Before we begin…
A note about …Medical Education…

"Half of what you are taught as medical students will in ten years have been shown to be wrong. And the trouble is, none of your teachers know which half"

Sydney Burwell, Dean, Harvard Medical School - 1956

"Knowing more and more about less and less until one has known everything about nothing"

Source: R. Biswas et al, In S Hatzipanagos, S Warburton, "Handbook of Research on Social Software & Developing Community Ontologies", Information science reference Series, IGI Global, Hershey, New York, 2009

5 dimensions in clinical encounters to optimise medical decision making

- *Empirical evidence:* derived from clinical research. (biomedical ontology)
- *Experiential evidence:* derived from personal clinical experience or the clinical experience of others. (individual ontology)
- *Patho-physiologic rationale:* based on underlying theories of physiology, disease and healing. (biomedical ontology)
- *Patient values and preferences:* derived from personal interaction with individual patients. (Individua ontology)
- *System features:* including resource availability, societal and professional values, legal and cultural concerns. (administrative-bureaucratic and cultural ontologies)

Source: R. Biswas et al, In S Hatzipanagos, S Warburton, "Handbook of Research on Social Software & Developing Community Ontologies", Information science reference Series, IGI Global, Hershey, New York, 2009

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The role of Big Data and Learning Analytics in Medical Education

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Aristotle University of Thessaloniki,

Greece

Twitter: @bamidis

Summary

- Taboos & Trends in Medical Education & Learning
- Big Data
- Medical Learning Analytics
- Achievements so far
- Envisaged new developments
  - PBL and Virtual Patients
  - Game based learning / Semantic Medical Games
  - Experiential Learning / Virtual spaces

Medicine has a reputation as a conservative discipline

- Not due to the disciplinary content
  - always on the forefront of scientific innovation...
- But due to how learning and teaching is supported via policies and educational practices… The evidence:
  - Big lecture theatre sessions (no interaction)
  - End of “semester” exams (summative assessment): most popular methods of assessing student knowledge.
  - Hierarchical models of operation prevent effective interactions & exchange of knowledge between experts & learners.
  - Lack of any links to healthcare professional communities to support/sustain communities of learners

Hatzipanagos S. Disrupting traditional teaching practices with social media: the case for medicine in: Bamidis P, Anastassov V., Despotova-Toleva L (Eds), E-education & E-science. 2012, Plovdiv, Bulgaria: Medical Publishing VAP; 2011 ISBN 978-960-243-682-0

… the 'hidden curriculum' …

- In addition to the medical curriculum…
  - Effective performance as a healthcare professional depends on being able to assimilate, evaluate and use new information;
  - Clinical and communication skills are common to a range of healthcare professionals.
  - Developing proper attitudes is a major educational goal for all healthcare professionals.
  - These skills and competences can be supported or developed by a range of emergent technologies.

Leinster S. (2002) Medical education and the changing face of healthcare delivery
Medical Teacher, Vol. 24, No. 1, 2002.

Medicine: most appropriate test bed for alternative educational experiences

- …supported by learning technologies
- influenced by two recent thrusts in higher education:
  - a move towards more student-centred learning
  - a call for stronger links between teaching and disciplinary research
- Clinical experience is fundamental in medical education
- In learning environments ➔ acquired by scenario-based learning or inquiry-based learning.

Brew, A. (2003). Teaching and research: New relationships and their implications for inquiry based teaching and learning in higher education. Higher Education Research and Development 22, no. 1: 3–18.

Jenkins, A., M. Healey, and R. Zetter. (2007). Linking teaching and research in disciplines and departments. York: The Higher Education Academy.

Contemporary Medical Education approaches

- Scenario-based learning
- Just in time learning
- Personalised learning
- Early skills training
- Greater reliance on self –directed learning

Why are e-learning resources becoming so important?

- Scenario-based learning is increasingly more e-based
- Increased use of Just-in-Time learning
- Effective use of video and animations
- Increased personalised learning:
  - Self-Directed learning
  - Mobile learning

A shift in the design of curricula
which promotes personalised individual study

Medical education & emergent learning technologies

- Teaching and learning in medicine can be social & informal
- learning technologies:
  - Social media: support & sustain communities of practice much better than previous generations of learning technologies
  - Digital literacies … updated knowledge of technology enhanced learning resources; expertise of range of tools and of the pedagogical affordances that each provides
  - e-Portfolios: tools for reflection & demonstrating competence.
  - Open Educational Resources (OERs): sharing resources in medical education.

Hatzipanagos S. Disrupting traditional teaching practices with social media: the case for medicine in: Bamidis P, Anastassov V., Despotova-Toleva L (Eds), E-education & E-science. 2012, Plovdiv, Bulgaria: Medical Publishing VAP; 2011 ISBN 978-960-243-682-0.

Setting the Scene

uses

Academic Institution

uses

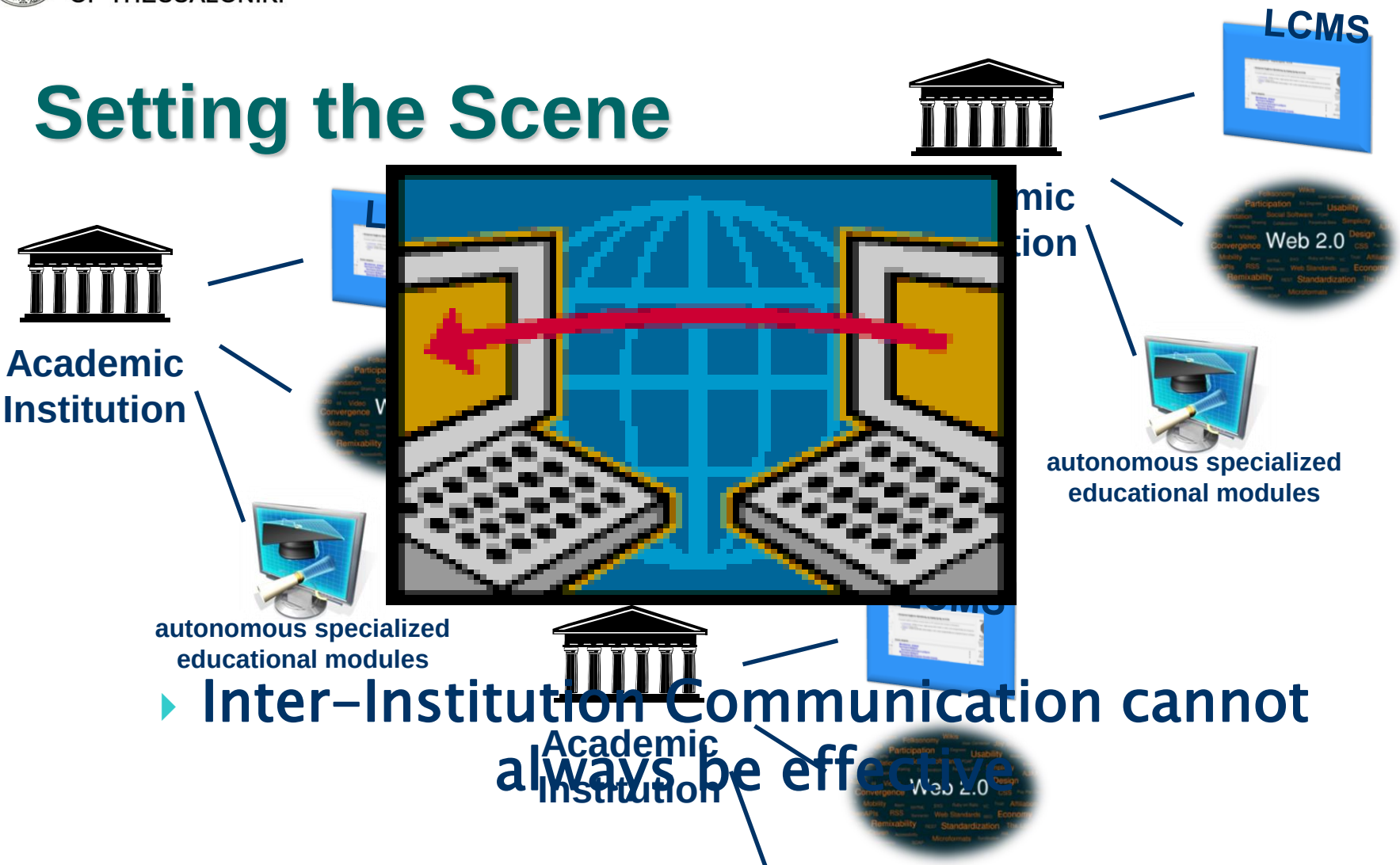
has/creates

autonomous specialized educational modules

How do people usually share?

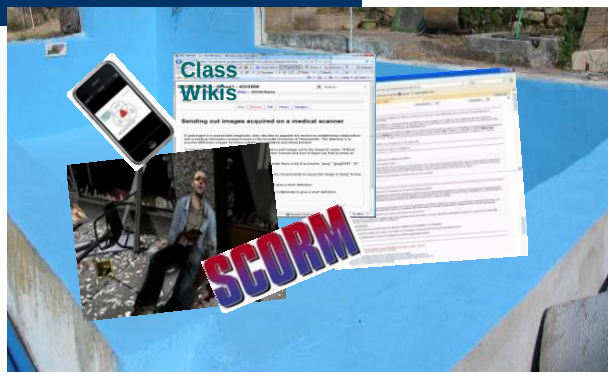
- Usually expose individual repositories
  (instead of allowing distributed searches)
- Case of search engines (e.g. Google):
  - data are restricted to specific kinds of documents
    (such as HTML, PDF…
    i.e. do not harvest metadata as such)
- Minimal sharing mechanisms…
- Minimal interoperability between systems…
- Peer collaboration ?

Setting the Scene



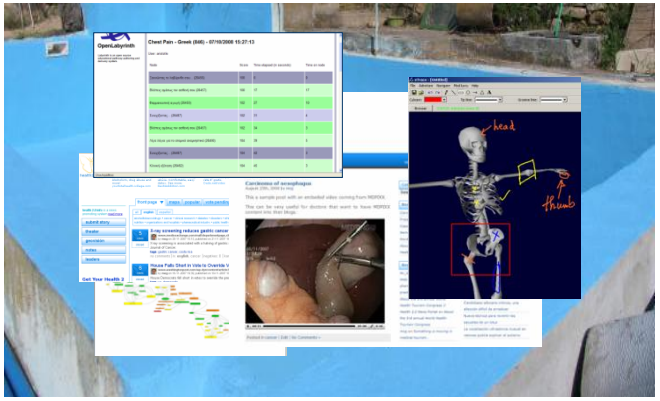
- Inter-Institution Communication cannot always be effective

