September 21, 2012:  
Multi-Dimensional Learning Analytics  

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www.crlt.umich.edu/slam
Multidimensional learning analytics:
Finding the whole in fragmentation

George Siemens, PhD
September 21, 2012
Presented at: University of Michigan
- Publicly funded
- 38,000 students
- One of four research universities in Alberta
- Only US accredited Canadian university (MSCHE)
- Bachelor, masters, doctoral education
- Fully online
Leading learning analytics at AU

- What kinds of data do we collect?
- How can that data be used to improve learning
- How can that data be used to improve organizational efficiency
“The world is one big data problem”

Gilad Elbaz
“Social data is set to be surpassed in the data economy, though, by data published by physical, real-world objects like sensors, smart grids and connected devices.”

Data trails reveals
our sentiments,
our attitudes,
our social connections,
our intentions,
what we know,
how we learn,
and what we might do next.
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Global Market Size</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Education Expenditure</td>
<td>$4,450.9 B</td>
<td>$5,508.7 B</td>
<td>7%</td>
<td>$6,372.5 B</td>
</tr>
<tr>
<td>K-12</td>
<td>$2,227.0 B</td>
<td>$2,625.6 B</td>
<td>6%</td>
<td>$2,930.3 B</td>
</tr>
<tr>
<td>Postsecondary</td>
<td>$1,495.2 B</td>
<td>$1,883.5 B</td>
<td>8%</td>
<td>$2,196.9 B</td>
</tr>
<tr>
<td>Corporate &amp; Govt. Learning</td>
<td>$356.6 B</td>
<td>$449.3 B</td>
<td>8%</td>
<td>$524.0 B</td>
</tr>
<tr>
<td>eLearning</td>
<td>$90.9 B</td>
<td>$166.5 B</td>
<td>23%</td>
<td>$255.5 B</td>
</tr>
<tr>
<td>K-12 eLearning</td>
<td>$16.6 B</td>
<td>$39.0 B</td>
<td>33%</td>
<td>$69.0 B</td>
</tr>
<tr>
<td>Higher Ed eLearning</td>
<td>$48.8 B</td>
<td>$95.4 B</td>
<td>25%</td>
<td>$149.0 B</td>
</tr>
<tr>
<td>Corporate eLearning</td>
<td>$25.5 B</td>
<td>$32.1 B</td>
<td>8%</td>
<td>$37.5 B</td>
</tr>
<tr>
<td>For-Profit Postsecondary</td>
<td>$96.1 B</td>
<td>$146.1 B</td>
<td>15%</td>
<td>$193.2 B</td>
</tr>
</tbody>
</table>

*Education Sector Factbook, 2012*
Some sectors are positioned for greater gains from the use of big data

Historical productivity growth in the United States, 2000–08
Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs.
All share:
- Data-intensive approach
- Learner success focus
- Assist planning, strategy & decision making
- Contribute to research base of field

Learning Analytics

Academic Analytics

Educational Datamining

Organizational efficiency, strategy, and decision making
Reducing components, analyzing relationships

Systems & wholes
<table>
<thead>
<tr>
<th>Focus of analytics</th>
<th>Who Benefits?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course-level</strong>: social networks, conceptual development, language analysis</td>
<td>Learners, faculty</td>
</tr>
<tr>
<td><strong>Aggregate</strong> (big data) predictive modeling, patterns of success/failure</td>
<td>Learners, faculty</td>
</tr>
<tr>
<td><strong>Institutional</strong>: learner profiles, performance of academics, resource allocation</td>
<td>Administrators, IR, funders, marketing</td>
</tr>
<tr>
<td><strong>Regional &amp; National</strong> (state/provincial): comparisons between systems</td>
<td>Governments, administrators</td>
</tr>
<tr>
<td><strong>International</strong>: ‘world class universities’</td>
<td>National governments (OECD),</td>
</tr>
</tbody>
</table>
Top-down
System-wide

Enterprise-level tools
Automated Discovery
Social network analysis
Server/LMS stats
Integration of data sources
Automated Interventions
Quantified-Self
Language/discourse Analysis

Bottom up
Classroom-level

"Big data"
"Small Data"
Coordinated Team
Individual faculty member
Dashboards
Recommender Systems
Predictive models
Alerts/warnings/interventions
Unidimensional analysis
Whitmer, 2012
http://www.itap.purdue.edu/learning/tools/signals/
Figure 1. Degree Compass

BIOL 1010: Principles of Life

Course Description: A course for non-science majors. Topics covered include scientific methodology, the nature of living organisms, cell structure and function, cell chemistry and division, nature of heredity and gene action, the theory of evolution and principles of ecology. BIOL 1010 will not serve as a prerequisite of upper level biology courses.

