Analytics Series

Vol.1, No.8, Institutional Readiness for Analytics

By Stephen Powell (IEC) and Sheila MacNeill (CETIS)

Institutional Readiness for Analytics

Stephen Powell (IEC) and Sheila MacNeill (CETIS)

1. Introduction

This briefing paper is written for managers and early adopters in further and higher education who are thinking about how they can build capability in their institution to make better use of data that is held on their IT systems about the organisation and provision of the student experience. It will be of interest to institutions developing plans, those charged with the provision of analytical data, and administrators or academics who wish to use data to inform their decision making. The document identifies the capabilities that individuals and institutions need to initiate, execute, and act upon analytical intelligence.

For the purpose of this paper, the term Learning Analytics (LA) is used to cover these activities using the definition of:

> 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. (CETIS, 2012)

The proposition behind learning analytics is not new. In the school sector particularly, good teaching practice has long involved record keeping with pen and paper and the analysis and reflection on this data to inform courses of action, and more recently using technology. Similarly, in different ways, all higher education (HE) and further education (FE) institutions use data to inform their decision making in assessment boards and course committees. However, as institutions increasingly use technology to mediate, monitor, and describe teaching, learning and assessment through Virtual Learning Environments (VLEs) and other systems, it becomes possible to develop 'second generation' learning analytics. The large data sets being acquired are increasingly amenable to new techniques and tools that lower the technical and cost barrier of undertaking analytics. This allows institutions to experiment with data to gain insight, to improve the student learning experience and student outcomes, and identify improvements in efficiencies and effectiveness of provision.

Analytics can play a role across the lifecycle of courses and for students who study on them from planning and development, through to recruitment and admissions and in offering on-going support for learners. Different approaches are used to turn the data into information that can be understood and acted upon and include; online dashboards, traffic light warnings and visualisation through charts. (The CETIS Analytics for Learning and Teaching paper provides a comprehensive review of current practice and trends in learning analytics).

When introducing such approaches, there will, for some staff and students, be the need to develop their skills and digital literacy around handling and interpreting data. Data handling skills will become an increasingly important part of digital literacy skills required by both staff and students. Increased use of analytics more generally has already highlighted a skills shortage for data scientists[1]. Within the education sector, there is also a need for the development of new skill sets and team working approaches across teaching and administrative domains, to ensure that relevant actionable insights from data can be identified and acted upon in meaningful, measurable ways.

---

[1] Harvard Business Review http://hbr.org/2012/10/data-scientist-the-sexiest-job-of-the-21st-century/ar/1

There is a burgeoning use of analytics in institutions with a range of different audiences and purposes across the educational system. However, careful thought needs to be given as to what the purpose of analytics is; in other words what organisational business objectives are the analytics being applied to which could be a specific issue of concern or a broader strategic aim.

Possibilities include:

1. for individual learners to reflect on their achievements and patterns of behaviour in relation to others;
2. as predictors of students requiring extra support and attention;
3. to help teachers and support staff plan supporting interventions with individuals and groups;
4. for functional groups such as course teams seeking to improve current courses or develop new curriculum offerings; and
5. for institutional administrators taking decisions on matters such as marketing and recruitment or efficiency and effectiveness measures.

It is worth a note of caution that this kind of work is in its early stages and is attractive to stakeholders who may have very different motivations for undertaking analytics based projects and it is a good idea to surface and articulate these motivations early on. There is a moral dimension to education, and the needs of the individual learner may come into conflict with that of other stakeholder groups, such as managers and administrators.

Figure 1 illustrates three key institutional considerations when developing a learning analytics approach in an *analytics ready context*:

- provision of data - from different data sources that may be of variable quality, poorly integrated and not designed for accessibility and require the development of a data warehouse[2] triple store[3] approach. A good illustration of the importance of this stage is the Apple Maps debacle where either 'bad data, incomplete data, conflicting data, poor quality data, incorrectly formatted data[4]' has caused significant problems;
- interpretation and visualisation - working with practitioners to develop an understanding of how data held on systems can be used to inform the enterprise's activities and presenting information in an accessible and informative way and identification of additional data requirements; and
- actioning insights - processes by which practitioners and learners can turn insights into actions within their context.

Although each of these activities are distinctive, they should be considered as interrelated with each informing the work of the other in a process of experimentation leading to the development of practices and techniques that meet the needs of the organisation.   In many cases, individuals will undertake more than one of the activities and will be responsible for provisioning data, turning data into usable information and developing analytics practice through planning and control of

---

[2] Data uploaded from different operational systems to be used for reporting purposes. In HEI, this might include systems such as: the institutional VLE; student records; attendance monitoring; and library loans.

