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Improving Learning by Using Data:

A Guide to Better Understand Learning Analytics

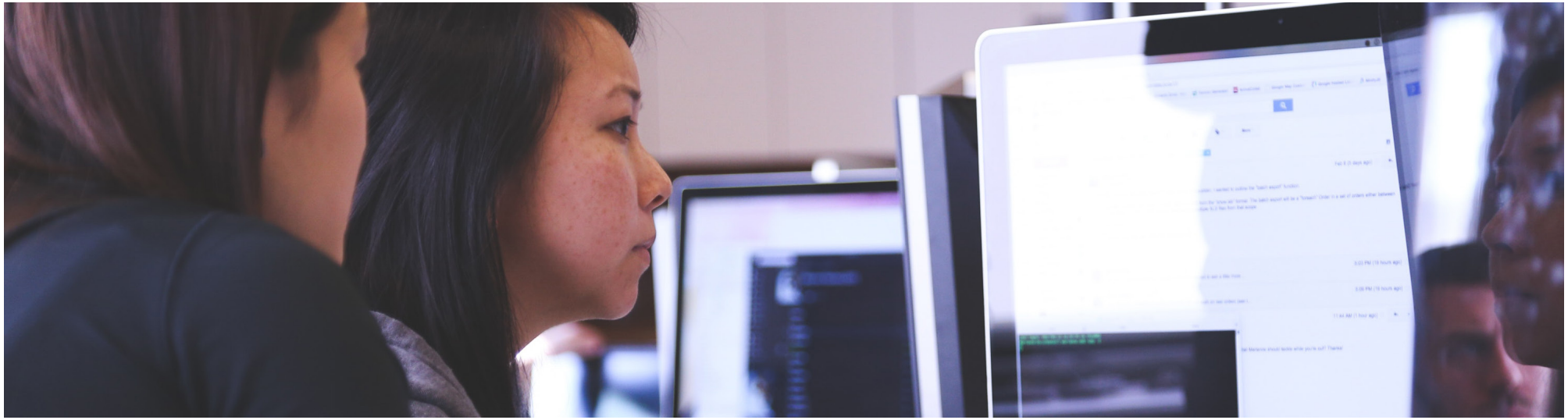
Getting to know Learning Analytics

The Edtech world is constantly evolving. Every year, investments in Edtech startups rise, matching with 2020's projections of 252 billion dollars invested. Every year, new trends come out, catching the attention of entrepreneurs and educators.

New digital supports will surely disrupt and reform Education, like augmented reality or virtual reality. Exams are getting more and more digital and secured, improving test-making and competence monitoring. There are game changers happening, with educators focusing more and more on **soft skills**, thus changing learning drastically.

Among these significant changes, one comes back very often in schools' top priorities: **Learning Analytics (L.A.).** This term is e-ve-ry-where. Although L.A. exist since the 2010's, interest seems to have taken off in 2017.

In fact, it is reasonable to say that Learning Analytics are the basis of a new organization in educational institutions. A new organization with a precise goal: adapt learning to students as much as possible and engage them in learning processes. It's called **adaptive learning** and it is Edtech's grand framework these days.



A lot of people understood it and it quickly became one of the most talked-about term in 2017 and in 2018's first quarter.

Nevertheless, not everyone understand it. Indeed, L.A. are still foggy as they englobe many processes, tools, different uses and so on. Furthermore, L.A. are often approached in a very technical way, which makes them difficult to understand for people that aren't skilled in digital learning, software development or data base management.

Hence the goal of writing this white paper!
We would like to make Learning Analytics accessible and understandable for everyone.
The objective is for you to understand how they work and what they can solve.
Finally, this guide aims at underlining the opportunities and challenges they are facing today and will face tomorrow.

What you'll find in this document:

- Learning Analytics is the big trend in Education this year.
- Although they are pretty technicals and can be hard to understand, Learning Analytics are simple to understand as a process.
- Learning Analytics offer many opportunities for institutions, notably in terms of adaptive learning and proactive learning.
- Learning Analytics open the door for learning optimization, a set of learning processes aiming at accelerating knowledge integration for students. And aiming at optimizing courses towards more soft skills application in projects/initiatives. All of this backed by data analysis and constant feedback.
- There are two big challenges that schools will be opposed to: ethics and (strangely) the over reliance on digital footprints.
- Learning Analytics are transforming and giving birth to new forms that could overcome the challenges of this over reliance.

