Learning Analytics and Linked Data (LALD2012)
1st International Workshop on Learning Analytics and Linked Data

29th April 2012

Hendrik Drachsler CELSTEC NL | Abelardo Pardo University of Madrid ES

Stefan Dietze L3S, DE
Mathieu d’Aquins The Open University UK
Wolfgang Greller Open University NL
Jelena Jovanovic, University of Belgrade, SR

Wolfgang Reinhardt
University of Paderborn, DE
Katrien Verbert
K.U. Leuven, BE

#LALD
Overview
Motivation for #LALD

dataTEL
Collecting datasets
Release datasets publicly
Great BIG datasets

Linked Education
Connecting datasets
Make datasets accessible
Great BIG datasets

Motivation

3 stages of the LinkedUp competition

Stage 1 - Initialisation
- Lowest requirements level for participation
- Initial prototypes and mockups, use of data testbed required
- 10 to 20 projects are expected

Stage 2
- Medium requirements level for participation
- Working prototypes, minimum amount of data sources, clear target user group
- 5 to 10 projects are expected

Stage 3
- Deployment in real-world use cases
- Sustainable technologies, reaching out to critical amount of users,
- 3 to 5 projects are expected

Stage 4

LinkedUp Challenge Environment
- LinkedUp Evaluation Framework
- Methods and Test Cases
- LinkedUp Data Testbed
- Competitor ranking list

LinkedUp Support Actions
- Dissemination (events, training)
- Data sharing initiatives
- Community building & clustering
- Technology transfer
- Cashprice awards & consulting

Network of supporting organisations
(see 3.2 Spreading excellence, exploiting results, disseminating knowledge)
#LALD main objectives ...

... to connect the research efforts on Linked Data and Learning Analytics ...

... to create visionary ideas how to combine the Web of Data and Learning Analytics ...

... to support TEL processes and applications.
#LALD

## Agenda

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter(s)</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td>Organisers</td>
<td>Hendrik Drachsler, OU NL, Netherlands</td>
<td>Welcome, Introduction</td>
</tr>
<tr>
<td>9:15</td>
<td>Presentation 1</td>
<td>Hendrik Drachsler</td>
<td>The SIG dataTEL of the European Association of Technology-Enhanced Learning</td>
</tr>
<tr>
<td>10:00</td>
<td>Presentation 2</td>
<td>Abelardo Pardo, UC3M, Spain</td>
<td>Extending Course Level Learning Analytics with Linked Data</td>
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<tr>
<td>10:45</td>
<td>Coffee break</td>
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<tr>
<td>11:00</td>
<td>Presentation 3</td>
<td>Dragan Gasevic, Alhabasca University, Canada</td>
<td>LinkedData and its potential for Learning Analytics</td>
</tr>
<tr>
<td>11:45</td>
<td>Presentation 4</td>
<td>John Doove, SURF, Netherlands</td>
<td>LinkedData at SURF</td>
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<tr>
<td>12:15</td>
<td>Presentation 5</td>
<td>Katrin Niemann, Fraunhofer, Germany</td>
<td>The OpenScout, MACE datasets</td>
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<td>12:45</td>
<td>Lunch break</td>
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<tr>
<td>14:00</td>
<td>Group work + Introduction</td>
<td>Hendrik Drachsler, Abelardo Pardo</td>
<td>Grand Challenge (GC) on LinkedData for LAK</td>
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<tr>
<td>14:15</td>
<td>Group work</td>
<td>All participants on GC in groups of 5 people</td>
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<td>15:30</td>
<td>GC group presentations</td>
<td>Presenting GC of groups (15 min per group)</td>
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<tr>
<td>16:30</td>
<td>Organisers</td>
<td>All participants</td>
<td>Final discussion round</td>
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</table>
Plus-Minus-Interesting Rating

Listen to the presentations of the LALD workshop

Meanwhile…create notes and/or tweets

P: Plus
M: Minus
I: Interesting

e.g., #LALD #Plus

Write down everything that comes to your mind, generate as many ideas as possible, do not filter your ideas.
Overview

Motivation

dataTEL

Linked Education

LALD
Who is dataTEL?

dataTEL was a Theme Team funded by the STELLAR network of excellence (2009 - 2010)

Riina Vuorikari  Stephanie Lindstaedt  Katrien Verbert  Nikos Manouselis  Martin Wolpers  Hendrik Drachsler
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Riina Vuorikari
Stephanie Lindstaedt
Katrien Verbert
Nikos Manouselis
Martin Wolpers
Hendrik Drachsler