Need for virtual distributed pools of autonomous specialized educational modules

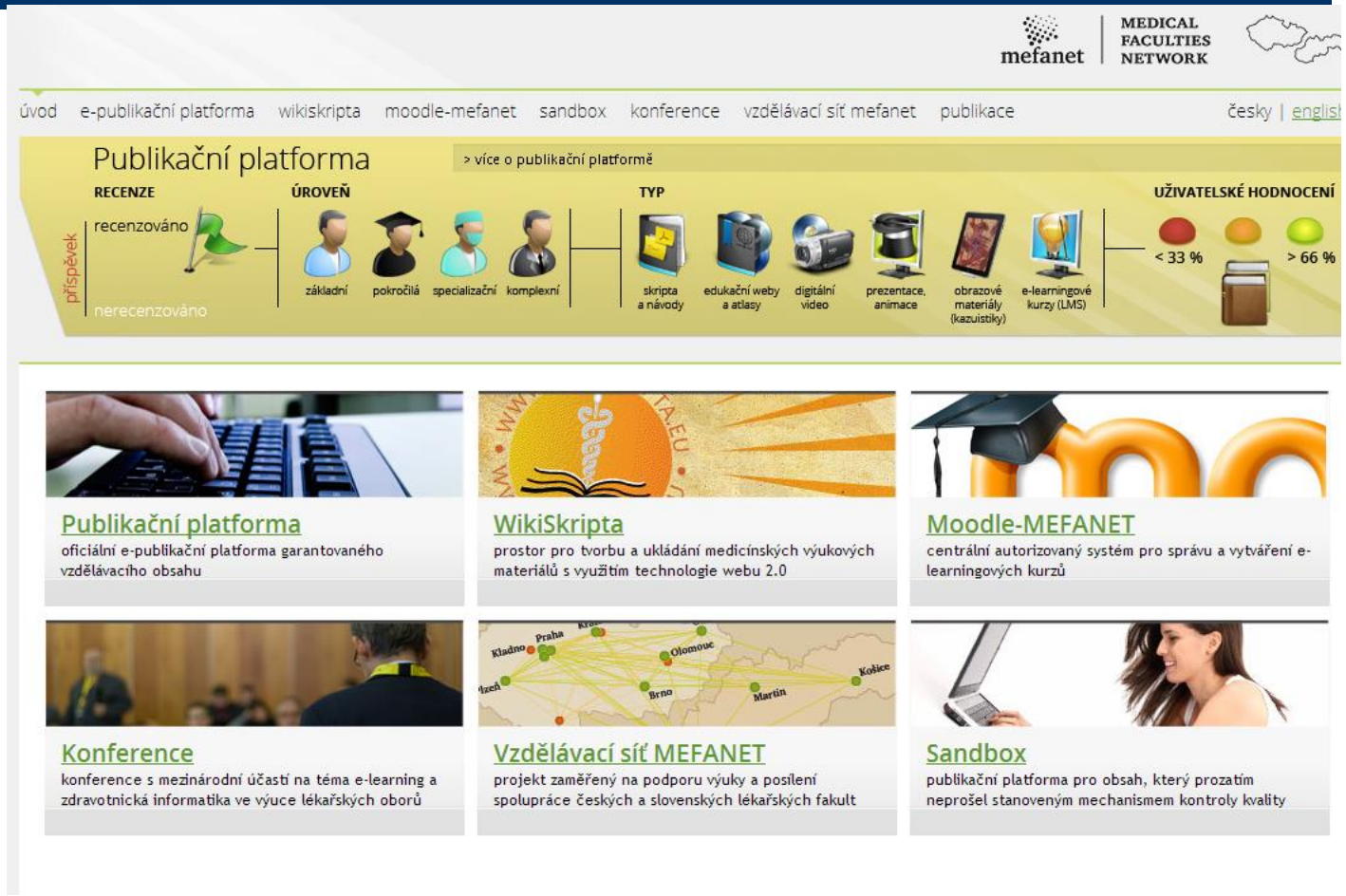


- **mechanisms for**
  - Searching
  - Retrieving
  - Evaluating
  - Rating
  - Adapting
  - Revising

  educational content in Medicine and Life sciences



MEFANET


mefanet
MEDICAL FACULTIES NETWORK
úvod
e-publikační platforma
wikiskripta
moodle-mefanet
sandbox
konference
vzdělávací síť mefanet
publikace
česky | english
Publikační platforma
> více o publikační platformě
RECENZE
recenzováno
příspěvek
nerecenzováno
ÚROVEŇ
základní
pokročilá
specializační
komplexní
TYP
skripta a návody
edukační weby a atlasy
digitální video
prezentace, animace
obrazové materiály (kazuistiky)
e-learningové kurzy (LMS)
UŽIVATELSKÉ HODNOCENÍ
< 33 %
> 66 %
Publikační platforma
oficiální e-publikační platforma garantovaného vzdělávacího obsahu
WikiSkripta
prostor pro tvorbu a ukládání medicínských výukových materiálů s využitím technologie webu 2.0
Moodle-MEFANET
centrální autorizovaný systém pro správu a vytváření e-learningových kurzů
Konference
konference s mezinárodní účastí na téma e-learning a zdravotnická informatika ve výuce lékařských oborů
Praha
Olomouc
Brno
Martin
Košice
Vzdělávací síť MEFANET
projekt zaměřený na podporu výuky a posílení spolupráce českých a slovenských lékařských fakult
Sandbox
publikační platforma pro obsah, který prozatím neprošel stanoveným mechanismem kontroly kvality

mEducator (www.mEducator.net)

- A Best Practice Network (BPN) co-funded by the
  - ***e*Content*plus* 2008** programme of the European Commission, Information Society and Media Directorate-General, Digital Content & Cognitive Systems
  - Contract Reference: ECP-2008-EDU-418006
- Run between May 2009 – April 2012
- As a BPN, it developed and compared two different solutions/frameworks
  - Solution 1 = mEducator2.0 (based on Web2.0)
  - Solution 2 = mEducator3.0 (based on Web3.0/semantic web)
- Scope: to draw best practice recommendations

mEducator central idea

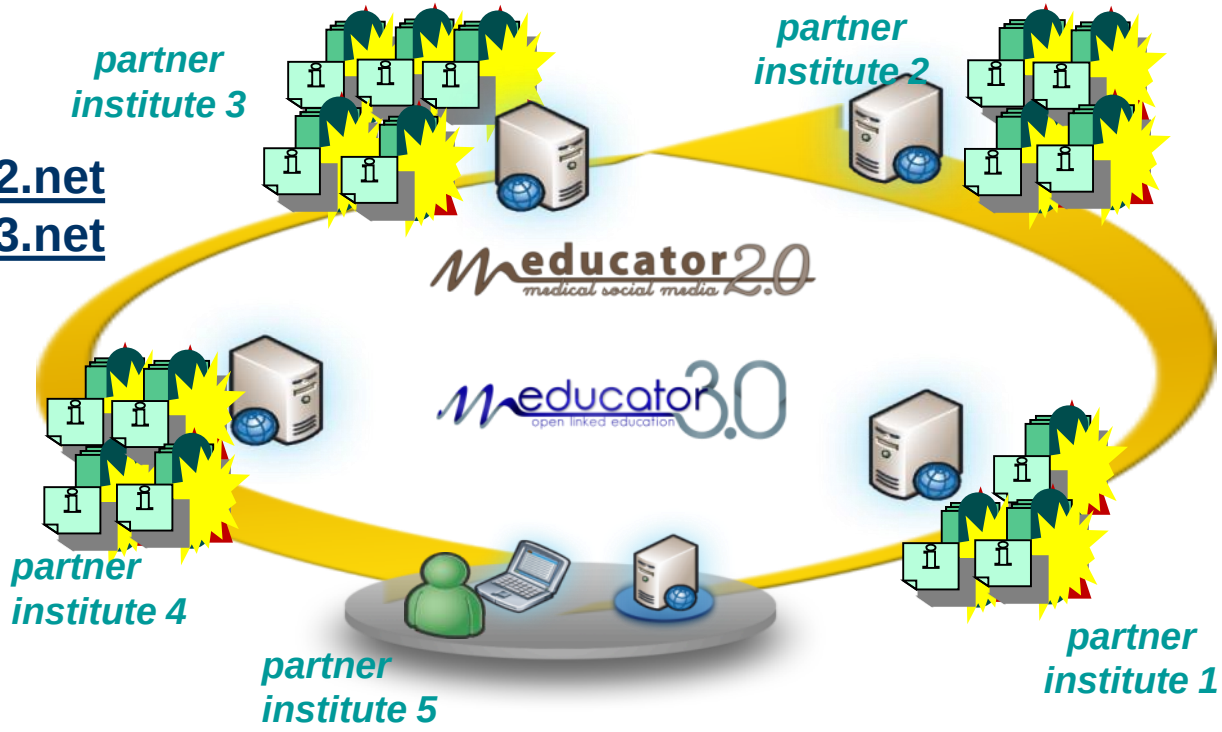
- discover, retrieve, use, rate, re-use and ***re-purpose*** educational content *irrespective* of any **L**earning **M**anagement **S**ystem use

- Target 1: providers and users of such content:
  - expert instructors (academics / health professionals)
  - students / learners
- Target 2: technical providers of educational (health care) solutions

The main product/service

1. mEducator 2.0: loosely coupled LCMSs via mashup technologies (Web2.0)
2. mEducator 3.0: LCMSs linked via (semantic) linked services (Web3.0)

www.meducator2.net
www.meducator3.net



meducator
world wide med

Video

… and suddenly a shift from

linked open data

to

big (open) data

Big (Educational) Data (1)

- Data coming from:
  - online learning environments (e.g. LMS), learning platforms, learning software
- includes log-in information, rates of participation in specific activities, time students spend interacting with online resources or others in the class, and, in some cases, grades (Norris 2011).

Big (Educational) Data (2)

- Analysing these new logged events requires new techniques to work with unstructured text and image data, data from multiple sources, and vast amounts of data
- …aka big data…
- Big data are datasets whose size is beyond the ability of typical database software tools to capture, store, manage, and analyse.

Manyika, J., 2011. Big data: The next frontier for innovation, competition, and productivity. Available at: http://www.mckinsey.com/insights/business_technology/big_data_the_next_frontier_for_innovation.

Some examples

Why bother?

- The society (in crisis these days) needs only 3 things:
- Better Education than before
- Much better Education than before
- Much much better Education in general

Learning Analytics: a recent term...

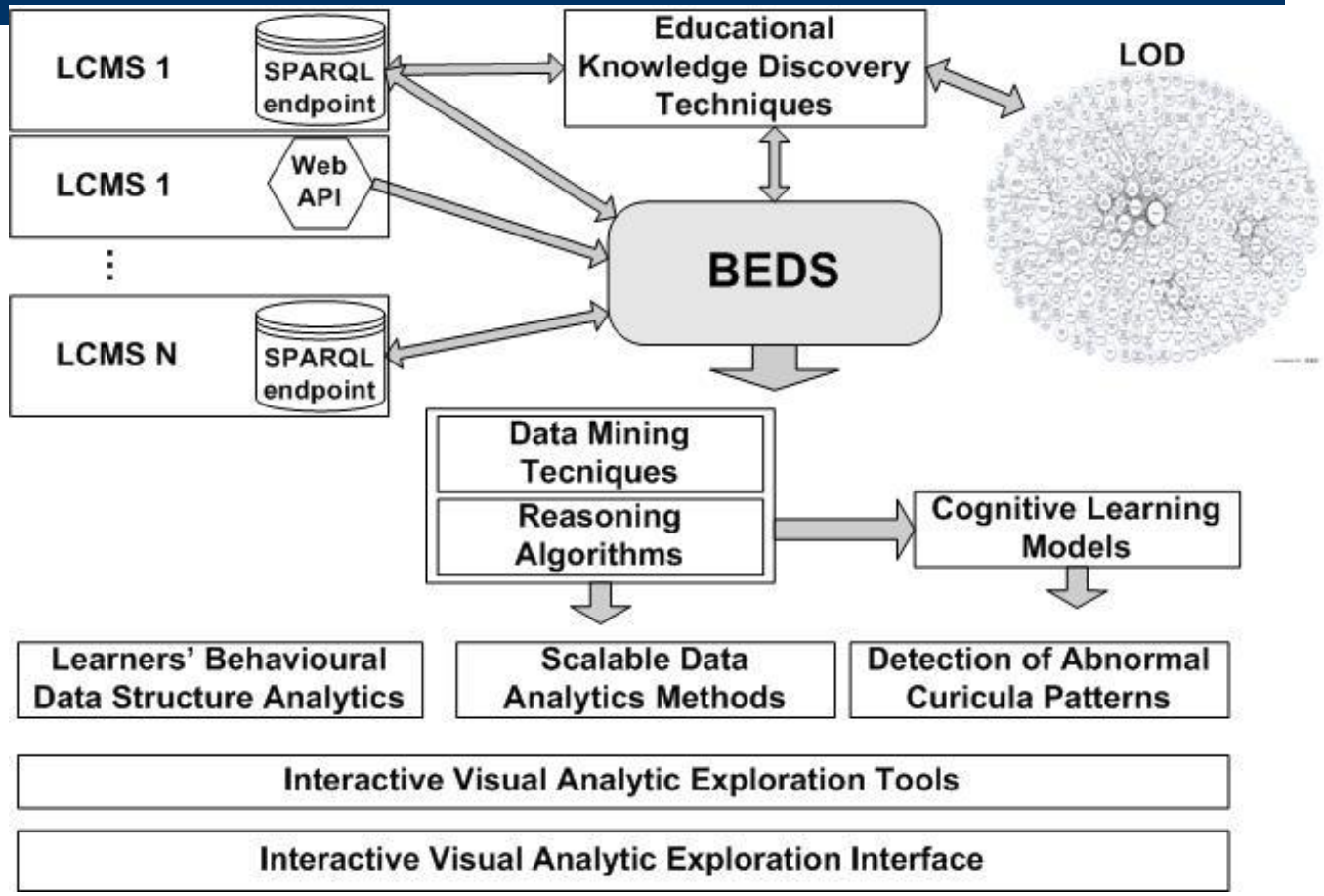
- need for better measurement, collection, analysis and reporting of data about learners…
- Related fields:
  - Educational Data Mining (EDM)
  - Academic Analytics
  - Social Network Analysis
  - Business Intelligence
- to convert educational data into useful information and motivate actions:
  - self-reflecting one's previous teaching or learning activities, to foster improved teaching and learning

Duval, Erik, 2011. Attention please!: learning analytics for visualization and recommendation. In *Proceedings of the 1st International Conference on Learning Analytics and Knowledge*. pp. 9–17. http://dl.acm.org/citation.cfm?id=2090118 [Accessed April 3, 2013].
Dyckhoff, A.L. et al., 2012. Design and implementation of a learning analytics toolkit for teachers. Journal of Educational Technology & Society, 15(3), pp.58–76.

