Learning Analytics in Education:
Using Student’s Big Data to Improve Teaching

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Content

• Definitions: What’s Learning Analytics and Big Data?
• The Importance of Learning Analytics in Education
• What Learning Analytics Can Do and Can Not Do
• Using Learning Analytics in Moodle
• Using the Results to Improve Teaching
• Questions
**Big Data**

**Extremely large data sets** that may be analyzed computationally to **reveal patterns, trends, and associations**, especially relating to human behavior and interactions.
Big Data
Big Data

Getting Users’ Data

http://www.tubechop.com/watch/5748183
WAIT, I MAY HAVE A CARD SHOWING MY LOYALTY TO WHATEVER STORE THIS IS
Big Data

Diapers and Beer

One of the largest U.S. retail shops found that the sale of disposable diapers had some connection with the sale of beer. This type of information is quite strange at first and if we analyze the data "manually" we would probably ignore it.
How Target Figured Out A Teen Girl Was Pregnant Before Her Father Did

Every time you go shopping, you share intimate details about your consumption patterns with retailers. And many of those retailers are studying those details to figure out what you like, what you need, and which coupons are most likely to make you happy. Target, for example, has figured out how to data-mine its way into your womb, to figure out whether you have a baby on the way long before you need to start buying diapers.

Target knows your secrets (from The Power of Habit by Charles Duhigg)

https://youtu.be/RC5HNTj3Dag
Big Data

Getting Users’ Data

“Likeosphere”
1 ZB = $1000^7$ bytes = $10^{21}$ bytes

= 1000 exabytes

= 1 billion terabytes

= 1 trillion gigabytes
WE'VE DECIDED TO TAKE BIG DATA TO THE NEXT LEVEL...

HUMONGOUS DATA
Big Data in Education

Data should be used to improve learning!
"Learning Analytics is the use of intelligent data, learner-produced data, and analysis models to discover information and social connections for predicting and advising people's learning."  

George Siemens

Examples:

- Student dropout predictions systems
- Live statistics about the learners
- Individual progress vs group progress
Learning Analytics is the measurement, collection, analysis and reporting of data about learners and their contexts,

In order to understand and optimize learning and the environments in which it occurs.
Educational Data Mining is a term used for processes designed for the analysis of data from educational settings to better understand students and the settings which they learn in.
## Academic vs Learning Analytics

<table>
<thead>
<tr>
<th>Academic Analytics</th>
<th>Learning Analytics</th>
</tr>
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<tbody>
<tr>
<td>A process for providing higher education institutions with the data necessary to <strong>support operational and financial decision making</strong></td>
<td>The use of analytic techniques to help target instructional, curricular, and support resources to <strong>support the achievement of specific learning goals</strong></td>
</tr>
<tr>
<td>Focused on the <strong>business of the institution</strong></td>
<td>Focused on the <strong>student and their learning behaviors</strong></td>
</tr>
<tr>
<td><strong>Management/executives</strong> are the primary audience</td>
<td><strong>Learners and instructors</strong> are the primary audience</td>
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Learning Analytics

Predictive Analytics
- Predict future outcomes and behavior

Analyzing Trends
- Identify historical trends and correlations

Reporting Data
- Summarize historical data
Types of Learning Analytics Systems

- Academic Early Alert Systems
- Data Visualization
- Student Advising & Recommendations
- Adaptive Learning & Cognitive Tutoring
Learner-Produced Data
Big Data in Education

Education is increasingly occurring online or in educational software, resulting in an explosion of data that can be used to improve educational effectiveness and support basic research on learning. In this course, you will learn how and when to use key methods for educational data mining and learning analytics on this data.

https://www.coursera.org/course/bigdata-edu

MOOT: “Big Data in Education” (2014)

http://www.columbia.edu/~rsb2162/bigdataeducation.html
Brandeis expands online course offerings with Learning Analytics graduate certificate

New fall program combines data analysis with the expanding field of online learning

April 14, 2015

Brandeis University’s Graduate Professional Studies division (GPS) will launch a fully-online graduate certificate program in Learning Analytics in September 2015, the university announced today.

