

HOW DATA CAN IMPROVE THE QUALITY OF HIGHER EDUCATION



SURF NET

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Big data are found in all segments of society. Even the Dutch higher education sector is increasingly recognising the potential for the vast volumes of data that it has at its disposal. What opportunities does learning analytics offer? And what challenges are the early adopters facing?

Are there any runners out there who still do not track their performance with an app? Is anyone still shocked by their electricity bill now that there is a smart meter that shows real-time household energy consumption? Insight is the buzzword in the data revolution. People who have insight into their behaviour will be able to work more efficiently from now on. This equally applies to organisations, higher education institutions and nations. The digital revolution has brought about a tremendous increase in the volume of data and it is comparatively easy to access. It would seem to be a lost opportunity to ignore such data.

Just as all sectors in which ICT is used regularly, in the higher education sector too data are there for the taking, so to speak. From the moment students browse the higher education institution's website for information until the moment they are registered as alumni, they leave a digital footprint. Student information systems, the online learning environment and the library, but even items such as students' wearables, generate a wealth of potentially interesting data. If you connect all systems to each other, you will gain insight into students' learning behaviour, the quality of teaching and the institution's effectiveness. Greater insight translates into better education for students. It obviously is not so easy to gather, analyse and report data from learning environments as suggested here. There are educational, ethical, legal and technical challenges which need more clarification.

Even so SURFnet believes in the potential for learning analytics, the umbrella term for processing study data to understand and improve learning behaviour. "Learning analytics always existed, but in the lecturer's mind," says Erik Huizer, SURFnet CTO. "The lecturer looked at the list of marks and was able to properly assess whether a student needed further support. Because lecturers have to work with ever larger groups, it is increasingly difficult for them to maintain oversight nowadays."

The scale of education stands in stark contrast to the call for customised education. The members of SURFnet aim to offer an environment in which they can provide students the most effective and preferably the most personalised programme possible. "Without automation it's just not possible," says Huizer. "A lecturer must have good insight into a student's progress. It's important for students to know at what stage they are in the programme and what next steps they are ready to take. This is where learning analytics comes in. SURFnet's challenge is to help create that environment for its members."

A practical example:

SETTING GOALS TO IMPROVE GRADE POINT AVERAGES

What do grade point averages say about succeeding in the labour market? If it were up to data psychologist Stefan Mol, first-year students will soon have a better understanding of what they are undertaking. In his vision for the future he can present them with statistics on their job prospects and suggest what would be the best subjects to take for the profession they have in mind.

He plans to use alumni data footprints to identify trends to help prospective students pursue an effective study pathway. “While study behaviour, high marks and salaries clearly are not the only indications of an individual’s ‘value’ to society, they are interesting indicators nonetheless,” he admits. “The emergence of learning analytics makes it comparatively easy to analyse developments in and correlations between these indicators”.

Mol coordinates seven learning analytics pilots being carried out by the University of Amsterdam. The initial precursor of the research he aspires to conduct is an experiment at the Amsterdam Business School, which he set up in collaboration with Vladimir Kobayashi, a doctoral researcher involved in the [Eduworks project](#). Mol and his team developed a dashboard which encourages students to set personal goals. The pilot is based on the goal-setting theory popular in psychology. Students set personal goals during the course such as ‘I aim to read chapters 3-5 this week. The lecturer provides feedback on the anonymised goals. The students are then given the opportunity to adopt a number of fine-tuned goals. When the deadline arrives, the students receive an email reminding them of their goal, can tick off their goal as achieved and set a follow-up activity. All data generated by the process are stored in the central Learning Record Store created by the University of Amsterdam for the pilot projects.

“We are examining which goals will project the final mark for the course,” explains Mol. “Based on the analytics of the data collected to date, we hope to be able to advise our students next year which goals they should adopt to earn higher marks. Though we obviously won’t be able to offer any guarantees.”