Medical Learning Analytics (MLA)

- a completely new field, under-researched…
- encompasses the leverage of Learning Analytics technologies for boosting medical educational practices
- *…and establishing best practices in obtaining student interaction quality*
- *…by optimising learning in medicine and health sciences and fostering those activities that achieve clinical competency.*

An envisaged architecture…

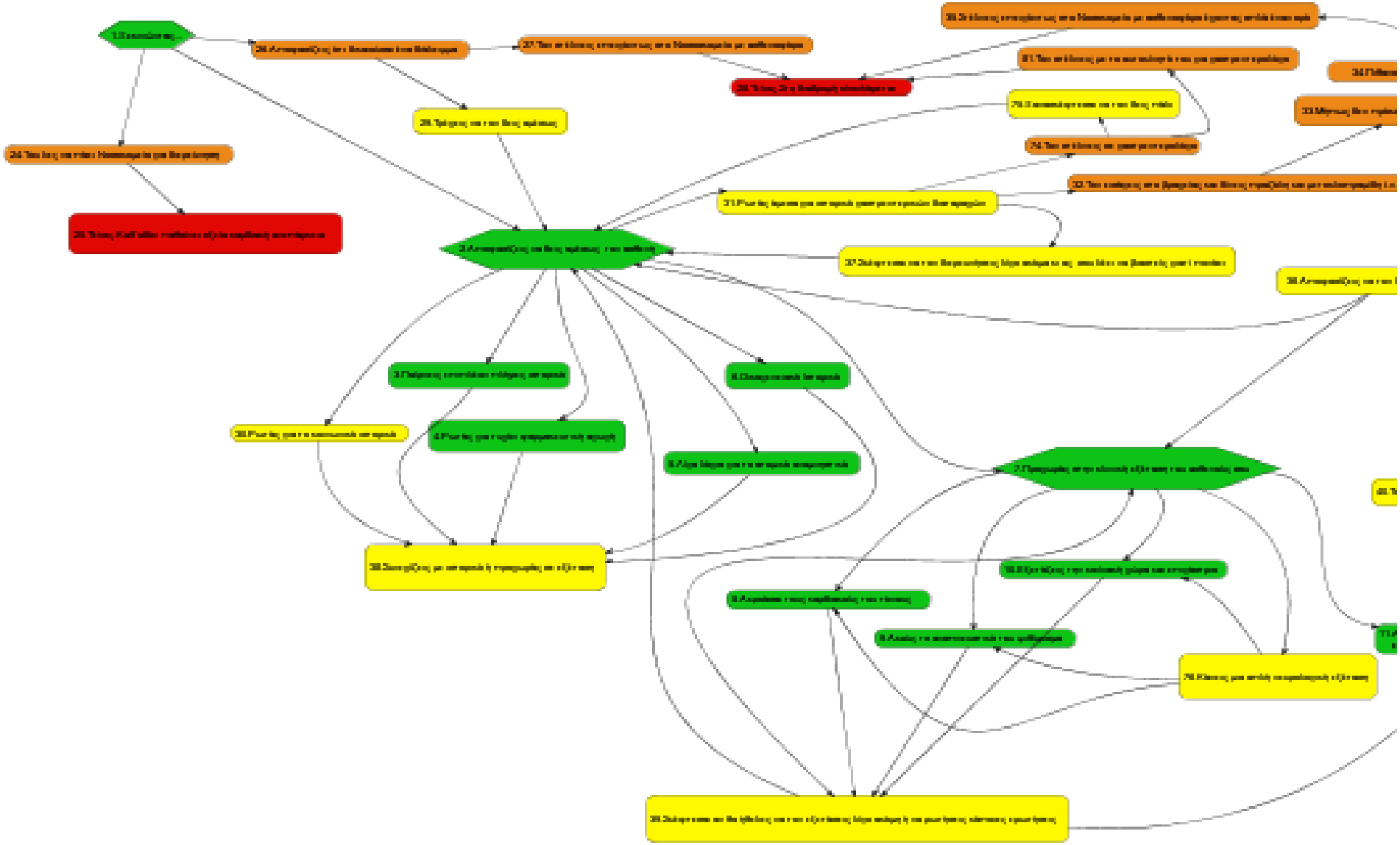


An example from

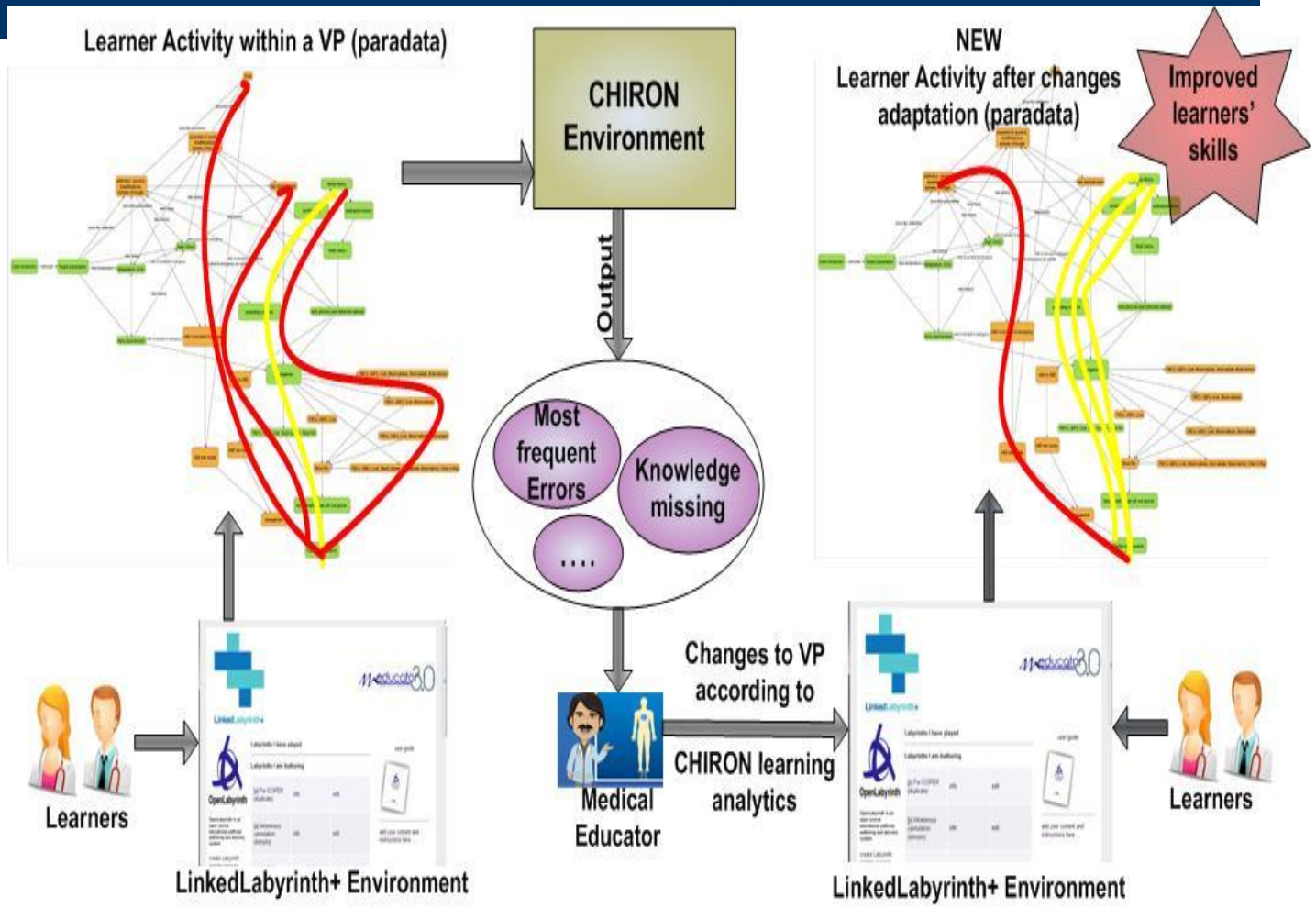
Problem Based Learning and

Virtual Patients

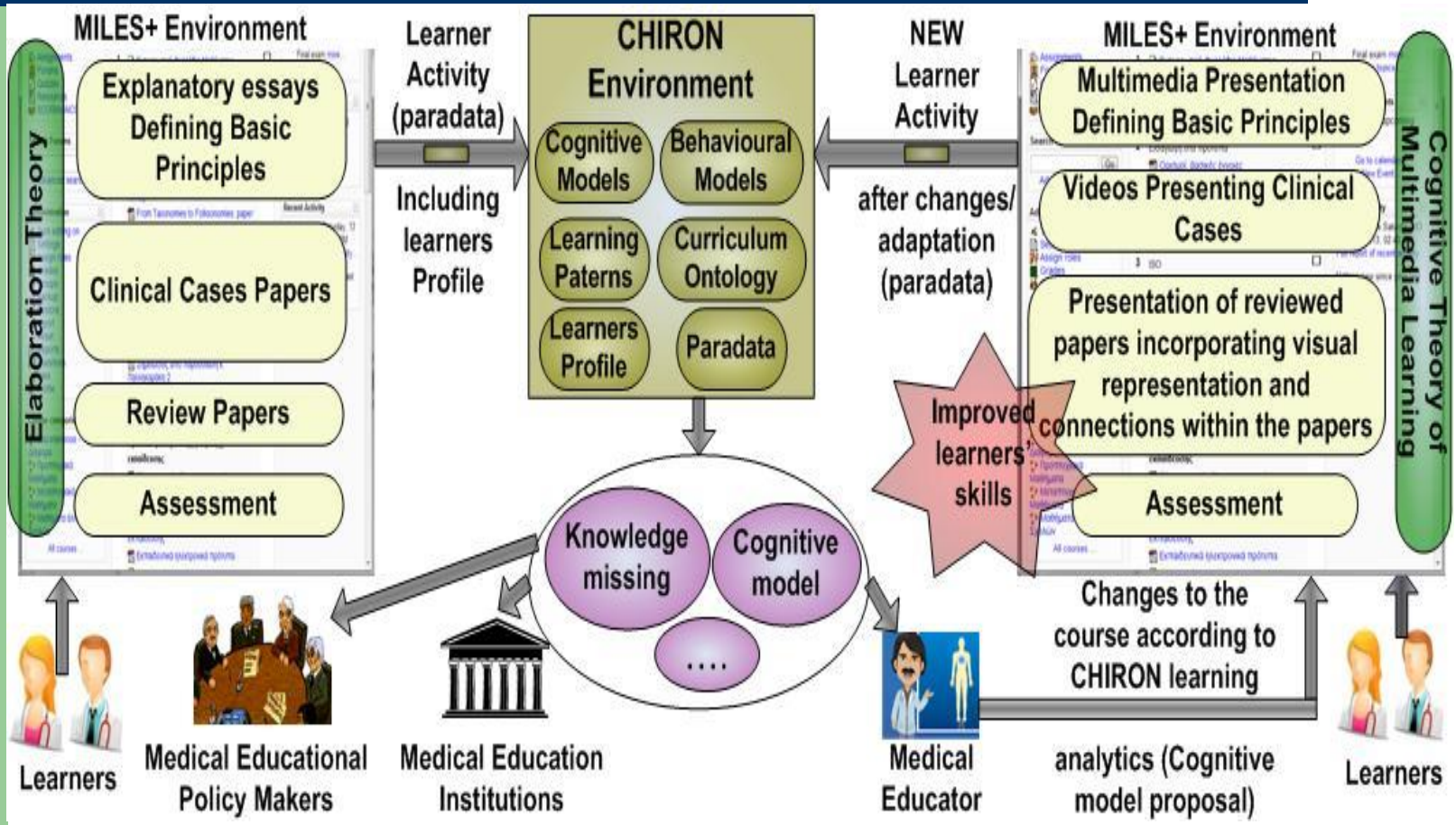
A VP map: a graphical tree of (connected) nodes