Why are Learning Analytics so popular today?

Mostly because of three factors:

1. There's a new paradigm in Education based on personalizing Education to students. A paradigm that is dependent on understanding each students behavior and ways of learning. Analyzing students' digital footprint is, for now, the best way to reach optimal personalization

2. Online learning and MOOCs, being entirely online, let educators access easily students' digital footprints

3. Data analytics improved so that educators can prevent students failure at school leading to enhanced communication with those in need and lead the way to solutions that could be installed. Furthermore, Education technology and eLearning platforms are now compatible with that level of data exploitation

Defining Learning Analytics

In a way L.A. are very simple. **It is the application of data collection, analytics, measurement and reporting to Education with the goal of improving and optimizing learning and learning environment for students.**

Sébastien Fraysse, consultant and specialist in digital learning **gives another definition** that is very interesting: “Learning Analytics are the art of asking the right questions and to try to answer them.”

According to Dara Cassidy, Director of Online Learning at Hibernia College, a higher education institution based in Ireland that specialises primarily in teacher education, “Learning Analytics are the use of data to produce insights into student learning and the use of those insights to help students learn more effectively”.

You understand the core of it. Now let’s go a little bit deeper.

Who are they for?

In class or online courses

Higher Education

Administration:

- Institution's Education strategy
- Program development
- Fixing budgets for programs, infrastructures and marketing
- Faculty management
- Help get accreditations easier

Faculty:

- More autonomy for professors
- Pedagogy and course content improvement
- Better communication with students
- Better understanding of students' competences/ knowledge acquisition and integration
- Improve students' engagement and retention

Students:

- Better understanding of their strength and weaknesses
- Accelerate learning
- Better communication with professors
- Help progress and learn better

Corporate universities

HR department

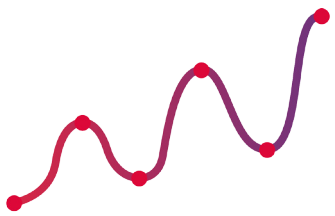
- Improve recruitment and training
- Better follow up and understanding of employee's strengths and weaknesses
- Better program for employees who want to evolve
- Increase mobility in the company

Digital learning managers

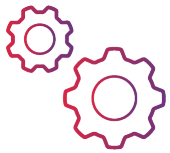
- Improve course content and learning programs
- Better understanding of employee's strengths and weaknesses
- Increase mobility in the company

Employees

- Better understanding of their strength and weaknesses
- Accelerate learning
- Specialize and find positions favored by employees



How it works?



To shape your L.A. campaigns, it is important to identify four different ways to analyze situations. Analysis that will determine the way you will interpret and use data.

Descriptive: you're trying to know what happened.
eg: Did students globally succeeded at this exam?

Diagnostic: you're trying to understand why did something happen?
eg: Why aren't students engaged in my cours?

Predictive: Obviously you try to predict what's going to happen based on probabilities and patterns.
eg: Considering present and past grades for this students, how likely will he succeed in his final year?

Prescriptive: It is what follows prediction. You try to go deeper than a simple prediction based on probability and try to understand what course of action you might take in order to solve a problem or improve a situation.
eg: What should I do to avoid a potentiel failure from this student in this course?

These different levels of analysis are used according to the different goals professors or faculty can have. Evidently, the more you are searching for a prescriptive use of Learning Analytics, the more complex it will be.

Today, the descriptive analysis is the most used and only necessitates to have a basic Learning Management System (eg: Moodle, Blackboard…) and a simple data visualization tool. Nevertheless, the three other levels call for reflection, teamwork, a more organized data collection process and better knowledge in algorithms in order to automate actions and improve problem solving.