Miguel Angel Sicillia
Joris Klerkx
Abelardo Pardo
<table>
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<th>Name</th>
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<td>Hendrik</td>
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<td>Maria Perez</td>
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<td>Dieter Theimer</td>
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<td>Olga</td>
<td>madrid, spain</td>
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<td>Karin Schöfegg</td>
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<td>Christian</td>
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<td>Peter Krämer</td>
<td>My favorite R</td>
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<td>Martin</td>
<td>Hannover, Germany</td>
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<td>Raquel M.</td>
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<td>Eelco Herder</td>
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<td>Nikos M.</td>
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<td>Shlomo Bialosin</td>
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<td>Mart Latvia</td>
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<td>Hannes E.</td>
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<td>Riina Vuik</td>
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<td>Cristian C</td>
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<td>Katrien Verbert</td>
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<td>David Delgado</td>
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<td>Thomas Ullmann</td>
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<td>Katrien Verbert</td>
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</tbody>
</table>
Data-driven Research and Learning Analytics

EATEL-Special Interest Group

Hendrik Drachsler (a), Katrien Verbert (b)

(a) CELSTEC, Open University of the Netherlands
(b) Dept. Computer Science, K.U.Leuven, Belgium
Objectives SIG dataTEL

- Fostering of a research network on educational datasets
- Representing dataTEL researchers to promote the release of open datasets
- Contributing to policies on ethical implications (privacy and legal protection rights)
- Fostering a shared understanding of evaluation methods in Learning Analytics
- Fostering the standardizations of datasets to enable exchange and interoperability
Chapter 12
Recommender Systems in Technology Enhanced Learning

Nikos Manouselis, Hendrik Drachsler, Rina Vuorikari, Haas Hummel and Rah Koper

Abstract Technology enhanced learning (TEL) aims to design, develop and test socio-technical innovations that will support and enhance learning practices of both individuals and organisations. It is therefore an application domain that generally covers technologies that support all forms of teaching and learning activities. Since information retrieval (in terms of searching for relevant learning resources to support teachers or learners) is a pivotal activity in TEL, the deployment of recommender systems has attracted increased interest. This chapter attempts to provide an introduction to recommender systems for TEL settings, as well as to highlight their particularities compared to recommender systems for other application domains.

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Survey on TEL Recommender

Chapter 12
Recommender Systems in Technology Enhanced Learning

Nikos Manouselis, Hendrik Drachsler, Rina Vuorikari, Haas Hummel and Rah Koper

Abstract Technology enhanced learning (TEL) aims to design, develop and test socio-technical innovations that will support and enhance learning practices of both individuals and organisations. It is therefore an application domain that generally covers technologies that support all forms of teaching and learning activities. Since information retrieval (in terms of searching for relevant learning resources to support learning activities) is a key component of any TEL solution, recommender systems are an important aspect of TEL.

Table 12.3: Implemented TEL recommender systems reported in literature

<table>
<thead>
<tr>
<th>System</th>
<th>Status</th>
<th>Evaluator focus</th>
<th>Evaluation roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altered Vista</td>
<td>Full system</td>
<td>Interface, Algorithm, System usage</td>
<td>Human users</td>
</tr>
<tr>
<td>[81, 82, 82, 104]</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>RACOFI</td>
<td>Prototype</td>
<td>Algorithm</td>
<td>System designers</td>
</tr>
<tr>
<td>[2, 61]</td>
<td></td>
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</table>

Conclusions:

Half of the systems (11/20) still at design or prototyping stage only 9 systems evaluated through trials with human users.

The TEL recommender research is a bit like this...
But...

“The performance results of different research efforts in TEL recommender systems are hardly comparable.”

(Manouselis et al., 2010)
But...

The TEL recommender experiments lack transparency. They need to be repeatable to test:

• Validity
• Verification
• Compare results
1\textsuperscript{st} Workshop on Recommender Systems for Technology Enhanced Learning (RecSysTEL 2010)

Issues and Considerations regarding Sharable Data Sets for Recommender Systems in Technology Enhanced Learning

Hendrik Drachsler\textsuperscript{a}, Toine Bogers\textsuperscript{b}, Riina Vuorikari\textsuperscript{c}, Katrien Verbert\textsuperscript{d}, Erik Duval\textsuperscript{d}, Nikos Manouselis\textsuperscript{e}, Guenter Beham\textsuperscript{f}, Stephanie Lindstaedt\textsuperscript{g}, Hermann Stern\textsuperscript{f}, Martin Friedrich\textsuperscript{h}, Martin Wolpers\textsuperscript{h}

RecSysTEL 2010

Workshop on Recommender Systems for Technology Enhanced Learning

Organised jointly by
4th ACM Conference on Recommender Systems (RecSys 2010)
5th European Conference on Technology Enhanced Learning (EC-TEL 2010)

Barcelona, Spain, 29-30 September 2010
1st Workshop on Recommender Systems for Technology Enhanced Learning (RecSysTEL 2010)

Issues and Considerations regarding Sharable Data Sets for Recommender Systems in Technology Enhanced Learning

