The state of the art of Learning Analytics

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About me

EUNIS Business Intelligence
Task Force Leader

Image of ISCTE-IUL University Institute of Lisbon

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take the leap with us.
join our task forces

The mission of the European University Information Systems (EUNIS) organization is to help member institutions develop their information technology (IT) landscape by sharing experiences and working together. One of the ways we do this is by Task Forces that are focused groups of EUNIS members dedicated to key initiatives, considered most relevant for the IT community in Higher Education. They are instrumental in transforming theories into concrete activities and in the pursuit of standards and guidelines. Currently we have six active groups: BenchHEIT, Business Intelligence, InfoSec, Learning & Teaching, Student Mobility and ERAI initiative.

www.eunis.org
learning and teaching

The Learning and Teaching Task Force, founded in 2004, explores all aspects of learning & teaching through technology. The group runs various projects and activities including an annual workshop and managing the EUNIS Darp E-learning Award.

Key topics of interest include:
- Assessment and feedback
- Technology in physical learning spaces
- Learning design & learning analytics
- Online learning & immersive technologies

business intelligence

The Business Intelligence (BI) Task Force was created in 2012, with the goal of creating an European collaboration network to exchange and share good practices among Higher Education (HE) BI practitioners. Main projects of this group include the 2012 Maturity Model Survey to assess the maturity level of BI initiatives in HE, the 2014 Paris EUNIS BI conference, and the 2017 Manchester Learning Analytics Workshop.

Throughout the years, the BI Task Force has promoted national level collaboration events, in Ireland, Spain and Portugal, and masterclasses at the EUNIS annual congress. Focusing on analytics, this group has natural synergies with other EUNIS Task Forces, in particular with the Learning & Teaching task force (working together on the topic of Learning Analytics).

The BenchHEIT (working on data visualization) and InfoSec (working on the impact that new data management regulations have on data analytics projects). Current activity is focused on learning analytics, institutional analytics and BI, data science, strategic decision making, and information visualization.

information security

The InfoSec (Information Security) Task Force, created in 2017, focuses on the current challenges of the information security field. It aims to share knowledge about information security development and compliance, as well as solutions to support the implementation of the GDPR from the information security point of view.

Its main objectives are to:
- Identify and share higher education information security and privacy threats, countermeasures as well as technical solutions
- Build a network of higher education information security and Data Protection professionals.

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ERAI - EUNIS research and analysis initiative

The ERAI initiative, launched in 2004, aims to aggregate research on Higher Education and scale it to a E level. Its main goal is to provide a platform where to find this information and share it and the activity focuses on publications, surveys and popularizing research on HE IT, and the EUNIS TFs outputs. A European Journal of Higher Education IT was created under the umbrella of ERAI. Through ERAI, EUNIS provides case studies, shares contributions coming from members, publishes and promotes surveys and analysis, etc.

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Agenda

• Defining Learning Analytics
• Drivers of LA
• Discussion of case studies
• Conclusions
Defining Learning Analytics
Analytics

• “Putting analytics to work is about improving performance in key business domains using data and analysis.”

• “By analytical we mean the use of analysis, data, and systematic reasoning to make decisions.”

(Davenport et al., 2010)
Analytics: types of questions

- **Past**
  - How and why did it happen? (Modeling, experimental design)
  - What happened? (Reporting)

- **Present**
  - What’s the next best action? (Recommendation)
  - What is happening now? (Alerts)

- **Future**
  - What’s the best/worst that can happen? (Prediction, Optimization, simulation)
  - What will happen? (Extrapolation)

(Adapted from Davenport et al., 2010)
Learning Analytics defined

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.

**Goal:** converting educational data into useful actions to foster learning and improve learner success.
Business Intelligence

“A broad category of applications and technologies for gathering, storing, analyzing, sharing and providing access to data to help enterprise users make better business decisions.”

(Burton, Geishecker et al. 2006)
Learning Analytics

is a recent research area, in which Business Intelligence and Analytics techniques are applied to learners and their contexts, with the purpose of acquiring a greater insight about the entire learning process (including outcomes).
Learning Analytics roots

- Contributions from different fields and communities

- Education
- Technology
- Social Sciences
- Learning Design
- Active Learning
- Educational Data Mining
- Business Intelligence
- Recommender systems (Artificial Intelligence)

Adapted from (Ferguson, 2012)
Academic Analytics

Improvement of organizational processes, workflows, resource allocation, and institutional measurement through the use of learner, academic, and institutional data

**Goal:** improve organizational effectiveness
Academic Analytics

Application of business intelligence tools and practices in higher education

"AA “has the potential to create actionable intelligence to improve teaching, learning and student success”"