A number of difficult issues have surfaced as a result of the pilot. Participation is voluntary which means that the number of participating students is limited. Can you make participation in such a project mandatory in the future? Mol actually hopes that it will be so attractive to use the dashboard that mandatory participation will not be necessary. The University of Amsterdam is endeavouring to provide students complete transparency on the processing of the data. Each pilot is submitted to the relevant faculty’s ethics committee for review. Alan Berg, the leading technician behind the pilots, believes that this is an important lesson learned: “If you aim to use learning analytics for all students, you must ensure that the faculties do not need to approach the individual ethics committees. What is required is a central supervisory authority that makes decisions on ethics and data management.”

Mol wants to show correlations between goals and performance but is reliant on volunteers. Are these participants successful because they set goals, or because they are already more motivated and take part in the pilot for that reason? This is where a second ethical matter comes into play. “In an ideal world you would resolve this chicken or the egg dilemma by conducting a randomised controlled trial,” says Mol. “An experimental group would then be given access to the dashboard and instructions on the goals to be set. The control group should be comparable in every respect but will not be granted access. But can you simply deny half of the students use of a potential support resource?”¹

¹ For a series of follow-up studies in Australia the team is currently exploring a [regression discontinuity design](#) to which fewer ethical issues may be attached.

CHALLENGES OF LEARNING ANALYTICS

SURFnet is endeavouring to resolve the institutions' uncertainties in various ways and to contribute to the development of ethical ground rules for learning analytics. In the report entitled 'Grand Challenges in learning analytics & open and online education - a Survey', experts describe challenges relating to learning analytics and open and online education.

It emerged that technology was not the main challenge facing the University of Amsterdam. To cite Berg: "The technical architecture is relatively straightforward. Data management at the institutional level is another story, however, it's really complex. The legal and ethical boundaries are causing the most headaches." The guide to Learning analytics under the Dutch Personal Data Protection Act published by SURFnet sets out the legal guidelines applicable to using learning analytics in education. Mol's ambitions are high when it comes to learning analytics, but even a relatively minor research question seems to be difficult to answer unequivocally. The practical example shows that while learning analytics takes up the necessary time and energy, this method equally offers inspiring, new opportunities. So, what about the students? They are enthusiastic because they will personally benefit from the experiment they are contributing to.

Pedagogical challenges

It would seem tempting to shake out the data systems at random to find out which correlations the algorithms discover. Regrettably this would be a rather pointless exercise. For learning analytics to be really relevant, good research questions must be formulated in advance. A survey conducted by SURFnet during 'Dé Onderwijsdagen 2015' (Education Fair 2015) showed that higher education institutions are grappling with this issue. They stated that they do not measure what they want to know even though they would like to. They were found to have a great need for standards and knowledge transfer.

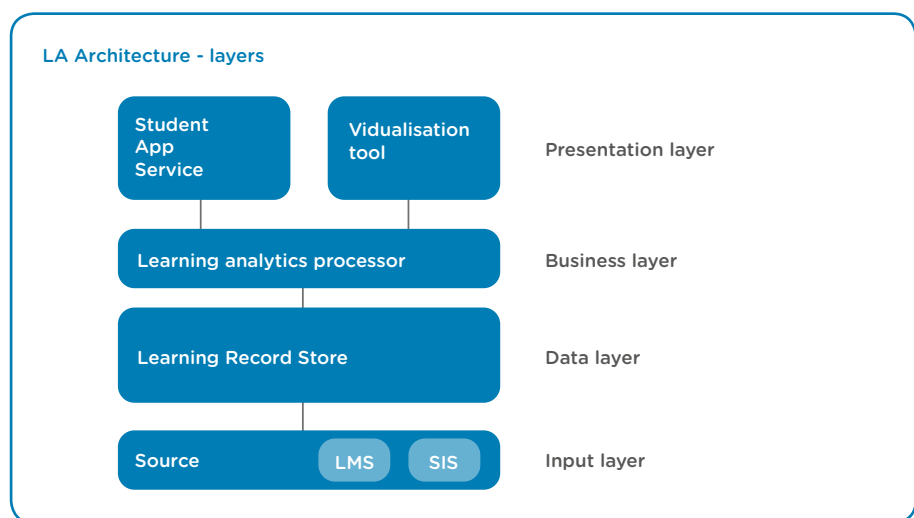
The use of learning analytics begins with a good research question. In this respect Maartje van den Bogaard believes that nothing has changed. The education consultant is conducting research into study success rates at Leiden University. "The question 'what is the best programme I can offer with the tools at my disposal?' is timeless," she argues. "Yet given that tools are becoming increasingly advanced, you need to put more thought into how you plan to use them. You need to start with the process well in advance of your course, otherwise data will not be available or cannot be interpreted for instance."