Just so you know, a Learning Analytics campaign is the application of L.A. solutions in a determined timeline, with a determined objective and a defined goal to solve a targeted issue, prevent a possible issue or simply improve aspects of an institution's learning process

The Recipe

Ingredients

To make it work you need:

- a Learning Management System (LMS) through which digital footprints will be collected as data
- a Learning Record Store (LRS) that you have to set up in order to filtrate the data you are searching and get all answers. All according to one of the four levels of analysis
- Learning Analytics Processor (LAP) through which you find all the data and automate actions (like Alerts for students in path to fail a course). It is the main tool to carry out predictive and prescriptive analytics
- a data visualisation tool (integrated into the LMS if not already available with the LMS) that will display general and personalized analytics pre and post Learning Analytics campaigns
- any digital support students will work or communicate from the LMS or Student Information System (SIS) and need to gather data in order to get accurate information that will help solve problem or improve learning. It can be a student app, an online library, an e-portfolio and so on

What is a LRS?

A Learning Record Store is like a database compiling all the data related to learning collected on a LMS and other interfaces. After being collected, data is organized and displayed generally through a data visualisation interface. LRS is the heart of Learning analytics. Among the best are YetAnalytics, Watershed LRS or Learning Locker.

What about xAPI?

xAPI (Experience API) is SCORM's successor, a communication protocol specifying how documentations and data are communicated between LMS and LRS and how they're organized and displayed. xAPI is kind of like Google Analytics, but better. Indeed, using xAPI you can analyze a population but also an individual and each of his specific interactions with learning content. If a LRS is the heart of Learning analytics, xAPI is the brain.

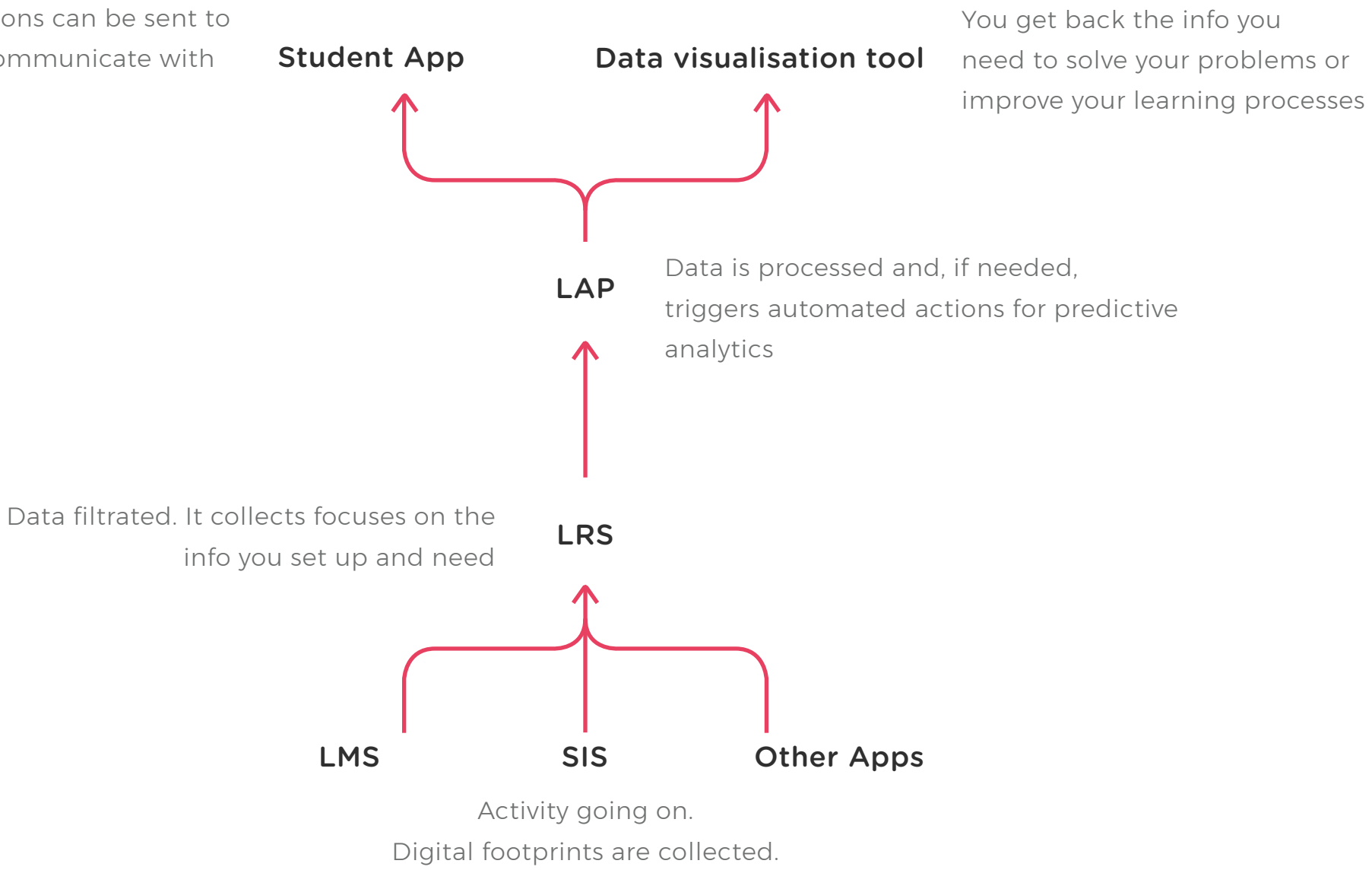
What is a LAP?

