Best practices for learning analytics initiatives in higher education

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This article aims to summarise international best practices for implementing a learning analytics (LA) strategy in a higher education institution (HEI). Universities have always collected data for reporting purposes. LA collects data while students are learning, enabling targeted interventions with potentially at-risk individuals or students with the ability to excel. LA has been made possible by the widespread use of technology, particularly learning management systems (LMSs) that enable the electronic collection of data. Such data can be combined with more traditional sources of data, such as student demographics or academic success plus qualitative information to produce analyses for decision making.

Recommendations

- Evaluate the current institutional readiness using available institutional readiness instruments to ensure that any solution chosen suits the context.
- Initiate LA at institutional level only if the institution is ready to make the investment and commitment (Bichsel 2012).
- Follow a specific project-orientated pathway. Identify an all-inclusive stakeholder team, set the objectives and determine where to begin through consultation (Diaz and Fowler 2012).
- Institutions should not only focus on tools and systems, but also on the expertise (analysts), process and policies. Invest in people and not only in technology, but plan for infrastructure that supports analytics across the institution (Bichsel 2012).
- Consider current policies to address ethical issues in learning analytics and challenges in context-dependent and appropriate ways (Prinsloo and Slade 2014; Prinsloo and Rowe, this volume).

Definition

Learning analytics is recognised as an emerging field, but one that will dominate higher education in the foreseeable future. Various efforts have been made to provide a distinctive definition.

A publication from the Educause Learning Initiative (ELI) (Barneveld et al. 2012) suggests that, as a new field, a variety of terms are adopted to describe concepts and processes linked to LA in education. This is the reason why the ELI paper (Barneveld et al. 2012) proposes that analytics should be viewed as 'an overarching concept', and defined LA as 'the use of analytic techniques to help target instructional, curricular and support resources to support the achievement of specific learning goals'. This definition must be read within the proposed ELI conceptual framework for positioning analytics within the education domain, to understand the varied and overlapping definitions of analytics in this domain. The scope of this article does not allow a detailed explanation of concepts such as business, academic, learning and predictive analytics, but it is important to note that each has its own level of focus. A table that contains an overview of the conceptual and functional definitions of the various types of analytics applicable to education is available in an ELI report entitled *Building organisational capacity for analytics* (Norris and Baer 2013), and will provide an overview of each type of analytics level of focus. There is a close link, according to Barneveld et al. (2012), between the Scholarship of Teaching and Learning (SoTL) and analytics, as LA can supplement the established theory and practice of SoTL. Therefore they have the opportunity to inform each other.

A Joint Information Systems Committee (JISC) publication (Cooper 2012) notes that any attempt to provide a detailed definition will be difficult as there are different perspectives or commercial motivations to emphasise a particular focus area or nuance. JISC focuses on the concept of 'actionable insights' as a substitute for decision making as an outcome of analytics (Cooper 2012). JISC's emphasis on actionable insights points to the essential characteristics of analytics, which are more about a personal and organisational perspective of how data can be used within the context of the HEI to yield benefits. The JISC views analytics as something people do. Its description of analytics is therefore as follows: 'Analytics is the process of developing actionable insights through problem definition and the application of statistical models and analysis against existing and/or simulated future data'.

The Society of Learning Analytics Research (SoLAR) (Siemens et al. 2011) divides analytics within the education sector into two categories: learning and academic analytics. The definition for LA as defined by SoLAR is often quoted in publications. SoLAR (Siemens et al. 2011) defines LA as follows:

> Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs. Learning analytics is largely concerned with improving learner success.

Discussion and analysis

Learning is associated with interactions between students, facilitators and the applicable content or subject matter. The effectiveness of the learning can be influenced by, among others, the course design and how the interactions meet the needs of the students to achieve personal goals and specific course outcomes. The success of any initiative to improve the course design or measure the success of the interactions was traditionally limited to the data that were available, such as the grades of the students at the completion of the course. The use of data available in educational technologies, such as LMSs, provides opportunities to improve teaching and learning through the use of LA. According to Greller and Drachsler (2012), the datasets available within an LMS offer opportunities for the implementation of early warning systems. This increases the importance of LA and that is why it is increasingly being recognised by governments, educators, funding agencies, research institutes and software providers.

The growth of interest in LA in higher education is also linked to the emergence of 'big data' in every industrial sector. 'Big data' is a phrase that describes structured, semi-structured and unstructured data available through the electronic traces that everyone leaves behind when working online. It is characterised by volume, velocity and variety. Norris and Baer (2013) indicate that analytics and big data offer the potential to identify promising practices, effective and efficient models, and powerful innovations to sustain higher education for the future. The use of data and analytics to produce new insights based on in-depth analysis of data has provided new opportunities for higher education. LA may improve education and specifically higher education as it provides lecturers, students and decision makers with actionable insight into classroom activities, both face-to-face and online, as well as into the impact of course design on student success (Siemens et al. 2011).