MLA reports on the effectiveness of learning material



MLA improves learner experience based on profiles & paradata in other learning environments



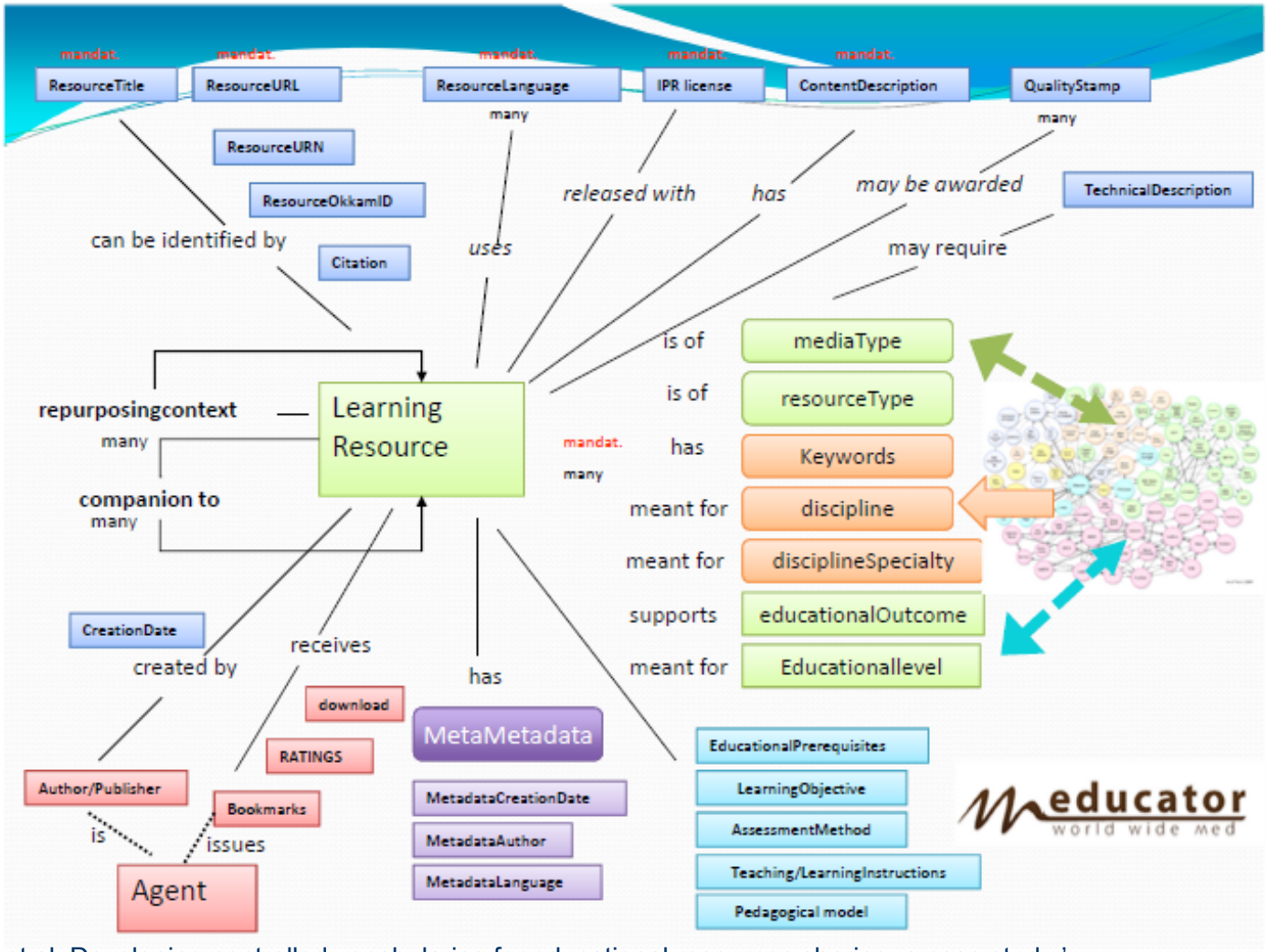
The pre-requisites…

metadata

&

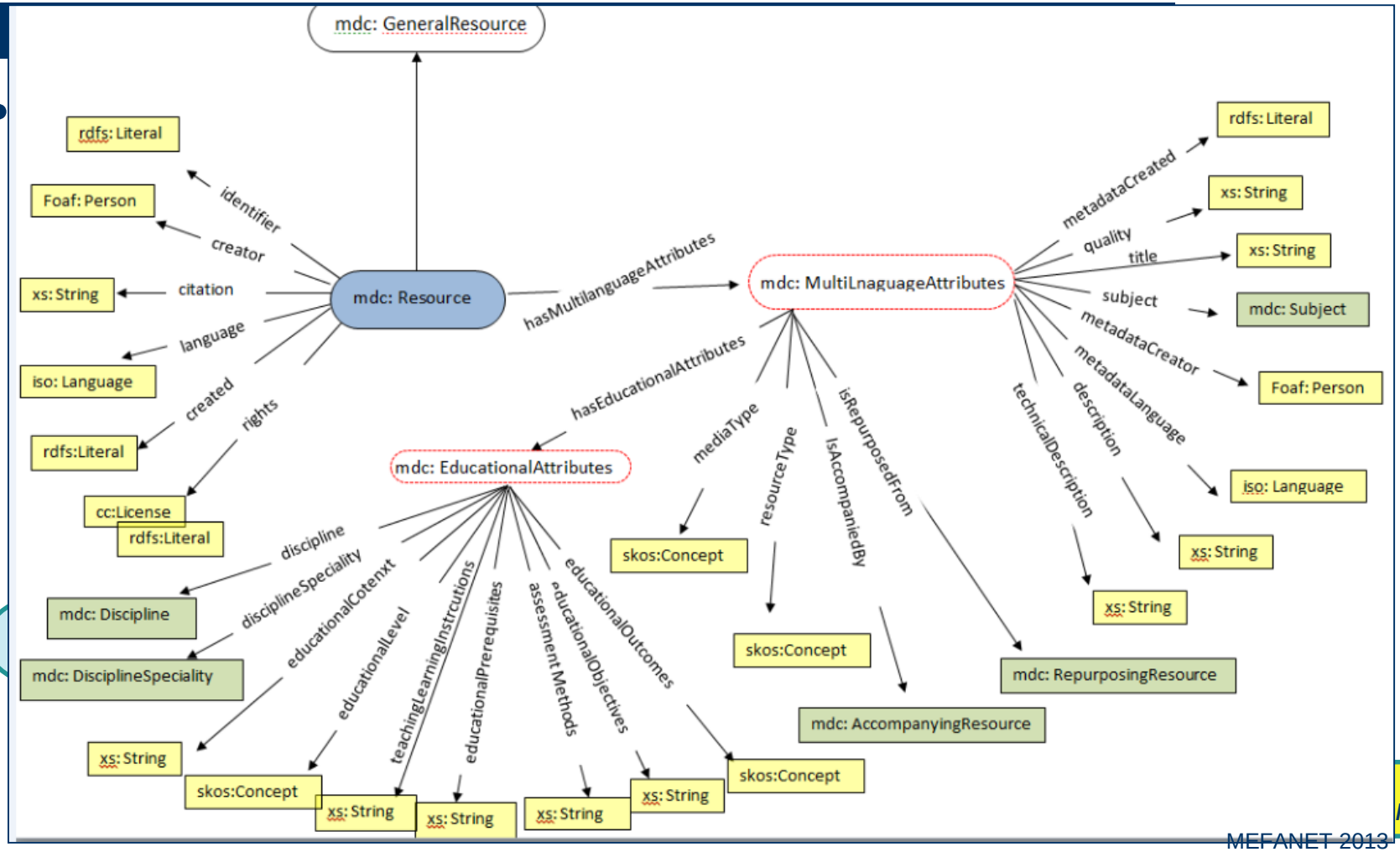
paradata

The mEducator Learning Resource Space



-Giordano et al, Developing controlled vocabularies for educational resources sharing: a case study,'
-Mistopoulou et al, Connecting medical educational resources to the Linked Data cloud: the mEducator RDF Schema, store & API; both in Proc. of 1st Int. Workshop on eLearning Approaches for the Linked Data Age (Linked Learning 2011, in ESWC2011)

mEducator Metadata Scheme RDF Model

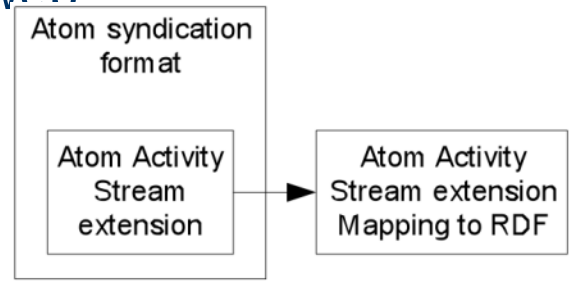


mEducator Metadata Scheme Ontology - Overview

- Classes
  - 12 main mEducator defined classes
  - 5 imported classes from external Ontologies
  - Complementary Classes (Enrichment, Clustering)
- Properties
  - Around 30 mEducator defined ones
  - 8 properties from existing standards
- Support of multiplicity and union of Ranges
- Support of metadata multilinguality

Attention metadata (AM)

- **Goal**: modeling user activity within the content sharing platforms to provide recommendations
- **Proposal**: extend the ATOM schema
- **Advantages**:
  - More intuitive and richer than other AM schemas (e.g., CAM)
  - Easily extensible
  - AAIR mapping (Atom Activity Streams in RDF Vocabulary) designed for social web sites to be used as starting point



Additional capabilities of the model

- static user-edited or automatically generated metadata fields
- the emerging, dynamic information clouds that surround a learning resource when users comment on it, tag it etc, i.e. by a combined use of strict taxonomies/controlled vocabularies with folksonomies.
- Enrichment: maps profile fields to existing Linked Open Data vocabularies and ontologies

So let us see

how we can use these concepts

in VPs

Virtual Patients

- Interactive simulation of health care incidents
- The learners take the role of the professional, being able to:
  - diagnose
  - make therapeutic decisions
- Medical errors challenge the learners without being harmful or fatal to any real person

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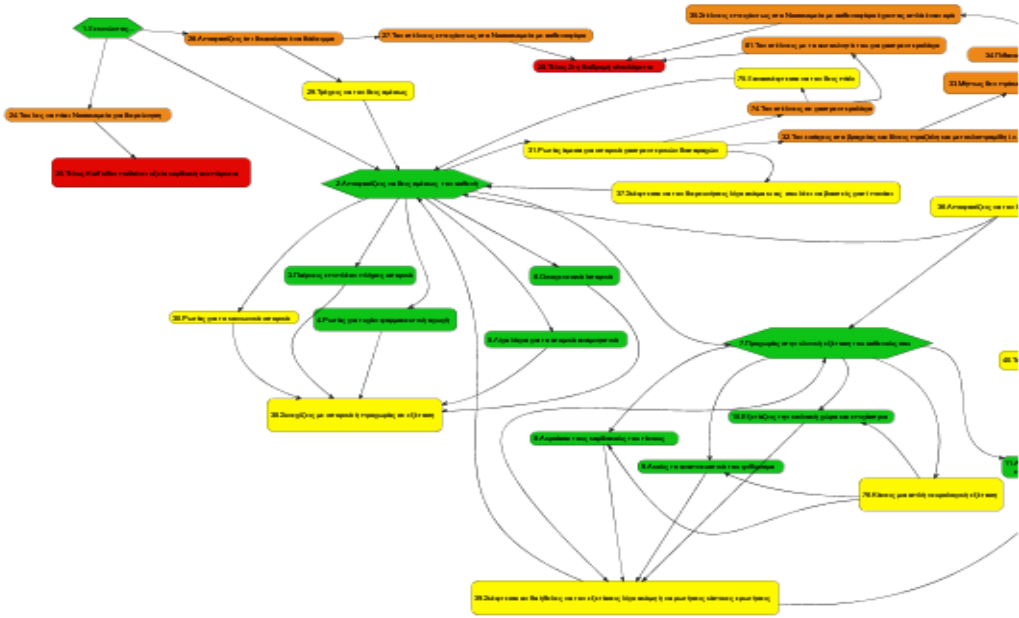
Open Labyrinth

- Web-based Virtual
- allows users to buil
  pathway-based ap
- Pathways may be l
  other sequence for
- Virtual patients are
  because of the many pathways
- Object referencing model allows for easy use and reuse of media, questions, avatars etc.



