear
   => covering
      => artifact, artefact
         => object, physical object
            => entity
   => whole, whole thing, unit
      => object, physical object
         => entity
=> consumer goods
   => commodity, trade goods, goods
      => artifact, artefact
         => object, physical object
            => entity
   => whole, whole thing, unit
      => object, physical object
         => entity
With CommonFolks we wish to define a system framework:

- which makes use and extends the natural language ontology in WordNet.
- incorporates (but hides from the user) a RDF/XML syntax, to maximize system interoperability.
- provides collaborative tagging like tools to facilitate the metadata creation process.
First Prototype

The first working prototype allows a user to annotate learning material represented by a URL with terms in WordNet.

Scott.Bateman's Annotations

Resources

http://test.org/lesson

HTML Lesson --- about html

Tutorial

Tags

- "topic" hypertext markup language x
- "level" medium x

Add More Tags
What will CommonFolks buy us?

- A more intuitive method to create ontologies for metadata.
- A way for metadata authors to receive support.
- A better alternative to a standardized domain ontology.
- Allow more metadata authors to become involved.
Future Work for CommonFolks

The extension of the prototype to include:
- Ability to add new terms.
- Collaborative based suggestions.
- RDF/XML definition.
- Ontology versioning.
**Focus:** Integration of CommonFolks within OATS, as an annotation system for students and instructors in an E-Learning System. Other applications we are investigating:

- integration with learning object repositories.
- a general purpose web annotation system.
Thank you!

Please contact me: scott.bateman@usask.ca

For more details see: "Collaborative Tagging Approaches for Ontological Metadata in Adaptive E-Learning Systems" (Bateman, Brooks, McCalla SW-EL @ AH06)
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