Learning analytics:

- reduces attrition through early detection of at-risk students and generating alerts for learners and educators;
- personalises and adapts learning process and content, ensuring that each learner receives resources and teaching that reflect their current knowledge state;
- extends and enhances learner achievement, motivation and confidence by providing learners with timely information about their performance and that of their peers, as well as providing suggestions on activities and content that address identified knowledge gaps; and
- makes better use of teacher time and effort by providing information on which students need additional help, which students are candidates for mentoring others, and which teaching practices are making the biggest impact (Siemens et al. 2011).

Additional benefits also include the impact on the curriculum development process. Higher-quality learning design and improved curriculum development processes through the use of data generated during real-time instruction and learning activities contribute to the cycle of curriculum improvement. The data available through interactive visualisations give students and educators the ability to 'zoom in' or 'zoom out' on data sets, depending on the needs of a specific teaching or learning context. Access to benchmarking tools helps students to evaluate their progress and determine which activities are producing the best results (Siemens et al. 2011).

With the hype focusing on big data and analytics, the tendency may be to focus on the software available in the market. Organisational capacity-building for analytics will only succeed if it is linked to a structured implementation of a major change management programme at all levels within the institution. Norris and Baer (2013) indicate that the selection of the correct software is not sufficient to achieve student success goals. They state that:

> The truly strategic issue facing higher education today is not just the availability of particular tools, applications and solutions: It is the ability of individual institutions and the higher education industry as a whole to deploy/acquire in a purposeful and continuous manner the full set of organisational capacity and behaviours needed to optimise student success.

An ELI report, focusing on organisational capacity-building (Norris and Baer 2013) specifies a combination of the following five factors that leading institutions have used to optimise student success:

- Technology infrastructure, tools and applications (IT intensity and ease of data capture, plus data availability)
- Policies, processes and practices (data-driven mindset incorporated in processes)
- Skills of faculty, staff, students and other stakeholders (talent)
- The culture and behaviours (data-driven mindset)
- Leadership at the institutional level (talent and mindset)

In order to understand the impact of leadership in organisational capacity, Norris and Baer (2013) propose three levels of student success analytics. These levels are as follows:

- Level 1: Static reporting
- The leadership focus is on data and reporting
- Level 2: Dynamic analysis and intervention
- The leadership focus is on supporting evidence-based decision making
- Level 3: Optimisation

Strong, committed leadership makes analytics a strategic imperative for the institution

According to Crow (2012), an example of institutional success is Arizona State University. The president made analytics a central component in a university-wide change to focus on improving student performance and retention, while also ensuring that the needed support is provided. The University launched newer academic departments and programmes to support the institutional strategy.

Greller and Drachsler (2012) developed a framework that includes six critical dimensions related to an LA initiative. Each of the dimensions must be addressed in order to institutionalise an LA initiative successfully. Figure 1 illustrates the framework.

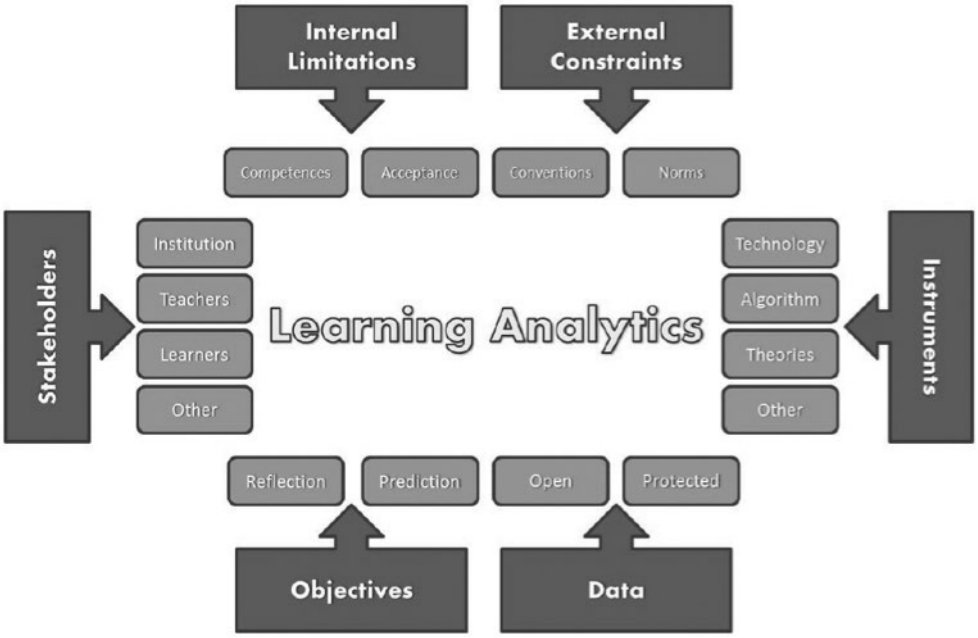

Figure 1: Critical dimensions of learning analytics (Greller and Drachsler 2012:44)