Next, a number of preconditions are required to achieve didactical added value. Niall Slater, a Scottish consultant for Jisc, SURFnet's British sister organisation, enumerates: "Do you have people in-house who understand the data, are familiar with and can interpret the data sources, can create predictive models or perform statistical analyses, and more importantly, when everything else has been done and dusted, can perform interventions with the students? You can produce statistics until you're blue in the face but if you're unable to perform interventions, you may as well not even bother." There is no need for lecturers to possess all these skills, but a certain aptitude for ICT, along with the ability to think critically and to interpret analyses, definitely is a requirement. "If you wish to do something with learning analytics, you'll need to commit to ICT courses as part of lecturers' teaching qualifications," says Van den Bogaard. She believes that the pedagogical challenges are part and parcel of the technological challenges. "If you aim to be a world-class university, first and foremost you must have a world-class electronic working environment and computer system. Many institutions are nowhere near that stage."

Technological challenges

Challenges relating to technology have a direct bearing on ethical issues. Systems cannot be connected to each other without predetermining to what extent a student's or a lecturer's data may be used without violating their privacy. With a view to transparency, a learning analytics architecture must contain a technical control system in which students can personally grant consent for gathering data. It clearly is of paramount importance to ensure that the data are well protected. Given that large volumes of complex data may be involved, there also are challenges in terms of the system's performance.

The technical infrastructure for learning analytics is roughly as follows:



The core of the architecture is what is known as a Learning Record Store. This is where the data are collected. The Learning Record Store is the repository for data derived from the learning environments, and the student information system (SIS). The store supplies its data to the Learning Analytics Processor, which makes predictions based on the data. The Learning Analytics Processor transmits the data and data analyses to the various systems, which usually includes a dashboard featuring visualisations for the tutor or institution and a mobile app for students. A protocol must be used to enable the various source systems, from which the data originate, to communicate with the Learning Record Store. Two protocols are currently embroiled in a battle to become the market standard. The protocols are [xAPI](#) and [IMS Caliper Analytics](#).

The Apereo Foundation is developing open source software for the higher education sector. A free open Learning Record Store, a Student Success Plan and an Open Dashboard have been made available under the [Apereo Learning Analytics Initiative](#).

Privacy and other ethical challenges

Learning analytics is set to become a standard component of a higher education institution's learning environment, expects Hendrik Drachler, associate professor at the Welten Institute of the Open University of the Netherlands, chair of the [SURF Learning Analytics Special Interest Group](#) and Board member of the [Society of Learning Analytics Research](#) (SoLAR). He says: I believe that we won't be talking about learning analytics any more in about five to ten years' time but we'll be using it routinely. Lecturers will take a system-generated report to use for a course, without giving a second thought to the fact that they're using learning analytics."

This may also mean that lecturers will see which students are still logged into the

digital learning environment at four o'clock in the morning. Should they speak to those students about it? And can lecturers refuse students admission to a course because the statistics show that they most probably won't pass?

Before reaching that stage, the higher education institutions will first need to address several difficult ethical issues, for which they should ideally draw up ground rules jointly. At Jisc's request, Niall Sclater has identified as many as 86 ethical and legal issues surrounding learning analytics. He says: "The biggest challenge by far is the institutional culture: are people ready to take decisions based on data?" Understandably many Dutch higher education institutions are somewhat hesitant. In the past, however, on more than one occasion prominent learning analytics projects, such as InBloom in the USA, were forced to be abandoned due to a lack of confidence in the way in which the data were handled. In collaboration with other parties' in the Learning Analytics Community Exchange (LACE), Drachsler designed the DELICATE checklist, which supports institutions in managing data transparently. Do the institutions have a duty to raise awareness among students for the risks associated with the release of data? Perhaps. SURFnet has already taken the first step by conducting a technology survey into personal data lockers in 2016. Personal data lockers enable students to control their own data and to personally decide with whom to share it.