Learning Analytics Processors are open source web apps used as data workflow manager tools that automatically process data stored on a LRS and trigger actions like emails sending or appointment demands to students in case of predicted failure. It has one main use: producing and managing predictions based on data collected from the different sources selected on which digital footprints are found.

Data visualisation?

Data visualization lets you focus on the key info you need. It is essential to target specific goals and follow the evolution of L.A. campaigns. Data visualization is everywhere, from Google Analytics to your bank account.

Finally, it gives something like this:



Niall Sclater, an Edtech and Learning Analytics expert among the experts, gives also a detailed checklist of what a L.A. recipe looks like, taking the example of Jisc Learning Analytics solutions.

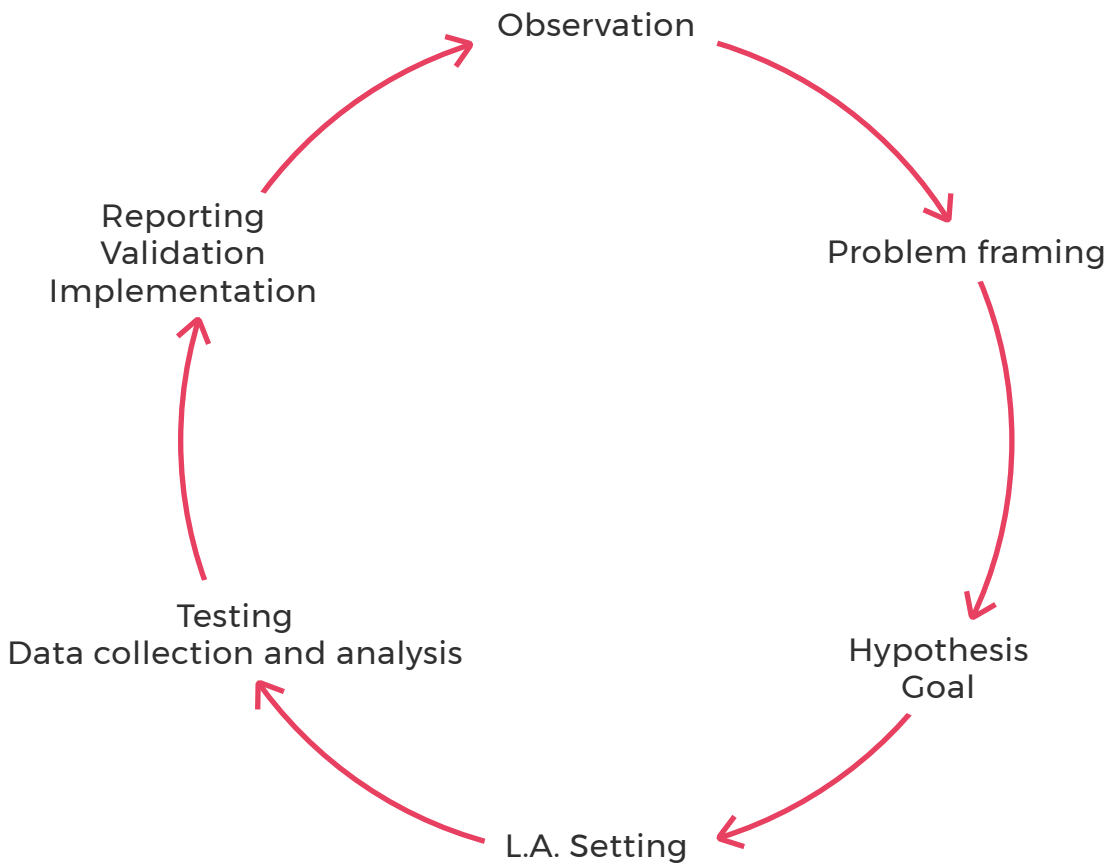
We said Learning Analytics were more than a technical discipline and flows of data. They're also about processes and organization between educators.

