1. Executive overview

‘Activity data’ is the record of human actions in the online or physical world that can be captured by computer. The analysis of such data leading to ‘actionable insights’ is broadly known as ‘analytics’ and is part of the bigger picture of corporate business intelligence. In global settings (such as Facebook), this data can become extremely large over time – hence the nickname of ‘big data’ – and is therefore associated with storage and management approaches such as ‘data warehousing’.

This executive overview offers higher education decision-makers an introduction to the potential of activity data – what it is, how it can contribute to mission-critical objectives – and proposes how institutions may respond to the associated opportunities and challenges. These themes and recommendations are explored in further detail in the supporting advisory paper, which draws on six institutional cases studies as well as evidence and outputs from a range of Jisc-supported projects in activity data and business intelligence.

1.1 Should we care?

In 2010, The Economist published its ‘Special report on managing information: Data, data Everywhere’ [1].

In 2011, the McKinsey Global Institute published the landmark report ‘Big Data: The next frontier for innovation, competition and productivity’ [2].

In 2012, the US Department of Education focused the data debate on the learner experience in its ‘Enhancing Teaching and Learning Through Educational Data Mining and Learning Analytics’ report [3]. For the first time, in 2012, analytics featured in the ‘Top 10 Issues’ highlighted annually by IT leaders in US colleges and higher education [4].

Meanwhile a wide range of UK institutions and shared services have identified business benefits in analytics and activity data through project work in the Jisc Activity Data, Business Intelligence and Customer Relationship Management programmes.

Is this just another IT fad, driven by highly capitalised adventurers and global purveyors of online shopping and social media? Or is there something here that uniquely addresses real operational and strategic issues in the increasingly performance-driven and
The higher education sector is potentially in an advantageous position. A number of systems and services collect activity data, ranging from the virtual learning environment (VLE) and the library to help desks and security.

1.2 What is activity data?

- **Open University** – ‘Our authentication logs record between 35,000 and 500,000 e-resource accesses per day’
- **University of Huddersfield** – ‘We have collected over 3.9 million library circulation records over 15 years’

The collection and analysis of activity data is now regarded as vital to successful customer-facing businesses and has become an everyday aspect of customer experience. This is most visible in online settings where patterns of client activity make it possible for brands such as Amazon and iTunes to personalise services and to make recommendations. Meanwhile our supermarkets demonstrate the potential of a variety of data capture mechanisms to support core business processes. These include resourcing and stocking, as well as offering direct customer benefits underpinned by personal profiles captured through loyalty cards.

Detailed activity data also underpins analytics in human performance such as sport. The film Moneyball [5], superficially about the American love affair with baseball statistics, highlights the power of data and analysis in performance management and the search for telltale metrics that deliver ‘actionable insights’ to unpack the million dollar question, ‘What is the problem we need to solve?’ – which may not be the problem that the coach, or business analyst first thought of.

1.3 What’s in it for higher education?

- **University of Huddersfield** – If you do not use the library, you are over seven times more likely to drop out of your degree...7.19 to be precise.
- **Roehampton University** – The first year of the Early Warning System saw clean student progression to Year 2 Psychology rise from 71.8% to 85.5%.

The higher education sector is potentially in an advantageous position. A number of systems and services collect activity data, ranging from the virtual learning environment (VLE) and the library to help desks and security. However, to make sense of human activity, context is king. Thanks to detailed knowledge of each user’s context, such as that held in registration and learning systems (for example level of study, course or specialism, course module choices and even performance), institutions have a powerful basis to segment, analyse and exploit low level human activity data.

Consequently, activity data can enable an institution or a service to understand and support users more effectively and to manage resources more efficiently. The following examples illustrate direct benefits:

- **Student success [6].** Patterns of student behaviour (such as VLE use, library resource access, lecture attendance) may help identify students at risk of performing poorly or dropping out, thereby generating early warnings and enabling timely interventions to increase success. This is illustrated in case studies from Huddersfield and Roehampton universities
Learner experience. Using activity patterns to recommend resources of particular relevance in the individual’s context (taking account of course, unit and even physical location) will accord with student expectations of a quality online experience [7]; the same techniques can also benefit researchers. This is illustrated in case studies from the University of Huddersfield and the Open University.

Resource management. Analysing how resources are being used, managed and curated should enable library and learning resource services to budget more economically and to resource and purchase more effectively. This is illustrated in the case study from the University of Pennsylvania.

Activity data may also serve the institution and its clients more broadly, especially when combined with operational data from related systems:

User behaviour. Insights derived from activity patterns may lead to efficiencies ranging from optimisation of marketing campaigns to enhancement of campus services and IT workflows. Examples are found in a number of Jisc Customer Relationship Management and Activity Data projects.

Data mining. Exploratory collation and examination of data from multiple institutional systems and above-campus sources (such as UCAS) can aid discovery of new narratives and identify actionable insights. This is illustrated in case studies from Cornell, Michigan State and Roehampton universities.