Pathways = nodes + edges

- Pathways form a network (graph)
- nodes are states of the patient incident
- edges are the decisions and diagnoses the learner makes

- Nodes can have many outgoing edges, pointing to different nodes, depending on the decision taken

Example

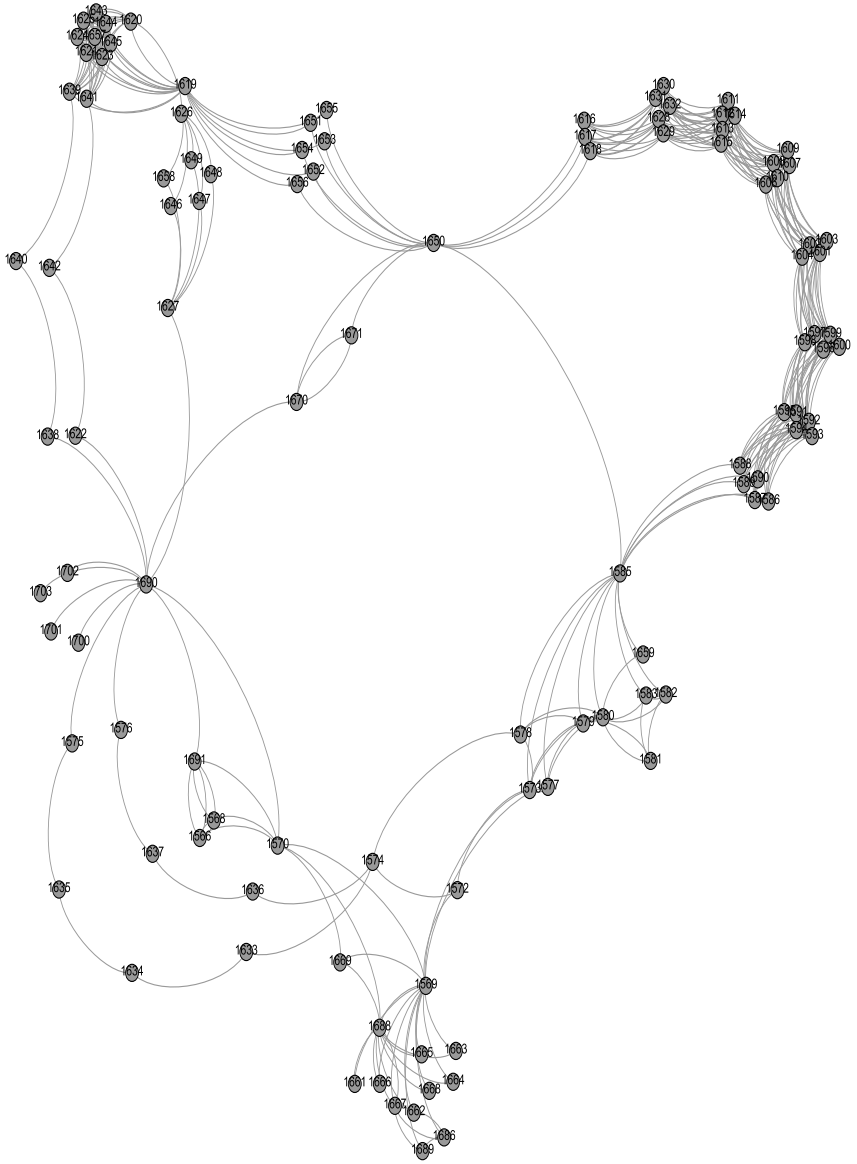
Your next patient is a 35 year old generally well male named Bob. He is booked for 20 minutes to discuss feeling sad. It is the first time you have seen him for this problem. You really don't know him that well, and forget what he looks like. He is waiting in the room.

You consider if you remember him well enough to go in without checking his chart. There is no computer in his examination room as it's being repaired. Your nurse also alerts you that he has created a Personal Health Record which he would like to share with you.

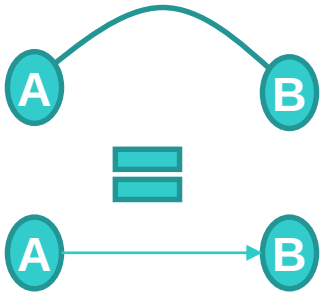
- ***What Would You Like To Do?***

Enter the room!
Open the chart!
Check Out His PHR!

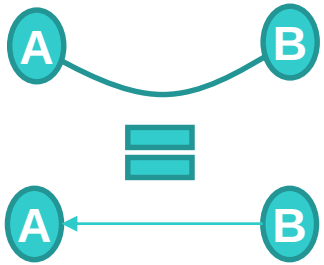
A rather complex labyrinth



For clarity:



and



VP related (Big) Data examples

A virtual patients repository can provide a wealth of data:

- Static
  - Annotation of labyrinth
    - →discover labyrinths that are related to geriatrics
  - Annotation of nodes or edges
    - →discover labyrinths where anaphylactic shock and opioids are referenced
  - Inline annotation of node content
    - →discover labyrinths where diagnosis of a blunt injury is made with additional investigations such as CT scanning, and also has coughing up blood as an indication

VP related (Big) Data examples

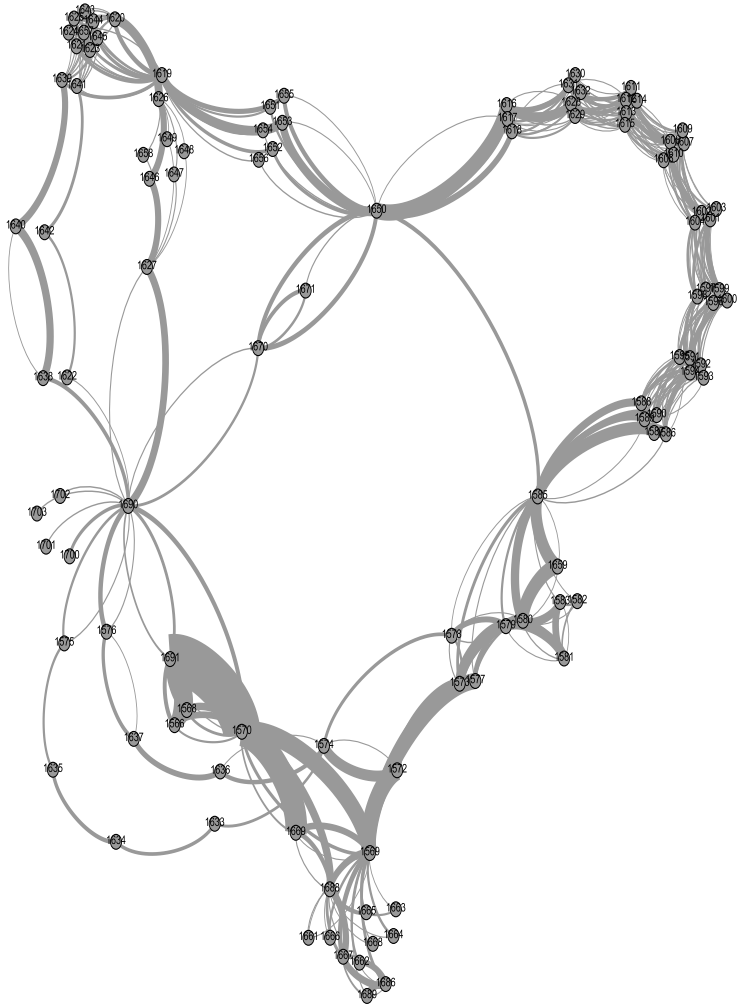
- Dynamic
  - Time spent on each node
  - Most ‘difficult’ pathways
  - Learning goals achieved (e.g. diagnosed correctly the existence -or lack thereof- of Crohn’s disease in more than 5 different cases

(How to discover and repurpose medical knowledge in an open and interoperable manner?)

Finding vs. discovering

- As an Open Labyrinth instance gets more popular, users are creating more and more labyrinths.
- Sooner or later, the amount of labyrinths becomes very large to be manually processed by someone who needs to find a specific labyrinth.
- Resource Description Framework: improve machine search by equipping the search engine with related knowledge.

Dynamic, VP related (big) data



Edge weights represent the traversions from the source to the destination nodes

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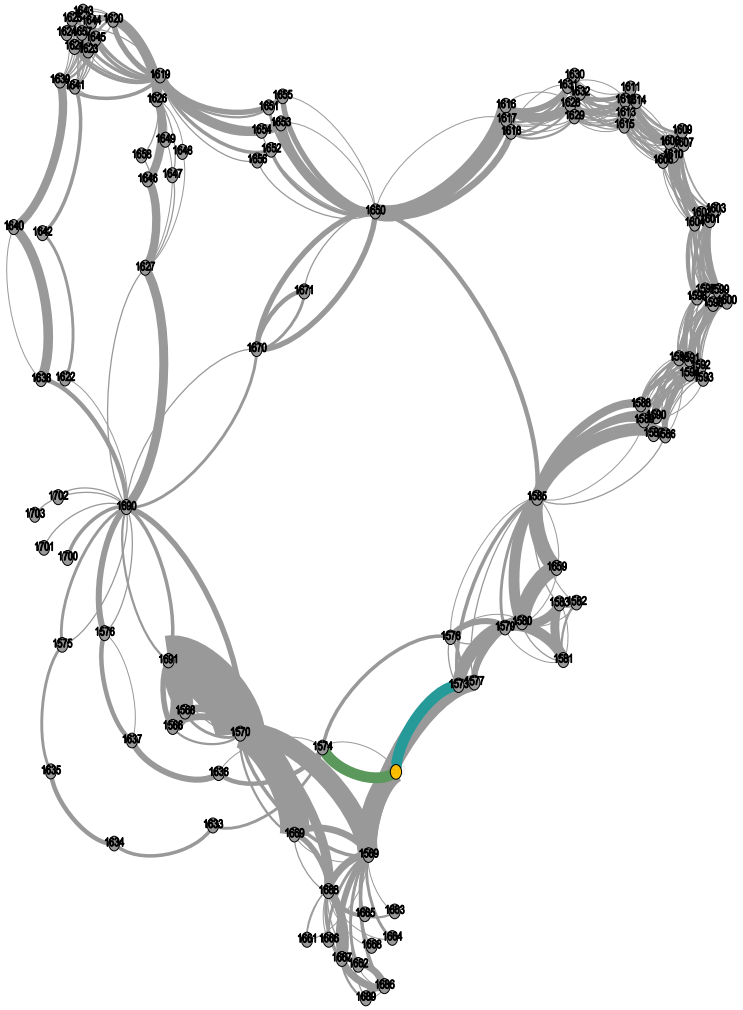
Dynamic, VP related (big) data

Bob Discusses His Warts
Bob: "I have some warts on my feet, about 5-6 of them. I've had them before and they healed well with some freezing and cutting." He shows you his foot and the lesions have the visual appearance of warts. "They cause me some discomfort but don't have a huge impact on my life. Would it be possible to have them frozen today?"
You figure it will probably take 5-10 minutes to do all of them. You want to promote a good relationship by respecting his request but simultaneously you feel like you might be cutting time short on his other issue if you comply. You notice Bob appears somewhat anxious and you really aren't sure why.
What Would You Like To Do?

Refuse - Ask Bob To Tell You About His Mood

Comply - Treat His Warts Now



14 students chose "Comply" and 14 others chose "Refuse"

Is this an intended confusion?

Can its choice somehow be resolved using some textbook?