Hendrik Drachsler, Toine Bogers, Riina Vuorikari, Katrien Verbert, Erik Duval, Nikos Manouselis, Günter Beham, Stephanie Lindstaedt, Hermann Stern, Martin Friedrich, Martin Wolpers

# dataTEL::Collection

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<th>ReMashed</th>
<th>Organic .edunet</th>
<th>Mace</th>
<th>Melt</th>
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<tr>
<td>Collection period</td>
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<td>2 years</td>
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<td>3 years</td>
<td>6 months</td>
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</table>
Dataset-driven Research for Improving Recommender Systems for Learning

Katrien Verbert1, Hendrik Drachsler2, Nikos Manouselis3, Martin Wolpers2, Riina Vuorikari3 and Erik Duval1

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Abstract. In the world of recommender systems, it is a common practice to use public available datasets from different application environments (e.g. MovieLens, Book Crossing, or EachMovie) in order to evaluate recommendation algorithms. These datasets are used as benchmarks to develop new recommendation algorithms and to compare them with other algorithms in given settings. In this paper, we explore datasets that capture learner interactions with tools and resources. We evaluate and compare the performance of different recommendation algorithms for Technology Enhanced Learning (TEL) by present an experimental comparison of the accuracy of several collaborative filtering algorithms applied to these TEL datasets and evaluate implicit relevance data, such as downloads and tags, that can be augmented with explicit relevance evidence in order to improve the performance of recommendation algorithms.

STEELAR Alpine Rendez-Vous White Paper

Workshop 6: dataTEL - Datasets for Technology Enhanced Learning

Workshop Organisers
Hendrik Drachsler, (Open University of the Netherlands, NL)
Katrien Verbert (K.U. Leuven, BE)
Miguel-Angel Sicilia (University of Alcala, ES)
Martin Wolpers (Fraunhofer Institute for Applied Information Technology, DE)
Nikos Manouselis (Greek Research and Technology Network, GR)
Räina Vuorikari (European Schoolnet, BE)
Stefanie Lindstaedt (KnowCenter, AT)

Workshop Provocateur:
Frank Fischer (LMU Munich, DE)

powered by

Special Issue on Data-Supported Technology-Enhanced Learning at International Journal for TEL.
STEELAR Alpine Rendez-Vous White Paper

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powered by

Grand Challenges

1. **Topic:** Evaluation of recommender systems in TEL

2. **Topic:** Data supported learning examples

3. **Topic:** Datasets from learning object repositories and web content

4. **Topic:** Privacy and data protection for educational datasets

Special Issue on Data-Supported Technology-Enhanced Learning at International Journal for TEL.
10 years of TEL RecSys research in one BOOK

Chapter 1: Background

Chapter 2: TEL context

Chapter 3: Extended survey of 42 RecSys

Chapter 4: Challenges and Outlook

Recommender Systems for Learning

Chapter 1: Background
Chapter 2: TEL context
Chapter 3: Extended survey of 42 RecSys
Chapter 4: Challenges and Outlook

10 years of TEL RecSys research in one BOOK


Overview

Motivation

data TEL

Linked Education

LALD
State of the Art
Educational Resources/Data on the Web

State

- Vast Open Educational Resource (OER) metadata collections (OpenCourseware, ARIADNE, OpenLearn)
- University channels on YouTube and iTunes
- Data on courses, teachers, institutions
- Competing Web interfaces (e.g. SQI, OAI-PMH, SOAP),
- Competing metadata standards (e.g. IEEE LOM, ADL SCORM, DC...)
- Competing exchange formats (e.g. JSON, RDF, XML)

http://purl.org/dietze Educational Web Data & Resources for (Informal) Learning
Issues

- Heterogeneity & lack of interoperability
- Lack of take-up
State of the Art
Web of Linked Data

"Stop hugging your data..."
Sir Tim Berners-Lee, 2009
State of the Art
Web of Linked Data

Linked (Open) Data

- Vision: well connected graph of open Web data
- W3C standards (RDF, SPARQL) to expose data, URIs to interlink datasets
- => vast cloud of interconnected datasets (currently over 300 datasets, 30+ billions of triples)
- Crossing all sorts of domains

http://purl.org/dietze  Educational Web Data & Resources for (Informal) Learning
State of the Art
Web of Linked Data for Education

Datasets which might enhance (informal) learning

- Publications & literature
  - ACM, PubMed, DBLP (L3S)…
  - OpenLibrary…
- Domain-specific knowledge & resources
  - Bioportal for Life Sciences
  - Historic artefacts in Europeana
  - Geonames for geodata
  - …
- Cross-domain knowledge
  - DBpedia, Freebase, …
- Media resource metadata
  - BBC, Flickr, …
State of the Art
Web of Linked Data for Education

University Linked Data:
- The Open University (UK): [http://data.open.ac.uk](http://data.open.ac.uk)
- CNR (IT): [http://data.cnr.it](http://data.cnr.it)
- Southampton University (UK): [http://data.southampton.ac.uk/](http://data.southampton.ac.uk/)
- University of Munster (DE): [www.lodum.de](http://www.lodum.de)
- [http://education.data.gov.uk](http://education.data.gov.uk)
- …and many more….