Designed to be completed in 1.5 years or less, the program is for professionals with strong backgrounds in education, instructional design, or institutional research. Cross-disciplinary in nature, the certificate will provide students with the foundational tool sets and theory of business intelligence and data analysis. These skillsets are necessary for evaluating the effectiveness of courses, programs and instruction, and prepare students to fill a highly in-demand skills gap in a burgeoning job market.

“As the learning analytics field continues to evolve, it is more important than ever before to use the technology and data we have available to us to understand and, ultimately, enhance the learning experience,” said Brian Salerno, director of Online Learning and Instructional Design at Brandeis GPS.

http://www.brandeis.edu/now/2015/april/gps-learning-analytics-grad-certificate.html
Learning Analytics

LA software compares a student’s activity with others in the class, with students who previously took the course, and/or against other rubrics to create a model for how each student is likely to fare.

In this way, LA capitalizes on the vast quantities of data that most colleges and universities collect to find patterns that can be used to improve learning.
Learning Analytics: What it Can Do?

• Predict future student performance (based on past patterns of learning across diverse student bodies)

• Intervene when students are struggling to provide unique feedback tailored to their answers

• Personalize the learning process for each and every student, playing to their strengths and encouraging improvement

• Adapt teaching and learning styles via socialization, pedagogy and technology
Learning Analytics

The most common use of learning analytics is to identify students who appear less likely to succeed academically and to enable—or even initiate—targeted interventions to help them achieve better outcomes.

LA tools to identify specific units of study or assignments in a course that cause students difficulty generally. Instructors can then make curricular changes or modify learning activities to improve learning on the part of all students.
Much of the data on which LA applications depend comes from the learning management system (LMS), including:

- log-in information
- rates of participation in specific activities
- time students spend interacting with online resources or others in the class,
- grades
• Applications that perform data collection and analysis are frequently either built into or added onto the LMS from which they draw primary data.

• Analytics tools: tied to their software, built by colleges or universities or by third parties to work with the LMS.
Learning Analytics

LA applications gather data, analyze that data, generate reports, and enable interventions. In most cases, this happens without an opt-in by students.

The types of analyses performed vary, but one approach involves the evaluation of historical student data to create predictive models of successful and at-risk students.
Reports can take various forms, but most feature data visualizations designed to facilitate quick understanding of which students are likely to succeed.

Some systems *proactively notify users*; other systems require users to take some action to access the reports.

System-generated interventions can range from a simple alert about a student’s likelihood of success to requiring at-risk students to take specific actions to address concerns.
Learning analytics can help educators identify students who are initially slow but surge ahead later, proceeding from the appearance of struggling to gifted in a couple of weeks.

Learning analytics can be customized to student needs, allowing students to get a better, faster picture of their performance.

Unlike a classroom setting, every student in a course using learning analytics answers every question, ensuring they interact with all course material.

Learning analytics can identify common wrong answers and create custom responses crafted to help address the specifics of each particular wrong answer.

Learning analytics allows for online peer grading and self-grading because educators can monitor correlations between current vs. past performance and teacher vs. peer/self-grading.
Learning Analytics
Humanizing Analytics

Marie Wallace: Privacy by design: humanizing analytics

https://www.youtube.com/watch?v=8JLzs_xVKxY
Data from tracking systems is not inherently intelligent

Hit counts and access patterns do not really explain anything.

The intelligence is in the interpretation of the data by a skilled analyst.

Ideally, data mining enables the visualization of interesting data that in turn sparks the investigation of apparent
Another thing analytics can not do by themselves is improve instruction

While they can point to areas in need of improvement and they can identify engaging practices, the numbers can not make suggestion for improvements.