[3] Form of database that is very flexible in combining different data sources including those external to an organisation

[4] O'Reilly Radar 'Apple Maps' http://tinyurl.com/cahpx8r

data. In this paper, we will examine how these three areas have been developed in learning analytics projects in the Open University (OU) and the University of Bolton (UoB).
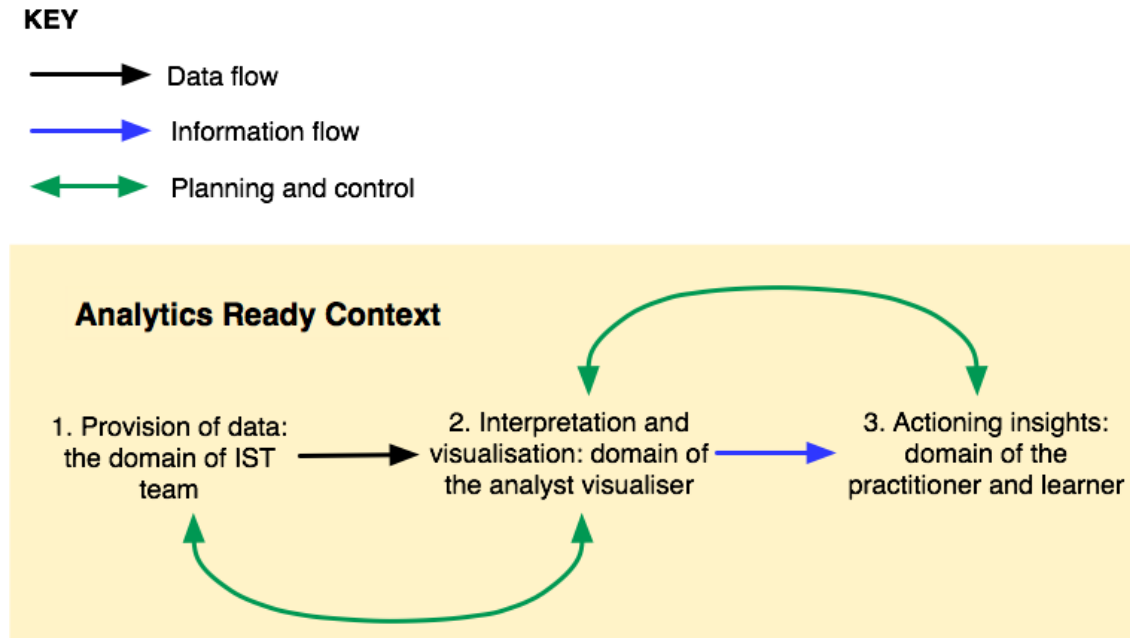
KEY

⟶ Data flow

⟶ Information flow

⟷ Planning and control

Analytics Ready Context

1. Provision of data: the domain of IST team ⟶ 2. Interpretation and visualisation: domain of the analyst visualiser ⟶ 3. Actioning insights: domain of the practitioner and learner

Figure 1. Three areas of analytics ready context

1.1   INTERPRETATION AND VISUALISATION

There is a continuum of provision of information, which at one end is very descriptive and factual; the kind of statistical information that has been provided for examination boards for many years. At the other end of the continuum more interpretation is required in combining different sources of data with different techniques and choices about how to display and visualise it. It is at this end that the OU have identified the need for a professional role of a 'Data Wrangler'. A Data Wrangler is someone who is comfortable handling statistics and manipulating data for visualisation and also capable of engaging with academics about the student experience and course design. It is their job to experiment with different tools to interpret, visualise and share information with academics as a basis for gaining actionable insights.

Two approaches are being explored; one building on the dashboard approach developed for executives, which provides the functionality to drill down to further detail and finer grained information through links. The second approach uses Tableau[5], which, allows users with different levels of technical expertise to analyse, visualise and share data from multiple sources. Currently, this is largely the domain of the Data Wrangler who creates a 'workbook' of relevant information that can then be

---

[5] Commercial business intelligence analytics and visualisation tool http://www.tableausoftware.com/

passed on. As experience is developed it is hoped that with some initial support end users will increasingly be able to use the tool to further analyse and customise views of the data.

2. Open University - Data 'Wrangler' Project

2.1 ANALYTICS READY CONTEXT

The Open University (OU) has around 250,000 students undertaking distance learning and supported by centres in the UK, Europe and with partnerships worldwide. The OU provides a valuable case study of an organisation that is, perhaps, due to its wholly distance based model, uniquely placed to take forward a learning analytics approach to inform its curriculum development and improve the student learning experience. The possibility for this comes from the range of data that is routinely collected, automatically through online systems, about what students are doing and what they think about their experience studying with the OU. When combined with other sources of data and information generated through the course design and development processes and on-going quality mechanisms, this provides a significant opportunities for applying analytics.