Even more insight with semantics:

"Students of class X have trouble deciding when decision involves the treatment of depression and other health issues together

And a long-term (big data) shot

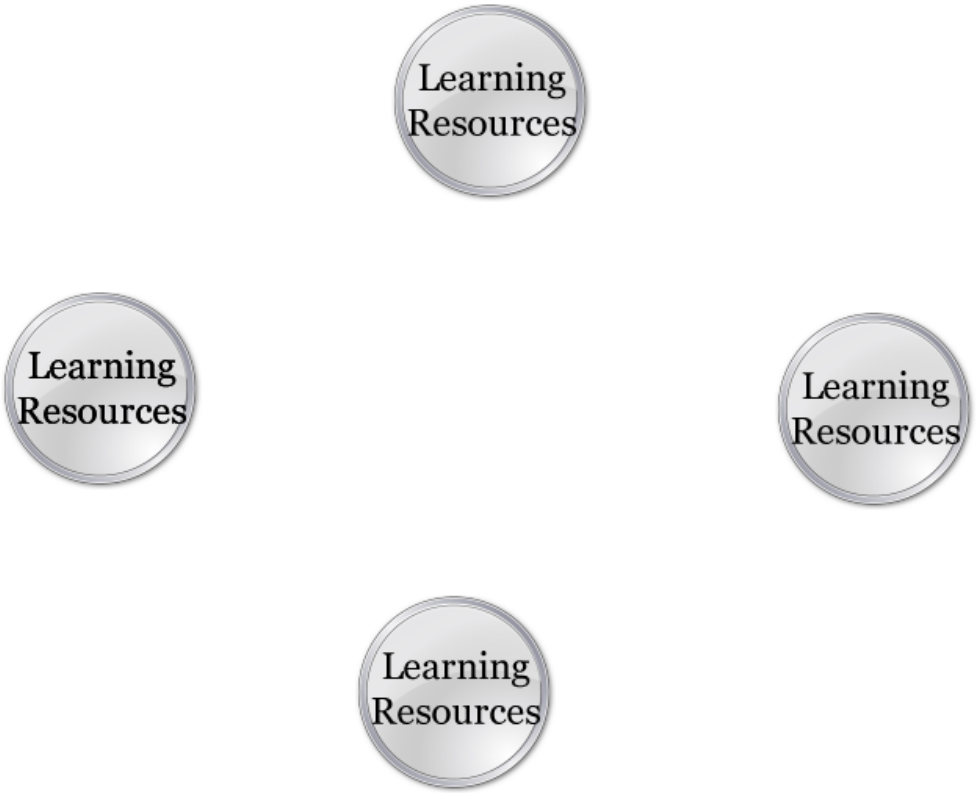
- Link nodes with other sources of big data (e.g. EHRs, quantified-self apps etc) and get them populated with data, counters and choices

mEducator3.0

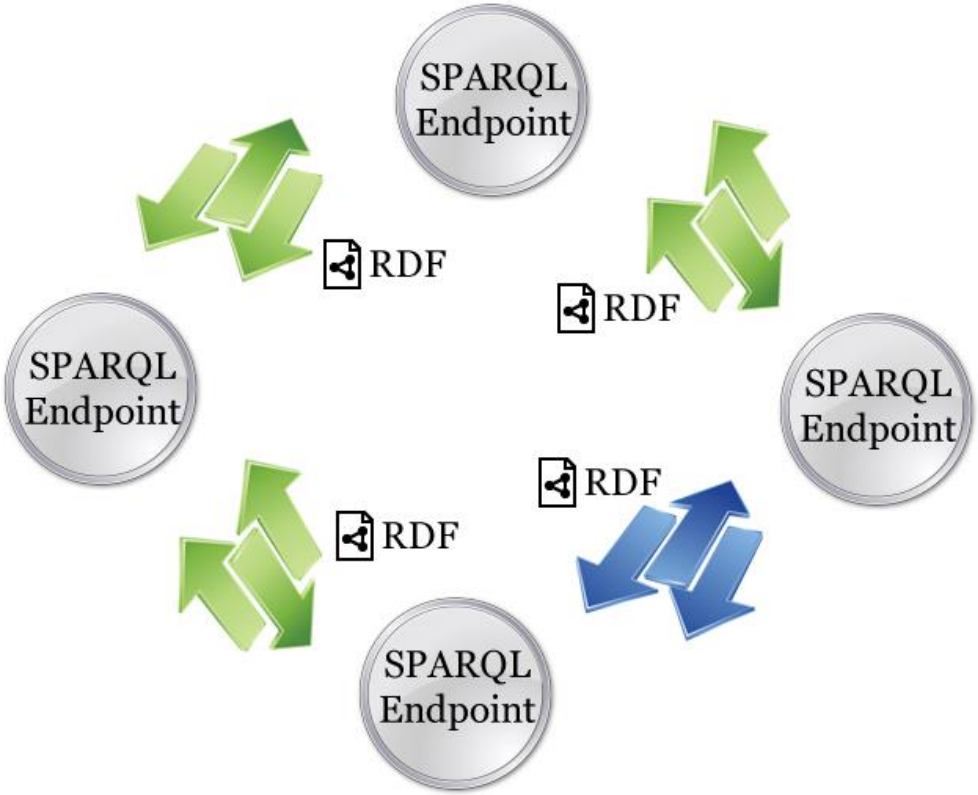
- The 2nd solution of mEducator project

- Based on the idea of linked data
  - **linked data** describes a method of publishing structured data so that it can be interlinked and become more useful.
  - rather than serve web pages only for human readers, why not extend them to share information in a way that can be read automatically by computers?
  - this enables data from different sources to be connected and queried.

mEducator3.0



mEducator3.0



mEducator3.0

MELINA+

- **M**edical **E**ducation **LIN**ked **A**rena
- MELINA+ is one of the implementations of the mEducator3.0 technologies.
- A content management system for medical educational resources.
- Based on **Drupal,** an open source content management system.

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DRUPAL/MELINA+

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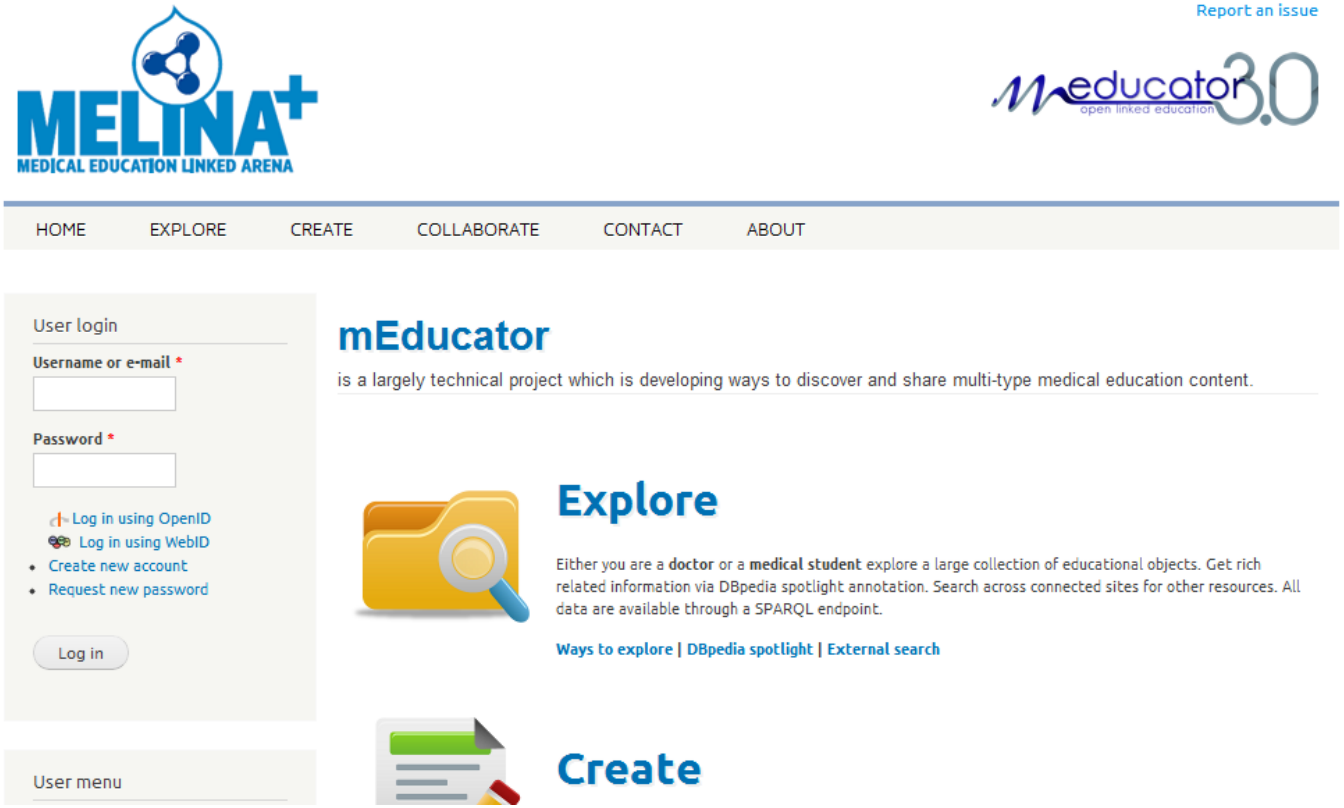
MELINA+



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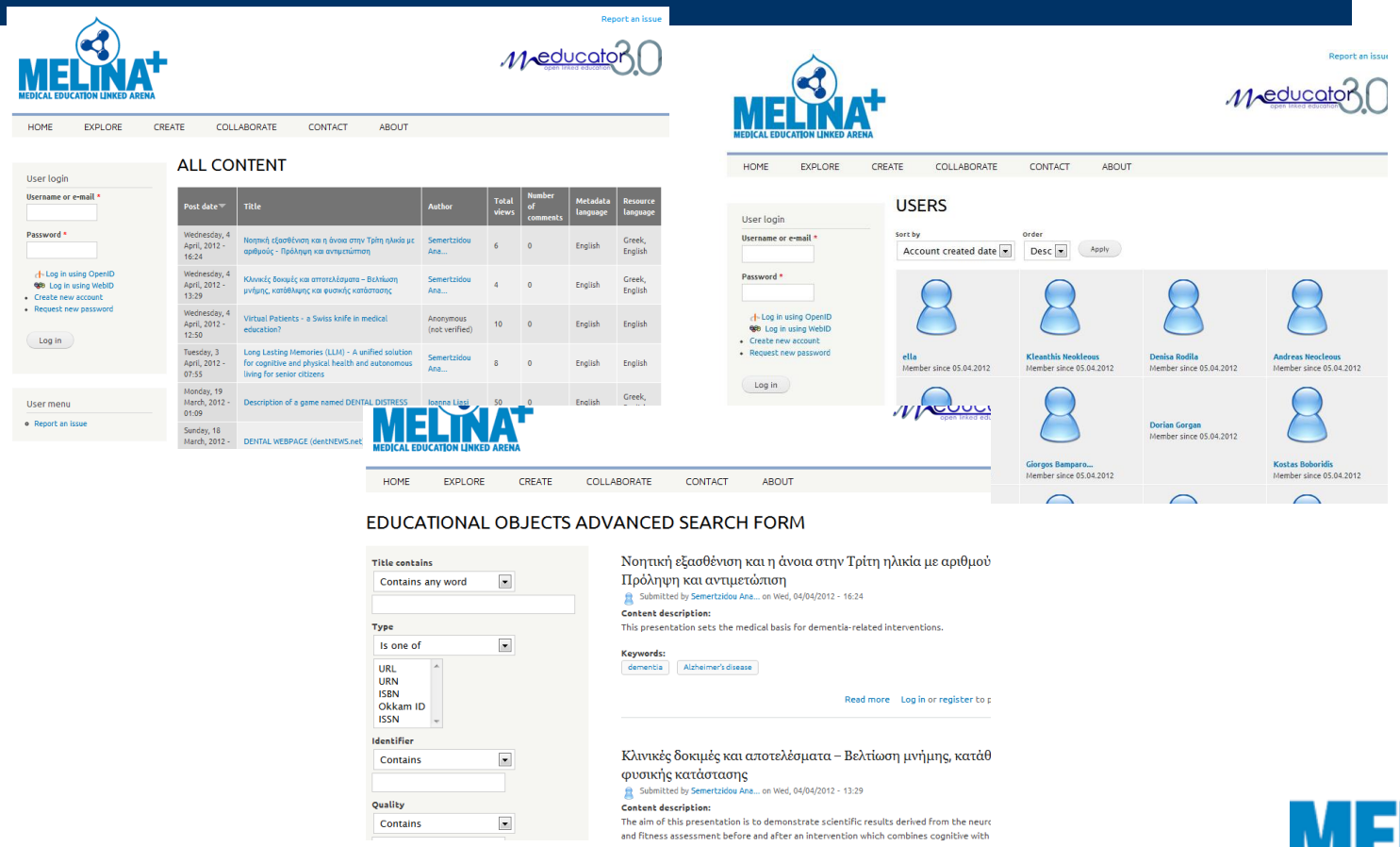