The growth of interest in LA within higher education can also be linked to the substantial strides made by solution providers. Norris and Baer (2013) provide the following insights about solution provider offerings and strategies, based on their recent research:

- New functionalities, applications, solutions and consulting services are available from enterprise resource planning (ERP) and LMS solution providers that offer student success/retention solutions.
- New firms offering student success/retention solutions are gaining traction in the market. ERP and LMS providers are also marketing student success/retention solutions.
- New vendors with an analytics focus have emerged in many categories.
- Acquisitions and consolidations have continued, such as Blackboard, which acquired iStrategy and embedded its pre-packaged analytics applications into an expanded Blackboard Learn offering that can extract data from major ERP systems and the Blackboard LMS. SunGard signed a memorandum of understanding with the Purdue Research Foundation to continue to develop the Course Signals product from Purdue. SunGard and Datatel consolidated into Ellucian. This will also have implications for the marketplace.
- New LMS alternatives with embedded analytics are proliferating, both as open-source software and in the cloud, such as Instructure/Canvas, LoudCloud, Moodlerooms and others.
- Consulting services are becoming a more significant component of analytics offerings for many vendors, and these services go beyond implementation to focus on know-how in leveraging analytics solutions to advance retention and student success.
- A number of cloud-based analytics applications and services demonstrate the cloud's potential to leverage vendor infrastructure, solutions, processes, cross-sector linkages and know-how. Pearson/eCollege is achieving some especially interesting outcomes in this area, conducting analytics across its constellation of cloud-based clients.
- The need for improved visualisation, recognised by many vendors, is being incorporated in next-generation tools such as the IBM and Desire2Learn partnership.

Institutional leadership will continue to ask questions about solutions that deliver student-success solutions based on return-on-investment criteria. The number of solutions will not only increase, but will become more sophisticated and more robust as new analytics applications and solutions emerge (Norris and Baer 2013).

Case studies

In South Africa, there are few case studies to take note of as the field is new. The University of Pretoria is perhaps the most advanced in the field. It uses Blackboard Learn as its LMS and has licensed the Analytics for Learn product. Blackboard Learn already includes a Retention Centre that can deliver basic LA information for individual modules, and this is included in the licence. However, to look across modules and provide data and dashboards to a variety of stakeholders (students, lecturers, deans, faculty student advisors and the University's executive management), Analytics for Learn is a more powerful tool. The University of Pretoria piloted Analytics for Learn in 2013 and rolled it out in the Faculty of Economic and Management Sciences in 2014 to support its tracking and retention project: within six weeks of its launch, first-year students began to receive notices of not engaging sufficiently and information on whom to contact (tutors, advisors) or notices of congratulations on doing well and encouragement to keep it up. An area for improvement would be the inclusion of students' continuous assessment marks on the LMS as the current system involves data of number of times accessed, time spent on the LMS and tools used. In 2013, the University of Pretoria also launched the first South African Higher Education Learning Analytics event in collaboration with the Learning Analytics Summer Institute (LASI13) at Stanford, and followed this with an event linked to the Southern African Association for Institutional Research (SAAIR) conference in Pretoria and the Learning Analytics Summer Institute (LASI14) at Harvard. A number of workshops have subsequently been held across the country to introduce the concept to the leadership at other universities.

Norris (2011) provides a summary of first-generation LA systems within higher education. For-profit universities such as the University of Phoenix, Capella University and the American Public University System (APUS) were among the first institutions to adopt LA. The latter is an example of advanced implementation as it pulls data daily from an extensive data warehouse, compares it by using statistical measures and semantic analysis engines, and presents results in a visual format. The value of APUS lies not only in the daily ranking of the entire student body according to probable success with coursework, but also in the immediate interventions that are executed. The system costs millions of dollars to develop and costs millions to run annually, so it is perhaps not an approach to be emulated by South African universities.