Open Educational Resources Linked Data:
- mEducator Linked Educational Resources ([http://ckan.net/package/meducator](http://ckan.net/package/meducator))
- Open Learn LD
- ARIADNE RDF
- ..and many more….
State of the Art
Web of Linked Data for Education: Applications

Some LOD uses (eg from LILE2012):

- Web-wide search of educational courses/OER (educational graph)
- Game-based learning & automatic generation of assessment items from LOD facts
- Enrichment of learning resources (facilitating more exploratory learning approaches)
Educational perspective on Web data technologies
Some observations & questions

Observations

- Amount of relevant data increasing rapidly,
- But educational applications are missing which make large-scale use of open Web data (like in many other domains…)

Educational perspective on questions like

- How can learners/educators benefit from the wealth of relevant data? (enriching learning content/experience, informal learning, generating OER…)
- What kinds of data are able to aid or enhance (informal) learning? (OER metadata, domain/cross-domain knowledge, educational vocabularies, eg of competencies)
- What are requirements from an educators perspective on educational datasets?
- How can (often poorly structured & heterogeneous) OER metadata quality benefit from LOD to ease finding of learning resources? (disambiguation, expansion, clustering)
Overview

Motivation

data TEL

Linked Education

LALD
LinkedData might provide...

• BIG datasets
• Standards to educational datasets
• A collection of reference datasets for TEL
• your contribution...
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<td>11:00</td>
<td>Presentation 3</td>
<td>John Doove, SURF, Netherlands</td>
<td>LinkedData at SURF</td>
</tr>
<tr>
<td>11:45</td>
<td>Presentation 4</td>
<td>Katrin Niemann, Fraunhofer, Germany</td>
<td>The OpenScout, MACE datasets</td>
</tr>
<tr>
<td>12:15</td>
<td>Presentation 5</td>
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<tr>
<td>12:45</td>
<td>Lunch break</td>
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<tr>
<td>14:00</td>
<td>Introduction Group work</td>
<td>Hendrik Drachsler, Abelardo Pardo</td>
<td>Grand Challenge (GC) on LinkedData for LAK</td>
</tr>
<tr>
<td>14:15</td>
<td>Group work</td>
<td>All participants on GC in groups of 5 people</td>
<td></td>
</tr>
<tr>
<td>15:30</td>
<td>GC group presentations</td>
<td>Presenting GC of groups (15 min per group)</td>
<td></td>
</tr>
<tr>
<td>16:30</td>
<td>Organisers</td>
<td>All participants</td>
<td>Final discussion round</td>
</tr>
</tbody>
</table>
Grand Challenge Structure

(a) Grand Challenge description

(b) Needed actions to overcome the Grand Challenge

(c) Timeframe for the Grand Challenge to overcome

(d) Measurable progress and success indicators

(e) Possible funding opportunities
Grand Challenge Example

A generic framework to share, analyse, and reuse educational datasets

(a) Grand Challenge description
The increased application of LMS, e-portfolios, and PLEs in schools and higher education institutions produces large amounts of educational data. But, although these e-learning environments store educational data automatically, exploitation of this data for new learning services and advanced research on the phenomena “learning” is still very limited. Thus, there is an unused opportunity for the evaluation of learning theories, the development of future learning applications, and the evaluation of didactical concepts and educational interventions. A generic framework to...
Grand Challenge Example

A generic framework to share, analyse, and reuse educational datasets

(c) Timeframe for the Grand Challenge Problem
5 and to 8 years will be needed to overcome the current situation and achieve more sharable datasets ...

(d) Measurable progress and success indicators
• An increasing amount of publicly available datasets and research articles that are based on shared datasets
• The availability of data or privacy policies at educational providers
• More data-driven tools at educational providers
• A common dataset format
A generic framework to share, analyse, and reuse educational datasets

(b) Needed actions to overcome the GC

1. Data ownership and access rights are challenging because ...
2. Data policies (licences) that regulate how different users can use, share, and...
3. There is a lack of common dataset formats like suggested from the CEN PT Social Data group...
4. Standardised methods are needed to anonymise and pre-process educational data according to privacy ...
Many thanks for your attention, and now let us contribute to the state of the art...
Many thanks for your attention, and now let us contribute to the state of the art...

Free the data

picture by Tom Raftery  http://www.flickr.com/photos/traftery/4773457853/sizes/l