THE POTENTIAL OF LEARNING ANALYTICS FOR THE DUTCH HIGHER EDUCATION SECTOR

LACE is gathering evidence worldwide of the effective use of learning analytics in education. The [LACE Evidence Hub](#) contains a large number of good examples of institutions that have started using learning analytics. Where does the added value lie for the Dutch higher education sector? In interventions and customised education? Or should improvements in teaching material rather be examined in the short term?

Justian Knobbout believes that it should be the latter. He is studying the effects of learning analytics for the HU University of Applied Sciences Utrecht and has found that there still is very little information available on interventions. He is therefore reluctant to comment on the predictive value of learning analytics. “Our influence on a student who is immersed in student life may be limited,” he says putting it into perspective. “What’s more predictions are never perfect. Learning analytics should primarily serve as a positive tool for lecturers, rather than a rigid control mechanism.” Knobbout believes that the added value is mainly reflected at the course level. “Learning analytics should be used to evaluate the teaching material. Ideally, it would enable lecturers to gain a far greater understanding of the learning process than at present. This may translate into a situation in which the lecturer knows exactly how to manage different students.

Education consultant Maartje van den Bogaard shares Knobbout’s opinion. “We’re doing more online activities with students but we often have very little grip on what’s going in the learning environment,” she says. “Learning analytics would be a tremendous help in setting up digital class management properly. The principal benefit is that you’ll be able to use the learning environment more effectively because you’ll maintain far more insight into what’s going on. She is more cautious about the added value of learning analytics for customised education. “Students who get what they need from the learning environment on the basis of the behaviour they display still really is a long way off.”

Learning analytics has long proved its worth to Hendrik Drachsler. He believes that learning analytics “simply is a new filter on data to improve learning”. At the micro level, the subject level, learning analytics offers lecturers the opportunity to, for instance, view activities on a forum. “Aided by learning analytics lecturers obtain a basic overview of the interaction among students. They can see not only which students often initiate a discussion, how the contributions relate to the learning objectives, but also those who do not participate. They can make a detailed intervention.”

At the meso level the processes above the course level are scrutinised. Drachsler: “The system detects patterns that reveal what distinguishes a successful group of students from a less successful group. That kind of information enables lecturers to perform more specific interventions and to monitor the result of the interventions live.” At the macro level an entire faculty or university can observe certain indicators with a single click of the button, such as study success and student drop-out rates.

STARTING WITH LEARNING ANALYTICS

Starting to use learning analytics yourself mainly is a question of actually doing it. Fortunately you will not need to reinvent the wheel all by yourself. SURFnet gathers and shares all the relevant information; see also the sources and links at the end of this article.

We plan to describe a number of good practices during the course of 2016. For the purpose of this article the experts interviewed were asked to provide tips for lecturers and institutions that intend to experiment with learning analytics.

Tips for lecturers from the experts:

1. Start small. Select a small component of your course, such as one lesson, or one component of the learning environment, so that you can practice. Take the time to learn.
2. Start with a question. What problems would you like to resolve, or what would you like to know about your course?
3. Start with a visit to the ethics committee of your faculty and the legal specialists for advice on properly managing the data. Also study the guide to [Learning analytics under the Dutch Data Protection Act](#) published by SURFnet.
4. Be clear to your students about the data you are analysing and why. Show them that they own the data. Ensure they have confidence in the system. Include them in all stages of the project. Use the [DELICATE](#) checklist.
5. Involve the ICT department in your study from the outset. Communicate that you are working with learning analytics. Not all lecturers are always aware of each other's initiatives and as a result miss the opportunity to collaborate.
6. Make contact with like-minded people, such as lecturers who have practical questions you can work on using the data. Make sure to drop by colleagues who are already working with learning analytics as they will have already made all the mistakes once before.