Note: To add any of the sections below to your class schedule, return to the main OneStop window, click on the “Web Self Service” tab, then “Student”, then “Registration”, then “Add or Drop Classes”. You'll also want to make note of the CRN for the course you wish to register for as this will make finding the class in the registration system easier.

Spring Semester 2011

Class Section: 01
Class CRN: 1135
Instructor: Finley, Mack
Credit Hours: 3
Time: 08:00 am - 08:55 am
Days: MW
Campus: Austin Peay SU, Main Campus
Location: Sondquist Science Complex E106A
Instructional Method: Conventional Methodology
Start Date: 13-JAN-11
End Date: 06-MAY-11
Capacity: 99
Seats Open: 98
Seats Filled: 1

Courses You Should Consider:

BIOL1010 - Principles of Life

Description & Prerequisites: Course Description: A course for non-science majors. Topics covered include scientific methodology, the nature of living organisms, cell structure and function, cell chemistry and division, nature of heredity and gene action, the theory of evolution and principles of ecology. BIOL 1010 will not serve as a prerequisite of upper level biology courses.

BIOL1011 - Principles of Life Lab
BIOL1010 - Principles of Life
GEOG1041 - Physical Geography Lab
BIOL2011 - Human Anat and Phys Lab
GEOG1040 - Physical Geography

Filter: MATH, ENGL, etc.

These suggestions are courses in which other students similar to you have made successful progress in your program of study. You should always consult your advisor when planning your schedule.

Denley, 2012
Multidimensional analytics
Vision of the whole

Börner, 2011
Sensemaking (and social processes)

Multiple data sets/sources

Learning is a complex social activity (technical methods do not capture the full scope and nuanced nature of learning)

Integrated social and technical systems provide diverse and nuanced approaches
“Learning and knowledge creation is often distributed across multiple media and sites in networked environments. Traces of such activity may be fragmented across multiple logs and may not match analytic needs. As a result, the coherence of distributed interaction and emergent phenomena are analytically cloaked”

Suthers, Rosen, 2011
Analytics around social interactions
Analytics around learning content
Analytics in different spaces
Analytics on interaction with the university system
Analytics on intervention and adaptation
Assessment of analytics
Use of the virtual machine

The machine contains a complete Linux distribution and must only be used to work in the course. The installed programs should not be deleted and additional programs should only be installed when requested by the teaching staff.

The virtual machine is equipped with a “personal learning assistant”. This system records the use of certain tools and based on the obtained data, it offers personalized resources through the widget with name “Personal Help. Systems Architecture” shown in the desktop.

The system monitors the tasks that you perform, and therefore, you have total control over which information is stored, where and most importantly, how to enable or disable this monitoring feature. The downloaded version of this virtual machine contains this monitoring system enabled. In the following section we explain briefly which

Pardo, 2012
Social Learning Analytics

Buckingham Shum & Ferguson, 2012
Welcome to the Complete QS Guide to Self-Tracking!

Here you will find tools, apps, and projects that are tagged, rated, and reviewed by the global Quantified Self community (that includes you!) This guide is funded by the Robert Wood Johnson Foundation Pioneer Portfolio, which supports bold ideas at the cutting edge of health and health care, in partnership with Institute for the Future. Our goal is to gather and organize the world's collective self-tracking resources in one place, in a way that is useful and encourages collaboration between self-tracking experts and beginners who are just starting out. Dive in now and explore some of the Tools or Members who are part of this site...

What's New

TrackMe
TrackMe is an iPhone app that tracks your location permanently (in the background). TrackMe does not upload the location...

textWeight TM 2.0
Launched August 15, 2011 Free for new users during trial period! Receive a text message reminder each morning to reply with...

voyurl
Similar to how fitbit, mint.com, and nike+ help you quantify your life and get recommendations, voyurl helps you quantify...

What's Hot

Meditation Journal
Unlike Neurosky claims, you cannot actually see raw data with this app, it shows you to 0 to 100...

Withings Wifi Bodyscale
I've used the Withings scale since January 2010. &nbsp;I step on it most mornings before jumping in the shower...

HeatMath Stress Reduction Tools
As a Family Systems therapist, I often turn to Mindfulness techniques when a client expresses an interest to calm...

Digifit
About two years ago I had...
Result of analysis
Total number of messages: 114
Sum of score per message: 241
Average score: 2.11
Standard deviation: 1.02

Note:
- cognitive
- metacognitive
- social
Contractor, Monge, & Leonardi 2011
CFHE12 An Open Online Course

http://edfuture.net/

October 8-November 16, 2012
Third Conference on Learning Analytics and Knowledge

LAK 2013

Leuven, Belgium
8-12 April, 2013

http://lakconference.org
gsiemens @
gmail
Twitter
Skype
FB
Wherever

www.elearnspace.org

www.connectivism.ca

www.learninganalytics.net