Why a process?

- to be certain no mistake or misinterpretation of data has been made during the data collection/ reporting phase
- to ensure learning has improved and accelerated through rapid tests and execution
- to organize teams that'll work with Learning Analytics

How to Process Learning Analytics?

You can find below a process of actions that will help you use Learning Analytics and improve your learning processes.



It is simple and works a little bit like the Design Thinking method, although the basis isn't ideation but observation of learners' current state of competences' acquisition.

The opportunities offered by Learning Analytics

Learning Analytics offer unlimited opportunities from data-backed problem solving solutions to proactive improvements. Among these are:

- **Automation:** It is one of the opportunities offered by data applied in Education. Particularly through predictive analysis, Learning Analytics help professors and faculty to ensure students stay active in class (for example, you can figure out which kind of class suits students best ; a simulation, a role play games, a conference etc. thus help them stay engaged in class). Automation finally helps greatly adapting learning to each individual (as it helps you understand how each student performs or work). A task that was, until now, very challenging. Thus provoking great disparities between students in difficulty and the ones at the top of the class.
- **Improvement tool for educators:** It is clear that they are one of the best tool proposed today to proactively improve educators' pedagogy as well as learning process for an institution.
- **Anticipating students' problems by using Predictive Learning Analytics:** PLA are a continuation of Learning Analytics. Aiming at preventing possible issues concerning students by predicting their behavior based on a multitude of data, PLA are a very promising application of data in Education.
- **Rapid innovation in Education:** By adopting processes such as the ones displayed earlier for a complete set-up, the institution also rearrange the organization centered around rapid execution, constant innovation and *learning optimization**.

*What is learning optimization?

We might also call it "Hacking Learning". It is the application of learning processes in order to accelerate knowledge integration for students and optimise courses towards more soft skills application in projects/initiatives. All of this, backed by data analysis and constant feedback.

The limits and challenges

Very well, Learning Analytics are full of promises and opportunities in order to reform a bottlenecked Education. But (because there's always a but...), there are also big challenges and obstacles that Learning Analytics face or will face tomorrow. Barriers that can slow down or even block the exploitation of their full potential.

1 **Ethics & data privacy:** any institution that wants to integrate Learning Analytics tools will have to clearly state which data they want to collect and transparently show it to students. One disagreement from a student and the whole process is undermined.

Solution?

The Learning Analytics Community Exchange (LACE), an EU funded project, developed an 8 steps checklist to make sure they are well conducted, transparent and have realistic objectives for the educative institution.