(Goldstein and Katz, 2005)

(Campbell et al., 2007)
Different levels and stakeholders

Academic Analytics

Learning Analytics

(adapted from SOLAR, 2011)

UNESCO, OECD, League tables
National Governments
HEI Presidents, Deans, Administrators, Marketing

Students (learners), Teaching staff, Educators
Examples of analytics

Academic Analytics

International

National

Institutional

Learner profiles, performance of academics, resource allocation

Learning Analytics

Department

Predictive modeling, conceptual development, patterns of study and success/failure

Course

Social networks, patterns of study and success/failure

Personal level

Analytics on personal performance in relation to learning goals, learning resources and study habits of other classmates

(adapted from SOLAR, 2011)
Drivers of Learning Analytics
Learning Analytics **drivers**

- Big Data
- Online Learning
- Accountability and political concerns
- Stakeholders

Technical challenge  
Educational challenge  
Economic challenge

Adapted from (Ferguson, 2012)
Our world today

- Explosion and fragmentation of data
- New data sources
- Increased computing and analytic power
- Democratization of data & BI and the rise of data literacy
Learning Analytics **drivers**

“How can we extract value from these big sets of learning-related data?”

- **Data sources:**
  - Learning Management Systems (LMS)
  - Academic information systems
  - External systems (e.g., social media)

- **Different types:**
  - Interaction data
  - Personal data
  - Academic information

Adapted from (Ferguson, 2012)

Learning Analytics drivers

The Online Learning trend

*How can we optimize opportunities for online learning?*

- **Current Online Learning challenges:**
  - Students may feel isolated and loose motivation
  - Massive number of students
  - Teachers need new techniques to evaluate learning and identify at risk students

Adapted from (Ferguson, 2012)
Learning Analytics drivers

Accountability and political concerns

*How can we optimize learning and educational results at national or international levels?*

- Increasing demand for educational institutions to measure, demonstrate and improve performance

Stakeholders

Adapted from (Ferguson, 2012)
Supporting Higher Education to Integrate Learning Analytics

R.O.M.A.
Rapid Outcome Mapping Approach

http://sheilaproject.eu/
SHEILIA project

- State of art of LA adoption in Europe
- SHEILIA framework to establish a LA policy with 6 dimensions

http://sheilaproject.eu/
LA Stakeholders

- Students
- Senior managers
- Teaching staff

Interests  Concerns

TNC2018, Trondheim, Norway
# Stakeholders interests

## Senior managers

<table>
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<th>Improve:</th>
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<tbody>
<tr>
<td>• Student learning performance</td>
</tr>
<tr>
<td>• Student satisfaction and retention</td>
</tr>
<tr>
<td>• Teaching excellence</td>
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Explore what LA can do for our institution/ staff/ students

## Teaching staff

<table>
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<th>An overview of:</th>
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<tbody>
<tr>
<td>• student attendance,</td>
</tr>
<tr>
<td>• Submission of assignments</td>
</tr>
<tr>
<td>• Access to coursework and resources</td>
</tr>
<tr>
<td>• Student performance</td>
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Inform course design
Manage a big class
Know “why” students struggle

## Students

<table>
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<tr>
<th>Personalized approach to learning:</th>
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<tr>
<td>• Informed teaching support and curriculum design</td>
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<tr>
<td>• Assistance with educational transitions: into HEd and to employment</td>
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Adapted from (Tsai, 2017)
### Stakeholders concerns

| Senior managers | No one-size-fits-all solution  
|                 | Pressure to adopt LA  
|                 | Benefits for the whole institution  
|                 | Strictness of existing data protection regulations (GDPR) |

| Teaching staff | Workload  
|                | Judging staff performance  
|                | Not all learning is digital  
|                | No one-size-fits-all solution  
|                | Correlation does not suggest causation  
|                | Surveillance on students |

| Students | Data collection is unnecessarily personal  
|          | Production of stereotypes and biases  
|          | Limitations in quantifying learning  
|          | Worries about loosing the human contacts (automated feedback) |

Adapted from (Tsai, 2017)
Ethics and privacy of LA

• One of the strategic points and challenges addressed by the SHEILA framework
• Other useful resources:

analytics.jiscinvolve.org
Example from the Past
Signals Project

- **Problem**: students do not have a good understanding of how they are progressing in their courses

- **Goal**: aims to help students understand their progress early enough to be able to seek help and either increase their likely grade or withdraw from the module and take something else

- **Institutional goal**: aim for Purdue at an institutional level was to apply the principles of business intelligence to enhancing student success at a course level, thus contributing to overall retention and graduation rates

(Arnold, 2010), (Arnold & Pistilli, 2012)
Signals Project

• Signals mines data from the SIS, the VLE and the gradebook. This is then transformed and processed to produce a ‘traffic light’ indicator showing how at risk each student is considered to be.