This requires a human intervention – usually in the form of a focus group or by soliciting suggestions from the learners themselves.
Learning Analytics Outcomes

- **Prediction purposes**, for example to identify 'at risk' students in terms of drop out or course failure

- **Personalization & Adaptation**, to provide students with tailored learning pathways, or assessment materials

- **Intervention purposes**, providing educators with information to intervene to support students

- **Information visualization**, typically in the form of so-called learning dashboards which provide overview learning data through data visualisation tools
How to Get Started With Analytics & Reports in Moodle?
Analytics & Reports in Moodle

1. Overview Statistics (Plugin)

This plugin produces a website and course reports charts, comprising countries, user-login, preferred languages, number of courses by category, by size and enrolled users. Moreover, this high-end plugin will also extend the main feature of statistics in a Moodle website. The code has been designed in such a way that makes adding more reports a lot easier and simpler.

https://moodle.org/plugins/view/report_overviewstats

SmartKlass™ is a Learning Analytics dashboard that should be included as a part of the Moodle virtual learning platform to empower teachers to manage the learning journey of their students.

https://www.youtube.com/watch?v=yijkTDwmln8
A new feature introduced within Moodle 2.8, events monitoring allows admins and teachers to receive notification when certain events happen in Moodle.

Watch the events monitor in action here and explore some event examples.
Analytics & Reports in Moodle

4. Site-Wide Reports

Moodle administrators have access to a variety of powerful and useful site-wide reports for learning analytics, including security, question instances, logs and comments.

More info: site-wide reports
5. Engagement Analytics (Plugin)

Engagement Analytics block provides information about student progress against a range of indicators and student activities which have been identified by current research to have an impact on student success in an online course.

This plugin is not yet supported for Moodle 2.8 and requires mod and block plugins.

More info: Engagement Analytics plugin
6. Logs

These activity reports can be viewed by the administrator at the teacher level, site level and with live logs.

More info: documentation on Logs
7. Forum Graph

The **Forum Graph Report** analyses interactions in a single Forum activity and create a force-directed graph using the D3.js Javascript library.

This plugin is not yet supported for Moodle 2.8.

More info: [Forum Graph plugin](#)
8. Analytics (Piwik & Google)

This local Moodle Module adds Analytics, currently supports 3 Analytics modes: **Piwik**, **Google Universal Analytics** and **Google Legacy Analytics**.

This plugin is not yet supported for Moodle 2.8.

Read more about [the plugin here](#).
Using Excel Macros to Analyse Moodle Logs

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Abstract

Learning analytics enables tutors to gain useful insights on the behaviour of students in an online learning environment. This information can then be utilised to customize the educational space, optimize the learning resources and activities, and personalize the student experience. This paper presents our approach to analysing the data of users’ behaviours that are recorded in the Moodle logs. Currently, the Moodle logs manager suffers from functional limitations and uninspiring visualizations. Our method utilises the possibility of downloading the logs in Microsoft Excel format and provides a simple and effective offline solution. The method we have developed is based on Excel macros and visual basic. Tutors can experiment with different combinations of metrics such as total page views, unique users, unique actions, IP addresses, unique pages, average session length and bounce rate. Furthermore, the software allows the definition of date ranges and the selection of individual or groups of students. The complicated processes of analysing and combining data are carried out in the background, enabling tutors to focus on the pedagogic implications and invest in practical, realistic scenarios through informed decision-making. Future work includes transferring the offline functionality to an online Moodle plugin and increasing system intelligence to allow the production of meaningful and actionable suggestions with regards to set target goals.

Analytics & Reports in Moodle

Summary:
- Total page views: 13094
- Total unique users: 53
- Total unique actions: 827
- Total unique pages: 430
- Total IP addresses: 848
- Mean session length: 24.6 mins

Activity over date range:
- Total page views chart showing page view trends over time.

Day and time:
- Time of Activity chart showing activity trends by hour.

Top figures:
- User: Total views, Actions, Pages, Dates, Bounce (% of sessions)
- IP addresses: Unique users

Graphs and tables provide detailed insights into Moodle analytics.
edX Course (MOOC)

Archived Course

UTArlingtonX

LINK5.10x Data, Analytics, and Learning

Final course details are being wrapped up at this time. Your final standing will be available shortly.

https://courses.edx.org/courses/UTArlingtonX/LINK5.10x/3T2014/info
The Future

Teachers will fill multiple roles:

- TEACHER
- INSTRUCTORS
- FACILITATORS
- ANALYSTS
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DawsonITE Blog

http://dawsonite.dawsoncollege.qc.ca
MERCI!
THANK YOU!