MELINA+ MEDICAL EDUCATION LINKED ARENA

MEFANET 2013

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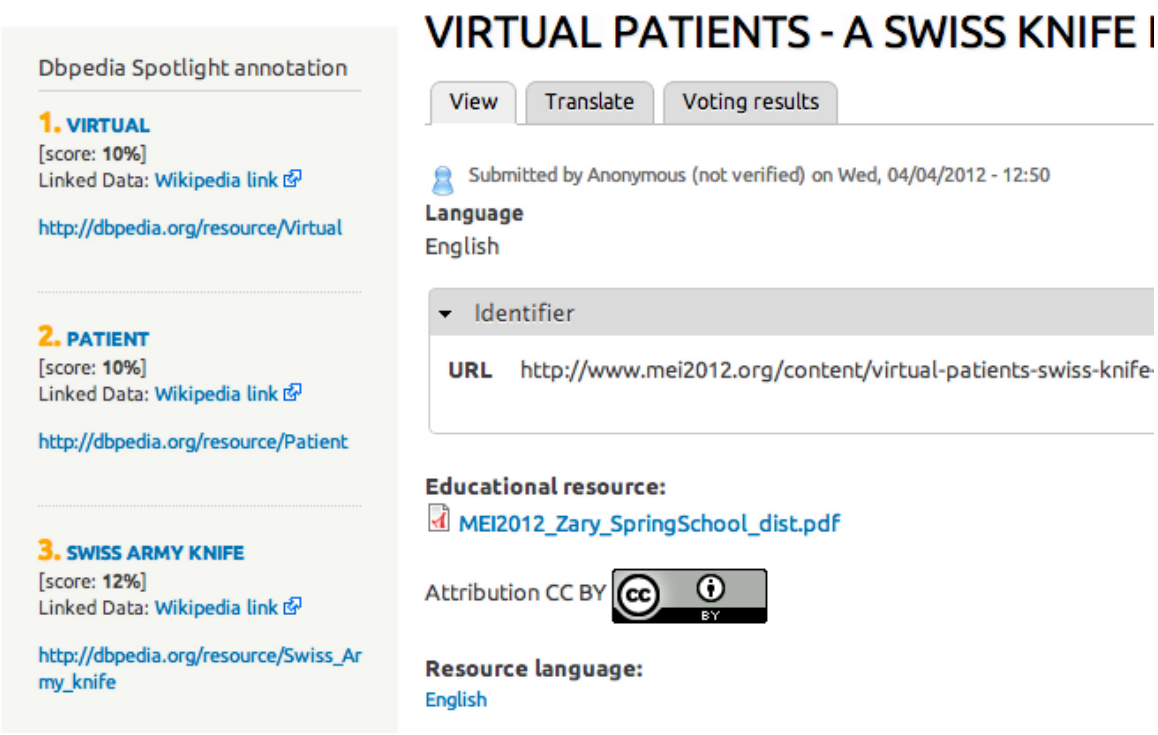
MELINA+ : Advanced features

DBpedia spotlight annotation



MELINA+ MEDICAL EDUCATION LINKED ARENA

MELINA+ : Advanced features

Social learning collaboration

MY RELATIONSHIPS (RECEIVED REQUESTS)

Current | Received requests (2) | Sent requests

Picture	User	Relationship	Operations
	Theofilos Tsach...	Friend	Approve Decline
	Prodromos Kouto...	Friend	Approve Decline

MELINA+ : Advanced features

Social learning collaboration

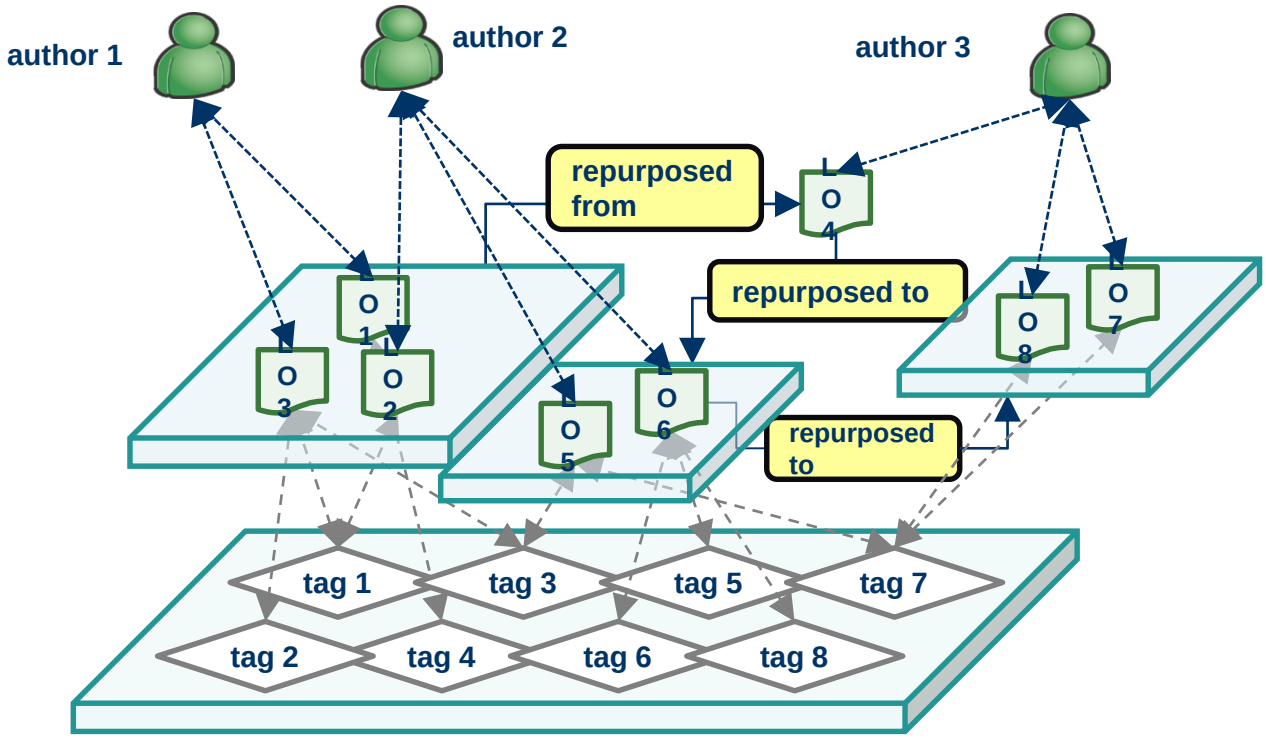
Share content

Content access based on your relationships to other users

Relationship Type	view	update	delete
Post to Coworkers	☐	☐	☐
Post to Friends	☐	☐	☐
Post to Group teammates	☐	☐	☐

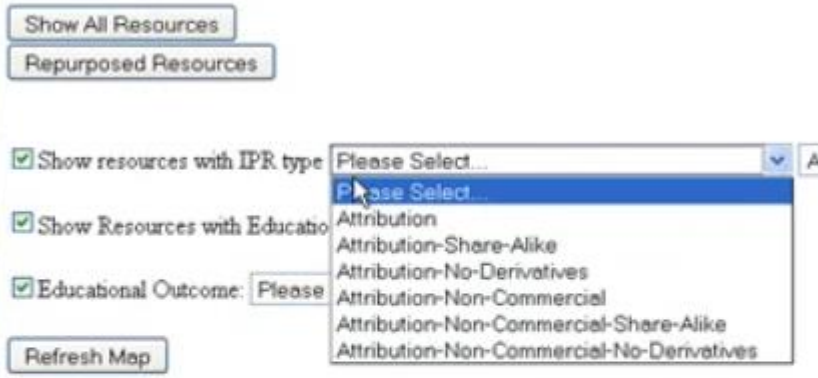
Save

Social networks of people linked with social resources



Kaldoudi et al, Social Networking for Learning Object Repurposing in Medical Education", The Journal on Information Technology in Healthcare, vol. 7(4), pp. 233–243, 2009.
Kaldoudi et al, Depicting educational content repurposing context and inheritance. IEEE Trans Inf Technol Biomed. 2011 Jan;15(1):164-70.

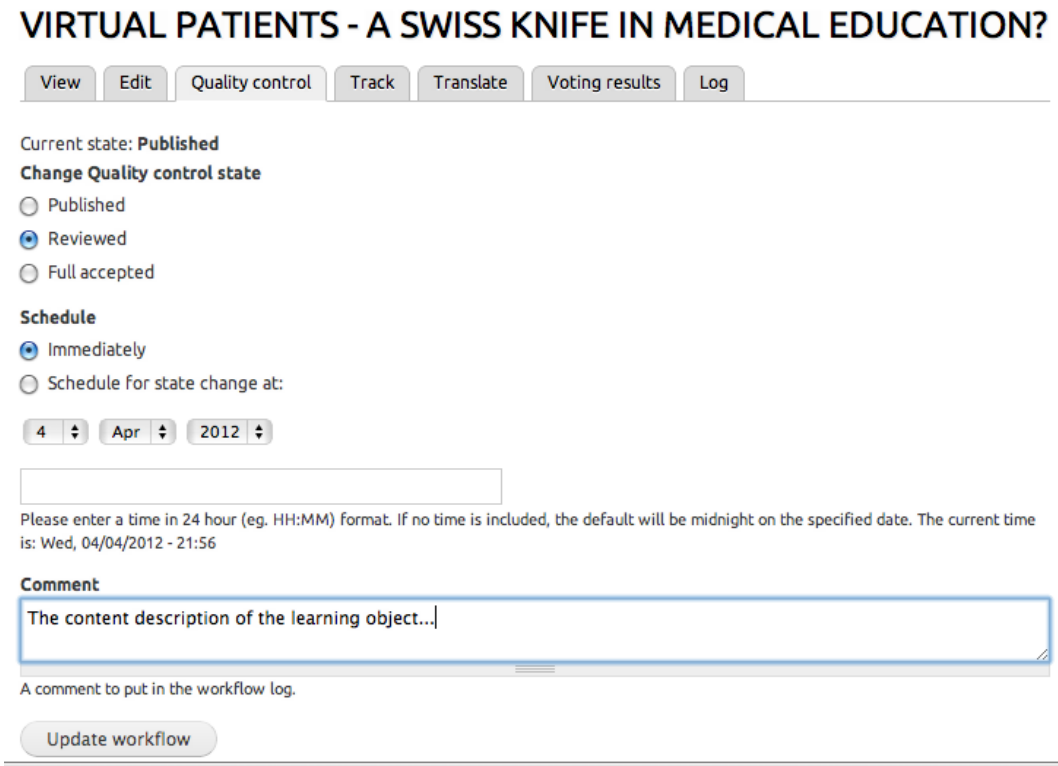
Google-Mapping histories of a resource



Konstantinidis et al, Geotagged Repurposed Educational Content through mEducator Social Network to Enhance Biomedical Engineering Education", In Proceedings of 12th MEDITERRANEAN CONFERENCE ON MEDICAL AND BIOLOGICAL ENGINEERING AND COMPUTING, MEDICON 2010, Springer-Verlag, 2010.

MELINA+ : Advanced features

- Quality process control for learning resources



MELINA+ : Advanced features

- Quality process control for learning resources

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MELINA+ MEDICAL EDUCATION LINKED ARENA

Meducator 3.0 open linked education

NA+ NKED ARENA

HOME EXPLORE CREATE COLLABORATE CONTACT ABOUT

REPURPOSE OF SERIOUS GAMES IN HEALTH CARE

View | Quality control | Translate | Voting results

This clone will not be saved to the database until you submit.

Title *

Repurpose of Serious games in Health Care

Main identifier

This property is used to identify the resource by means of one of the next options.

Please select *

- I want to upload my learning object
- My learning object exists already online or is a physical object (e.g. a book) and I'll provide a unique identifier

IPR Licenses

Type of IPR License granted for legally using this medical learning resource. The adopted license can be either one of the Creative Commons Licenses, or a different one.

Please select the appropriate IPR License (experienced users only) *

Attribution-NonCommercial-NoDerivatives CC BY-NC-ND

Dbpedia Spotlight annotation

1. SERIOUS GAME
[score: 35%]
Linked Data: Wikipedia link
http://dbpedia.org/resource/Serious_game

2. HEALTH CARE
[score: 18%]
Linked Data: Wikipedia link
http://dbpedia.org/resource/Health_care

DBpedia

User menu

NET 2013

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MELINA+

MELINA+ (Medical Education Linked Arena) is freely available to:

- Use directly! Just register and start using it at:

  www.meducator3.net/melinaplus

- download as an *installation profile through :*

  www.meducator.net

- Installation profiles provide site features and functions for a specific type of site as a single download containing Drupal core, contributed modules, themes, and pre-defined configuration.