An often-cited and large-scale LA success story is Purdue's Signals system, based on Blackboard Learn. In an Educause blog entry, Caulfield (2013) critically reflects on the Signals system and describes it as:

> a software product developed at Purdue University to increase student success through the use of analytics to alert faculty, students and staff to potential problems. Through using a formula that takes into account a variety of predictors and current behaviors (e.g. previous grade point average, attendance, running scores), Course Signals can help spot potential academic problems before traditional methods might. That formula labels student status in a given course according to a green-yellow-red scheme that clearly indicates whether students are in danger of the dreaded DWIF (dropping out, withdrawing, getting an incomplete, or failing).

Norris and Baer (2013) indicate that Purdue University estimates that it has improved retention in Signals courses by 20% and four-year degree completion rates by 4%. As the system is using data from Blackboard Learn, South African universities using Blackboard Learn could produce similar 'signals' for their students to help them take responsibility for improving their own success. LA does not have to be about what the university can do for its students in terms of interventions; it can be about promoting self-directed learning.

A traditional higher education institution, Rio Salado College in Arizona, implemented LA and predictive modeling (Norris 2011). Its software focuses on information such as log-in frequency, the pace of a student's work in the first eight days of class, and student involvement in discussion forums. While the Rio Salado College is not focusing on students' grades as an indicator of success, other systems, such as the Louisiana State University system, include grades as part of the analysis. The LA system of Louisiana State factors in grade data; where grades are high, but a student's participation is low, the software ignores the concern, sending out a caution only when both are low. This possibility also exists within Blackboard Analytics for Learn. Some universities are using predictive modeling to identify at-risk students; others use it as the basis for e-advising, and recommending courses to students on the basis of what they have already passed.

During the last two years, greater numbers of HEIs have started to pursue LA initiatives. In the USA, the University of Central Florida, the University of Wisconsin-Madison and the University of Maryland, Baltimore County have frequently been cited as examples of LA projects. These institutions are pursuing analytics in a range of ways, such as using built-in products from LMS vendors, third-party analytics products, in-house-developed solutions, or solutions offered as a service by another company or some combination of these four ways.

Key findings

Research in the USA, in particular, has led to some useful findings for anyone wanting to implement LA at a South African university:

- Analytics requires a culture of inquiry and it is a journey from data ownership to stewardship (Oblinger 2012).
- Analytics requires new skill sets (Oblinger 2012).
- A changed-leadership approach provides a framework to create a climate of transformative change (Diaz and Fowler 2012).

- Effective implementation of LA must be accompanied by a compelling vision, supported by a data and communication strategy, and an inclusive approach of all stakeholders (Daniel 2014; Diaz and Fowler 2012; Norris and Baer 2013; Crow 2012).
- Analytics programmes are most successful when they are viewed as an investment rather than an expense (Bichsel 2012).
- The involvement of information technology (IT) services departments in planning for data collection and use is deemed critical (Daniel 2014), but IT services should not govern LA (Diaz and Fowler 2012).

What one can glean from these findings is that we need executive leadership: an acknowledgement that LA is an investment that will yield gains in student success, expertise in analytics and the breaking down of silos of data to enable the integration of data.

Challenges

International research also points to some key challenges:

- Creating a culture within institutions to adapt processes and accept the importance of data implies adopting new processes and change management (Daniel 2014).
- Analytics implies additional costs on already constrained budgets within higher education (Daniel 2014).
- Data systems are seldom interoperable and a successful analytics implementation will rely not only on data integration, but also on quality of data (Daniel 2014).
- HEIs lack the availability of dedicated data management experts to produce needed datasets in a timely manner (Buerck and Mudigonda 2014).

South African universities have additional contextual challenges relating to backlogs in infrastructure on-campus and student access to computers and the internet off-campus. The integration of legacy student systems with new analytics software is also a challenge, even in well-resourced universities. One change in culture would be putting all continuous assessment marks into a central grade centre to allow for the tracking of student progress – many lecturers traditionally keep such marks on their own computers rather than entering them centrally. Finally, analytics expertise is a scarce skill in South Africa, so an increase in the production of data scientists is needed, not only for analytics in higher education, but also for the growing use of big data in business and government.

Acronyms and abbreviations

APUS	American Public University System
DWIF	Dropping out, withdrawing, getting an incomplete, or failing
ELI	Educause Learning Initiative
ERP	Enterprise resource planning
HEI	Higher education institution
IT	Information technology
JISC	Joint Information Systems Committee
LA	Learning analytics
LASI	Learning Analytics Summer Institute
LMS	Learning management system
SAAIR	South African Association for Institutional Research
SoLAR	Society of Learning Analytics Research
SoTL	Scholarship of Teaching and Learning

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Recommended reading/resources

JISC Cetis Analytics Series. Available at: http://publications.cetis.ac.uk/c/analytics.

Educause Library: Learning Analytics. Availability at: http://www.Educause.edu/library.

Journal of Analytics: Available at: http://learning-analytics.info/.