Here are the 8 steps that you can also find here:

1. **D -etermination:** Decide on the purpose of Learning Analytics for your institution
2. **E -xplain:** Define the scope of data collection and usage
3. **L -egitimate:** Explain how you operate within the legal frameworks, refer to the essential legislation
4. **I -nvolve:** Talk to stakeholders and give assurances about the data distribution and use
5. **C -onsent:** Seek consent through clear consent questions
6. **A -nonymise:** Disidentify individuals as much as possible
7. **T -echnical aspects:** Monitor who has access to data, especially in areas with important staff turn-over
8. **E -xternal partners:** Make sure externals provide highest data security standards

2 Over reliance on digital footprints: Strangely the biggest impediment to the use of Learning Analytics is the digital itself. Apart from online courses, learning is done in classrooms, outside the LMS and other online resources. Thus, no data can be collected, no analysis can be done, no improvement based on data can happen, finally, Learning Analytics become useless.

The challenge is significant here. How can educators connect their environment in order to analyse their students behavior? Two opposite visions for this question.

- One considers behavior analysis, in-class, as being “too much” and an intrusion of students’ privacy, unethical
- Whereas another group proposes a solution to this challenge for they consider in-class behavioral data collection and analysis as being key to a better adaptive learning

Solution?

It is called Multimodal Learning Analytics (MLA). Developed by **Xavier Ochoa**, MLA is about capturing learning data from offline, hands-on environments such as labs or classrooms via different tools. In a way, MLA are the application of the Internet of Things … In Education. Although it is incredibly promising and exciting, for the moment MLA are still at the theoretical stage and need in-depth decryption.

Going Further

Learning Analytics are a fascinating field of study that needs to be understood and researched plainly. That's why apart from this white paper, we invite you to deepen your knowledge about them with these resources.

- **Learning analytics in higher education: an analysis of case studies**,

by Billy Tak Ming Wong, (University Research Centre, The Open University of Hong Kong, Hong Kong)

- **Augmenting Learning Analytics with Multimodal Sensory Data**,

by Xavier Ochoa and Marcelo Worsley, appearing in SOLAR's (Society for Learning Analytics Research) Journal of Learning Analytics

- **Effective Learning Analytics, Jisc's Learning Analytics Architecture – who's involved, what are the products and when will it be available?**

by Niall Sclater on Jisc

- **Effective Learning Analytics, Using learning analytics to enhance the curriculum**,

by Niall Sclater on Jisc

- **Learning Analytics in Higher Education**,

by Niall Sclater, Alice Peasgood, Joel Mullan

- **From Bricks to Clicks - The Potential of Data and Analytics in Higher Education**,

a report by the Higher Education Commission

- **Experiments and Challenges with Learning Analytics Around the World,**

by Priscila Zigunovas, e-learn

- **Learning Analytics Possibilities and Challenges of Using Data Science**,

by Priscila Zigunovas, e-learn

- **How data can improve the quality of Higher Education**,

by Marjolein van Trigt

- **What Sources Of Learning Analytics Should You Be Collecting?**

by Jim Yupangco

We also invite you to follow these courses on edX:

- **Multimodal learning Analytics**,

by Xavier Ochoa, Professor at Escuela Superior Politécnica del Litoral (ESPOL), Ecuador

- **DALMOOC (Data, Analytics and Learning)**,

by UTArlingtonX

- **Predictive Modelling Learning Analytics**,

by Christopher Brooks (Director of Learning Analytics and Research at the Office of Academic Innovation at the University of Michigan) and Craig Thompson (Learning Analytics Research Analyst at the Centre for Teaching, Learning and Technology at the University of British Columbia)

- **Practical Learning Analytics**,

by Tim McKay (Arthur F. Thurnau Professor of Physics, Astronomy and Education at the University of Michigan)

TestWe and Learning Analytics

If we, at **TestWe**, are publishing this white paper, it is because we're personally attached to the vision of this new field of Education.

First because we believe our solution, as an academic data provider, is a great match with Learning Analytics.
Secondly because TestWe has the potential to become a great Learning Analytics tool. That's why we are currently developing data visualisation and academic data analytics tools to enrich our solution for our partners.

If you are interested in what we're building or simply want to help by giving us feedback on your personal use of Learning Analytics tools, do not hesitate to email us at **contact@testwe.eu**

A white paper made by a passionate team of Education lovers and innovators!

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