An example in Urology

ARISTOTLE
UNIVERSITY
OF THESSALONIKI

ISUD main page

Institute for the
Study of
Urologic Diseases
(ISUD)

www.imop.gr

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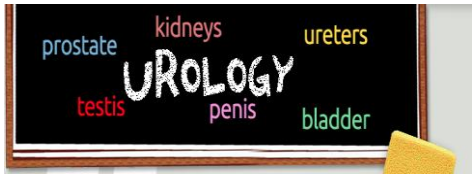
URO e-learning

ISUD Lessons



URO e-LEARNING

Treatment guidelines

Urology Quizzes

Questions

UROWEB TV

Virtual Patients

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URO Swords

Διαιτητής:
Αριστείδης Καραγιάννης

Ιωάννης Βαρκαράκης

Η μερική νεφρεκτομή είναι ογκολογικά ενδεδειγμένη

Ανδρέας Σκολαρίκος

Η εξάχνωση είναι πλέον η μέθοδος εκλογής

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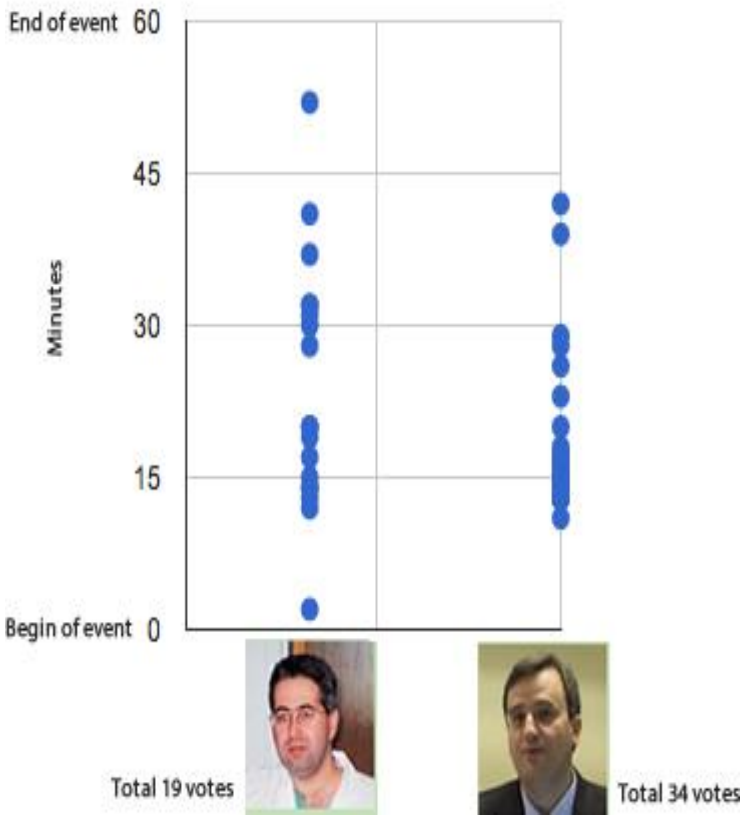
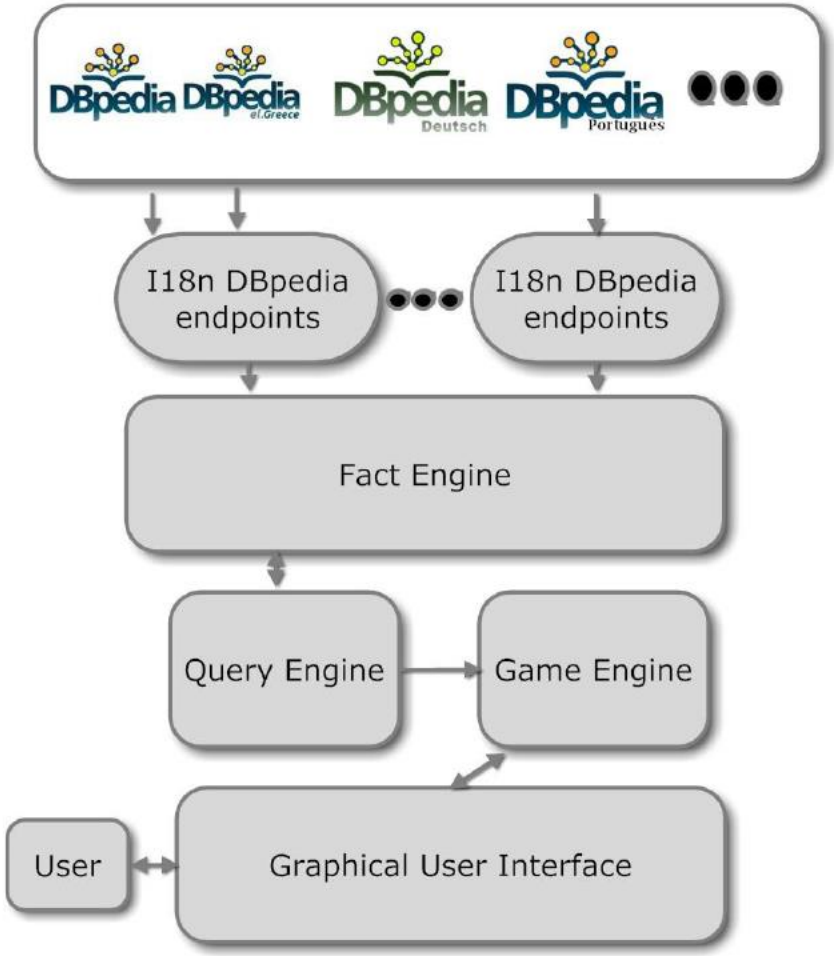
URO Swords' paradata



Further (related) work

Semantic Medical Games



C. Bratsas, D. E. Chrysou, A. Eftychiadou, D. Kontokostas, P. Bamidis, I. Antoniou (2012).
Semantic Web Game Based Learning: An I18n Approach with Greek DBpedia,
WWW Conference, 2nd International Workshop on Learning and Education with the Web of Data,
Lyon France. (http://www2012.wwwconference.org/proceedings/nocompanion/LiLe2012_01-paper-23.pdf)

Semantic Medical Games:

- The game begins with a central concept (a drug), that needs to be 'guessed' by the player.
- The player expands the concept and reveals some of the hints related with it.
- hints :
  - other concepts (like a disease targeted by the drug)
  - a simple property of the original concept (like a brand name).
- The related concepts can be expanded → a knowledge network is developed.
- The player has to exchange currency in the most effective manner, to reveal the hints.
  - A correct guess is rewarded.

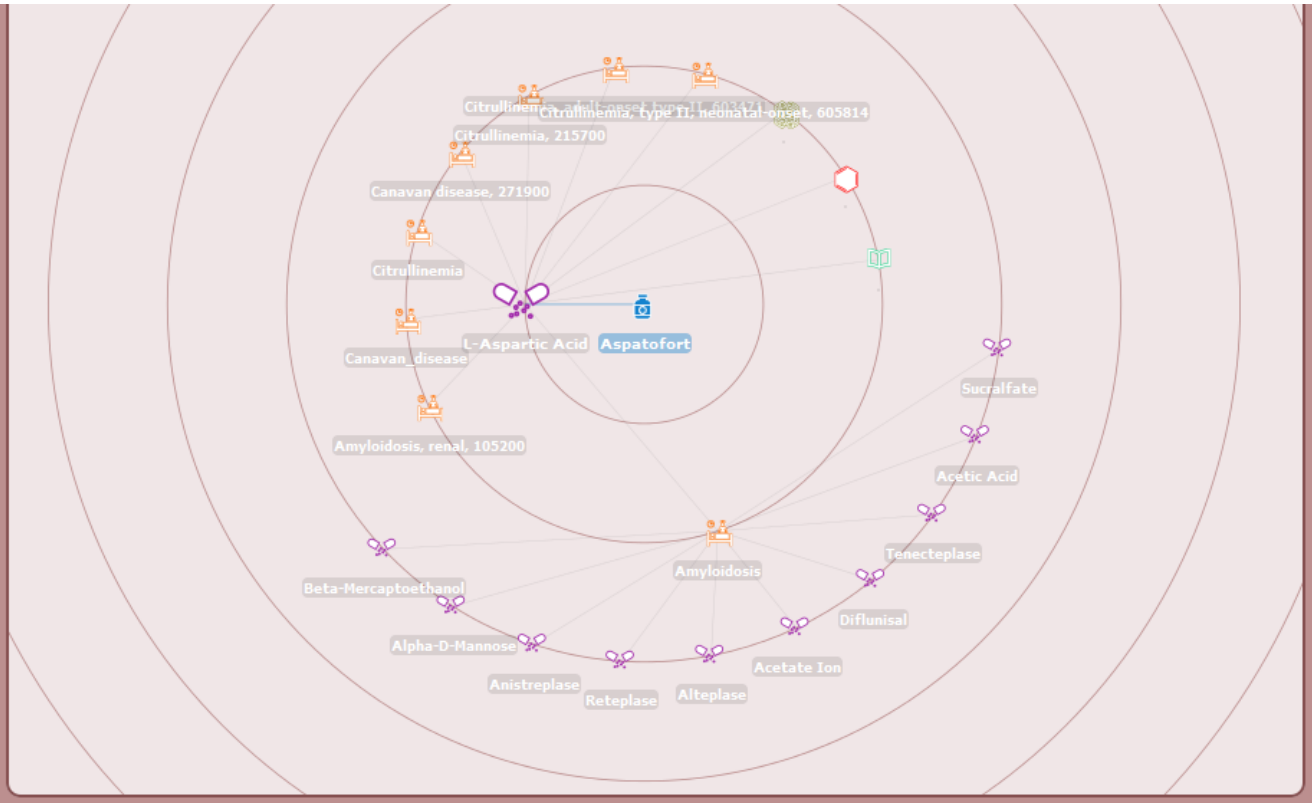
Dr Hoo

... is a puzzle game created by L. Ioannidis and C. Bratsas, in the frame of the **mEducator project**, to demostrate the power of Linked Data in the context of Medical Education.

The game begins with a central concept, say a drug, that needs to be 'guessed' by the player. Unless the player possesses unexplained guessing potential, they have to expand the concept and reveal some of the hints related with it. The hints might either be other concepts (like a disease targeted by the drug) or a simple property of the original concept (like a brand name). The related concepts can, in turn, be expanded and soon an exciting knowledge network is developed.

As resources are always limited, the player has to exchange some genetic material in order to reveal the hints. Nevertheless, a correct geuss is rewarded with loads of genetic material! The palyer then has to spend the genetic material in the most effective manner: reveal the least information possible to make guessing easier.

DB00128 (random)



4400

Aspatofort

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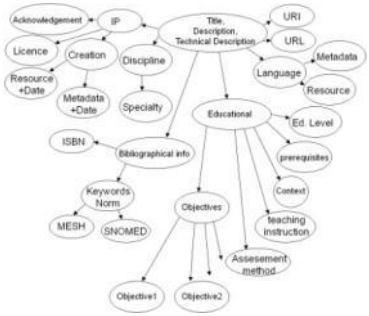
mEducator Spaces In Second Life.

Overview of the project's status

Two axes of action

An interesting virtual classroom in Second Life.

Visualization of semantic information



To visit the project's Island in SL install a Second Life viewer and either search for: LOMIMED AUTH island or point a web browser to:
http://slurl.com/secondlife/LOMIMED%20AUTH%20island/119/91/41/

Video demo

A year of change? Harness Web2.0 / 3.0 Who do we impact?

- Communities of practice:
  - Drupal CMS community
  - Moodle LCMS community
  - Medical Education/Virtual Patients/OpenLabyrinth community
  - Open source software community
  - Semantic web community
  - Social Media communities
- Target groups:
  - providers and users of such content such as:
    - expert instructors (academics / health professionals)
    - students / learners
  - Technical providers of educational (health care) solutions

The big (data) challenge

- Will these technological artefacts improve the educational experience of learners?

Exploitation of big educational data?

- The challenge is the learning impact
- …and we have to measure it properly…
- …this might take time…
- … but I assure you it is worth going for it!

- Thank you!

Info:

- Visit the YouTube mEducatorproject channel
- The project final video is in YouTube:

http://www.youtube.com/watch?v=HK5psY48kaQ

- Follow us in Facebook and twitter (meducator, @meducator)

- pdbamidis@gmail.com
- @bamidis