Having insight into their own processes is interesting for institutions. What route does a successful student take through the system. Employees and students should learn to understand the concept that data can help to control processes more effectively. Drachsler warns against becoming mired in a discussion about ethics or the institutional culture. He says: "You can work on a culture change for a very long time without making any further progress. It's far easier to talk to people about the opportunities and challenges based on a prototype."

Tips for institutions from the experts:

1. Ensure that the technical infrastructure is in order. For more information visit: www.surf.nl/learninganalytics.
2. Take the time. It will take an organisation about two years to connect all the different databases, to properly regulate privacy issues and find technical solutions.
3. Top down or bottom up? Both have their merits. Start small, use free software and uncomplicated research questions is the advice of a number of experts. Other parties say that chances are that it will go no further. A large project has greater impact and offers more opportunities to gain acceptance for learning analytics within the organisation.
4. A major challenge is the institutional culture: are people ready to take decisions based on data? Give employees the time to get used to the idea while supporting early adopters in the meantime.
5. Leadership is of vital importance. Institutions that experiment successfully often have a strong leadership figure, who has the authority to introduce learning analytics across the institution.
6. Work together. Study the experiences of other parties and share your own experiences.
7. Resolve ethical and data management issues in advance.
8. Appoint a supervisory authority at the central level.
9. Use the step-by-stop plan in the guide to [Learning analytics under the Dutch Data Protection Act](#).
10. Make the process interactive. Ask lecturers and students which questions they would like to resolve with the aid of learning analytics.
11. Set up a data management system.

CONCLUSION

SURFnet believes that learning analytics has vast potential to help improve the quality of education. Whether it is the key to customised education, time will tell, but there is sufficient reason to experiment. In the longer term it is essential to obtain greater clarity on the didactical possibilities, the technical challenges and the ethical and legal boundaries. SURFnet has an important role to play in sharing knowledge and defining the technical preconditions. The higher education institutions need to sit down together with SURFnet to determine the ground rules. Do not let any of the above aspects deter you from setting up pilots meanwhile, or from introducing top-down learning analytics at your institution and sharing these experiences with the [Learning Analytics Special Interest Group](#). Added value can be derived not only for the organisation, but especially for students and lecturers. If they are convinced of the usefulness of learning analytics, you will derive maximum benefit from the power of your data.

WANT TO READ MORE?!

- [Apero Learning Initiative](#)
- [DELICATE checklist](#)
- [Eduworks project](#)
- [Greller, W., & Drachsler, H. \(2012\) Translating Learning into Numbers: A Generic Framework for Learning Analytics. \(PDF\)](#)
- [Horizon Report > 2016 Higher Education Edition](#)
- [Interviews from the Institutional Readiness for Learning Analytics Workshop, 2015](#)
- [Journal of Learning Analytics, Vol 2, No 3 \(2015\). Special Section: Selected and Extended Papers from the Fifth International Conference on Learning Analytics & Knowledge.](#)
- [LACE project](#)
- [Open Academic Analytics Initiative \(OAAI\)](#)
- [Privacy dashboard](#)
- [Report: From Bricks to Clicks - The Potential of Data and Analytics in Higher Education](#)
- [Sclater, N. \(2014\). Code of practice for learning analytics. A literature review of the ethical and legal issues. JISC report.](#)
- [Sclater, N. \(2014\). Learning analytics. The current state of play in UK higher and further education.](#)
- [Society of Learning Analytics Research \(SoLAR\)](#)
- [SURF Innovation project Customised education > learning analytics](#)
- [SURF SIG Learning Analytics](#)



COLOFON

Author

Marjolein van Trigt

Project management

Jocelyn Manderveld, SURFnet

Design

Vrije Stijl, Utrecht

Photography

StartupStockPhotos ([Pixabay.com](https://pixabay.com))

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SURFnet

PO Box 19035
3501 DA Utrecht

admin@surfnet.nl
www.surf.nl/surfnet



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