• The predictive algorithm has four components:
  – Performance – based on points earned on the course so far
  – Effort – interaction with the VLE compared with other students
  – Prior academic history – including high school GPA and standardised test scores
  – Student characteristics – e.g. age or credits attempted

(Arnold, 2010), (Arnold & Pistilli, 2012)
Signals Project

Student View of the Signals Dashboard

(Arnold, 2010), (Arnold & Pistilli, 2012)
Signals Project

- Instructors then implement an intervention schedule they create, possibly consisting of:
  - Posting of a traffic signal indicator on a student’s CMS home page
  - E-mail messages or reminders
  - Text messages
  - Referral to academic advisor or academic resource centers

(Arnold, 2010), (Arnold & Pistilli, 2012)
Signals Project

Faculty View of the Signals Dashboard

(Arnold, 2010), (Arnold & Pistilli, 2012)
Examples from the Present
MMU Staff & Student Dashboards

- University-wide transformation program started in 2010
- Personalization: “wrapping the University around the Learner”
- Evidence-Driven Action
  - University Data Warehouse with weekly snapshots since Sept 2011:
    - Student records
    - VLE
    - Surveys
    - Attendance
    - Submissions

Adapted from (Stubbs, 2017)
MMU Staff & Student Dashboards

• Learner Tracker App
  – Designed with students for students

Adapted from (Stubbs, 2017)
Fitting the Dashboard into the university ecosystem

(Foster, 2017)
NTU Student Dashboard

Engagement with learning

Algorithmic engagement data

Static/manual information

Notes, Sense checking

Student data

Engagement score
Risk alerts
Referrals

Attendance
VLE log ins
Card swipes
E-resources
Dropbox submissions
Library loans

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NTU case study key points

• Study of engagement in the progression from 1\textsuperscript{st} to 2\textsuperscript{nd} year
• Engagement is the most important predictor of success
• Demographic factors and entry qualifications are also important
• Students evaluations were positive and Dashboard triggered action (e.g., more study, seeking tutoring)

Adapted from (Foster, 2017)
Netherlands

quantified student
Quantified Student

• **A Study Behavior App**
  
  **Goal:** Create a runkeeper app for studying; Collect data from students, and feed the data back to the students with the goal to improve their study experience

www.quantifiedstudent.nl

Adapted from (van der Vorst, 2017)
Quantified Student

• **Calibrating Students**

  **Goal:** Find relations between study results and things like concentration and sleep to coach students in becoming better students.

  www.quantifiedstudent.nl

  Adapted from (van der Vorst, 2017)
Learning Scorecard

A research project of Learning Analytics, BI, and Gamification in use since 2016

www.learningscorecard.pt

(Cardoso et al. 2016, 2017, 2018)
Learning Scorecard

- Provide HE students with an **analytical environment** to monitor their learning progress in a course during the semester
  - In a interactive an fun way
  - Promoting self-discipline

- Provide a **right-time** aggregated view of class performance to the course coordinator

**Goal:** Increase the student learning experience in a course

(Cardoso et al. 2016, 2017, 2018)
Learning Scorecard student dashboards

• Monitoring of individual learning experience and progress in a course with gamification techniques
  – XP
  – Ranks
  – Quests
  – Leaderboards
  – Trophies
  – Badges
  – Avatars
  – Guilds…

(Cardoso et al., 2018)
Learning Scorecard student dashboards

(Cardoso et al., 2018)
Learning Scorecard Faculty Dashboard

- Information rich providing a multi-dimensional view of student learning data (Engagement, Motivation, Responsibility, Collaboration)
- Aggregated data
- Leaderboards are also used
Conclusions
Conclusions

• LA is a recent research field in an early stage of adoption by Higher Education Institutions
• LA holds an enormous potential to improve student learning experience, performance and satisfaction
• Careful address the challenges and concerns of stakeholders

Want to start a Learning Analytics project in your Institution?
Further resources

Handbook of Learning Analytics – First edition

2017
The Handbook of Learning Analytics
Editors: Charles Lang, George Siemens, Alyssa Wise, Dragan Gašević
ISBN: 978-0-9952408-0-3
DOI: 10.18608/hla17

Download Book
Order printed copy

https://solaresearch.org/hla-17/
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Thank you!

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