The OU also has the staff capability and capacity within the Institute for Educational Technology ([IET](#)) (which has a mission to develop innovative use of technology to support open and distance learning) to undertake action research approaches to investigating new ways of using this information/data. The impetus for development of this work this originates from a combination of bottom up ideas from IET staff and top down strategic priorities from senior administration staff, which provides a dynamic context for the adoption of learning analytics in the OU.

The OU 'Data Wrangler' project has identified opportunities to:

- facilitate more informed discussion about strategic direction and resource allocation for faculties;
- share good practice between course teams;
- use of previously generated data for analytics to inform the design process of courses from end to end; and
- identify what was really useful in the design process to know to enable informed decisions about what data you want to capture from students in the future.

2.2 PROVISION OF DATA

Data is collected in a range of different ways including students interactions with online systems as part of their learning (Moodle statistics) and through end of module surveys about their experiences and other more diverse sources such as learning delivery reports that describe a module in terms of its learning design including activities and assessments and data provided by routine administrative processes. A data warehouse is being used to bring together these different sources so that they can be interrogated in such a way as to readily combine different viewpoints of the same student experience.

2.3 ACTIONING INSIGHTS

To demonstrate impact, the Data Wrangler project needs the active 'buy in' of faculties and academics. As would be expected, some are more attuned to the ideas that sit behind learning analytics. An important issue recognised by the team, is capacity building across the university in order to be able to understand and respond appropriately to analytics provided. Capturing what is happening in a particular course for reuse and adaptation is seen as an important aim, although

understanding what happens within a particular context might not be as successful in a different context. Supporting people to reflect on the experience of different course teams is seen to have value, as has been proved in similar contexts e.g. sharing learning design practice.

Take up varies according to experience and capabilities. For example, people who are used to using e-data visualisation and manipulation tools are generally more comfortable in working with /discussing data. For people who find managing any quantity of data out of their comfort zone there is a need for more mediation, skills and literacy development.

Some specific examples of the use of analytics from the project are:

- for a particular course. Combined data about learners participation in online forums, pedagogical design intentions, and student feedback can shed light on questions such as how helpful asynchronous communication was to the students;
- for retention. Research has shown that it is a relative drop in activity (that is, a change in behaviour) is a better indicator of dropout rather than the amount of use of the VLE; and
- for a predictor of success. A 'vulnerability model' has been developed based on what is known about students before they embark upon study that can be a useful predictor of success.

Experience thus far is that the information provided to academics has been useful. In some cases they are not simply consuming but coming back with suggestions and ideas about what information they think might be valuable to them. There are, however, significant resource implications if the initial project is to be expanded. The team recognise the need to evaluate the impact of the work to inform decisions about whether this will grow into a significant on-going service or be more limited in scope and used primarily for internal research purposes.

An early lesson identified by the team is that;

> …something that sticks out, there's almost always an interesting story behind it. And people are usually already very much aware of what's going on there. But not always, and that's why the OU are also producing a series of reports for staff in each faculty. Over time, as wider understanding is developed around what is of most value to different user groups, a range of dashboards will be developed with the aim of a continuous process of lifting the baseline for everybody. Although it is tempting to want uniformity, this may not necessarily be advantageous and it is recognised that different approaches may suit different purposes and user groups.

Initial work has revealed significant interest from academics for more fine grained and up to date information from the VLE, that is real time statistics about what happens at a given time. This is very much work in progress, as there are a challenges in optimising real time data collection and maintaining stability of systems.

3. Analytics Ready Context

The University of Bolton (UoB) is a relative new and small university with a student body of around 14,000 and many of these being part-time students. The UoB is embarking on a project to provide early warning information to academic managers and personal tutors to enable them to better target efforts to support students who are thought to be at risk of disengaging from their studies. This activity is seen to be a university priority and as such has the support of the senior leadership team as well as the academic managers who are charged at faculty level with implementing the plan. The technical work is supported by the Information System Technology (IST) department; with existing staff, and the appointment of an intern with a business intelligence education to undertake analytics work.   Each faculty has identified an academic

manager as a project champion and a researcher has been identified to coordinate an action-research approach[6] to the development of personal tutoring strategies. This approach leads to an on-going refinement informed by the needs of personal tutors and academics in providing student support.

Key to this project is the embedded practice of keeping online attendance registers for all on campus classes that have a high degree of accuracy and completion rates. This has been achieved over the past two years through working with academic staff to develop awareness and embedding the working practices required. Online registers are kept in class using CELCAT attendance[7], which combines the institutional student information management system with timetables and registers and offers the functionality to readily produce reports on student attendance.

3.1 PROVISION OF DATA

A data warehouse has been developed to initially store key data from the online attendance register and selected information from student data management[8]. This approach is being used to remove the risk of multiples users accessing live systems for data and to allow for the combining of different sets of data about the student experience.

3.2 INTERPRETATION AND VISUALISATION

An information dashboard allows staff, through a series of web-links, to access more detailed information about a student's attendance, and previous and current educational performance. An algorithm is used to highlight students most at risk of leaving the university, initially based on a combination of their UCAS[9] points and attendance. As students career progresses, the UCAS data is replaced by data on their assessment outcomes in module examinations in an attempt to provide a more relevant snapshot of their likelihood of either leaving the university or performing poorly in assessments.

A weekly email summarises this data and is sent to relevant curriculum managers and personal tutors that flags students that are of concern using a traffic light system where red indicates urgent action is required.

3.3 ACTIONING INSIGHTS

The information provided to staff is at this stage, no more than a possible indicator as to which students may be struggling for whatever reason. As part of their role as personal tutors, staff are expected to contact students highlighted, to ascertain if there is a problem they are struggling with and if so to develop a remediation plan to help them get back on track.

This work is in its infancy and is the subject of an evaluation programme. Initial reports suggest that the personal tutors do find the information useful and there is now significant effort being directed to identifying effective 'triage' process that can be applied consistently across the university.

---

[6] An iterative approach to change that change based on planning, auctioning followed by evaluation and reflection

[7] CELCAT Timetabler Attendance register http://www.celcat.com/products/timetabler-attendance.aspx

[8] SITS: Vision http://www.tribalgroup.com/technology/sitsvision/Pages/default.aspx

[9] organisation responsible for managing applications to higher education courses in the UK

4. Proposed further work

It is proposed to undertake a further review of JISC funded projects through a learning analytics lens. In particular, projects funded out of the Relationship Management [10]programme have, potentially, much to offer to the sector.

5. Further reading

In the corporate world there is a more sophisticated understanding of the potential of analytics. We need only to think of household names like Amazon and Tesco to appreciate how the 'breadcrumb' trail of our online activities enable those organisations to develop an understanding of us as consumers so that they can tailor offers and seek to influence our behaviour and enhance our shopping experience.

For a significant enterprise analytics strategy, Analytics at Work, Smarter Decisions Better Results[11] (Davenport, et al. 2010), offers a practical five-stage transition model for each the DELTA success factors (p19):

- D for accessible, high-quality data;
- E for an enterprise orientation;
- L for analytical leadership;
- T for strategic targets; and
- A for analysts.

Although this may appear to be an ambitious approach for UK higher education institutions, it is a useful framework for planning a strategy. Davenport offers many case studies that illustrate what is possible in the corporate context.

Recommended papers from the CETIS Analytics Series, relating to the issues addressed here are:

- Analytics for the Whole Institution - Balancing Strategy and Tactics
- Professional Practice and Analytics
- Analytical Tools and Infrastructure

---

[10] http://jisc.cetis.ac.uk/support/relationship-management

[11] Davenport, Thomas H, Jeanne G Harris, and Robert Morison. 2010. Analytics at Work: Smarter Decisions, Better Results. Harvard Business School Press Books. Harvard Business Press.

Acknowledgements

About the Authors

Stephen Powell is a Reader in Inquiry-based Learning at the Institute for Educational Cybernetics (IEC). He has worked as an educator for the past 20 years, initially as a teacher in the compulsory school sector, and then in Higher Education as a developer of online programmes. He has a particular interest in the use of data to develop insights and then to take action to improve the student experience; focusing on curriculum design and delivery, through to the organisation of teaching and assessment.

Sheila MacNeill is an Assistant Director with CETIS.   Sheila's main areas of interest and work are around the user experience of using and implementing technology for teaching and learning. Currently much of her work involves supporting the curriculum design and delivery programmes, distributed learning environments and the implications and potential of analytics to support teaching and learning.

About this White Paper

About CETIS

CETIS are globally recognised as leading experts on interoperability and technology standards in learning, education and training. We work with our clients and partners to develop policy and strategy, providing impartial and independent advice on technology and standards. CETIS are active in the development and implementation of open standards and represent our clients in national, European and global standards bodies and industry consortia, and have been instrumental in developing and promoting the adoption of technology and standards for course advertising, open education resources, assessment, and student data management, opening new markets and creating opportunities for innovation.

For more information visit our website: http://jisc.cetis.ac.uk/

The Analytics Series has been produced by CETIS for JISC: http://www.jisc.ac.uk/