1.4 Strategic institutional response

A group of institutional projects funded by Jisc in 2011 indicated the potential importance of activity data in learning and teaching, in supporting research and in resource management. They chime strongly with projects working in the broader area of institutional business intelligence. The underlying messages are increasingly clear:

Service directors are recommended to prioritise identification, collection and preservation of activity data. They should:

- Establish data governance. Central authority is required to clarify legal and ethical principles and to drive essential data compatibilities (based on indicators such as course).
- Activate collection. Data collection capabilities should be activated for existing systems.
- Harvest across systems. Making connections between activity data sources is a key consideration and merging data provokes fresh insights and cultivates new approaches.
- Include activity data in system requirements. New implementations should include accessible activity data logging and harmonisation of identifiers.
- Acquire skills. Key skills and practices need to be developed in new types of storage, data reconciliation, visualisation and, not least, business-led analysis.

However, experience in education and beyond indicates that efficient and effective exploitation of activity data requires institutional leaders to reconcile a range of local and tactical starting points with strategic development of the institutional analytics mission.

Exploitation of activity data to address immediate operational challenges is likely to differ from one area to another (from student retention to estates management to budgetary control) and the journey will necessarily involve data experimentation and incremental development of practice.
The projects’ findings cover areas ranging from learner success to service impact and resource utilisation, and from library recommendations to research dissemination.

<table>
<thead>
<tr>
<th>Key themes and Findings</th>
<th>Further information</th>
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<tbody>
<tr>
<td><strong>Expectation</strong></td>
<td>Users will increasingly expect services to be enhanced through the use of such intelligence</td>
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<td></td>
<td>Successful businesses will increasingly use activity data and analytical techniques, generating real-time feedback loops</td>
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<td><strong>Potential</strong></td>
<td>Most higher education business and educational processes are enabled by IT systems that already collect or could be collecting such data</td>
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<td></td>
<td>Previously anticipated inhibitors such as privacy and data protection can be appropriately addressed through clear governance</td>
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<td><strong>Strategy</strong></td>
<td>Act for the long term by establishing policies, consolidating systems of record, developing skills and activating data collection</td>
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<td></td>
<td>Recognise the low hanging fruit – minimal compute, easily understood applications relating to core business, such as student early warning systems</td>
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<td><strong>Coherence</strong></td>
<td>The starting points and cycles for exploiting activity data will vary in different areas of the business, so a single corporate business intelligence implementation is unlikely to be sufficient</td>
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<td></td>
<td>Focus on strategic direction that maximises common coding frames, and therefore the potential for data integration and reconciliation, is critical</td>
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<tr>
<td><strong>Urgency</strong></td>
<td>The intelligence to be gained increases as more data is accrued day by day and year on year, so collection should start now even if analysis is deferred</td>
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<td></td>
<td>The benefits of ‘learning from doing’ are at the heart of assimilating activity data and analytics more broadly for data integration and reconciliation, is critical</td>
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At the same time, the institution needs to learn from the local in order to develop the **enterprise-wide foundations** for efficient, effective and malleable data collection and analysis underpinned by responsible policy, data standardisation, reliable tools and professional skills.

Our case studies and institutional project experiences strongly suggest that institutions need to combine and cross-fertilise enterprise-wide and local (top down and bottom up) approaches in order to maximise the opportunities presented by analytics. As illustrated, this implies working towards a shared corporate approach, rather than imposing a single monolithic solution.

**2. Activity data: Delivering benefits from the data deluge**

**2.1 Context**

This section explores the issues raised in the executive overview in more detail, in particular the motivations, benefits and challenges of adopting activity data [14]. These are supported by case studies from six UK and US universities operating in a variety of settings. It considers what strategic problems or critical issues analytics can help address and therefore what might be the institution’s initial focus for analytics.

It also signposts guidance and exemplars of the strategies and skills required to realise the potential benefits in exploiting user activity data [15], which are:

» Internal efficiency and effectiveness of corporate business processes; assessment and prediction of returns on investment

» Outward-looking achievement of institutional mission; quality of services, particularly in learning and teaching; student experience and outcomes; wider business and community impact

Whilst principally addressing learning and teaching activity, including the use of libraries, learning resources and business intelligence from associated data governance, systems of record, common coding frames and data warehousing.

Our case studies and institutional project experiences strongly suggest that institutions need to combine and cross-fertilise enterprise-wide and local (top down and bottom up) approaches in order to maximise the opportunities presented by analytics.
systems, the guidance can be applied generally across a range of institutional systems.

Responsible exploitation of activity data is closely aligned with the mission of further and higher education. It can make a tangible contribution to both corporate and individual good, by enabling an institution or service to understand and support users more effectively and to manage resources more efficiently and responsively.

The timing is good for institutional take-up of these opportunities. Arguably, the business implications of doing nothing are unthinkable.

» Students will increasingly expect data to be used to their benefit, to enhance their learning experience and their chances of success

» Marketing and resource management and other financial imperatives demand highly responsive data-driven indicators

» Technologies, tools and practices have developed rapidly in response to consumer and social internet activity

» Whilst we should be wary of examples from global ‘web-scale’ online services, other sectors, ranging from retail to healthcare to sport, have demonstrated the business case for working with activity data.

2.2 The information explosion and the analysis gap

There is an exciting yet threatening intensification of the intelligence potentially available to businesses and institutions arising from digitally mediated interactions – in terms of volume ('big data'), variety (multiple connectable sources) and velocity (frequency of capture). The scale of opportunity challenges our ability to accumulate (store), to analyse (process) and to assimilate (present) using traditional means.

It is essential to determine how this ballooning dysfunction can be addressed not only to benefit higher education institutions but also to deliver the sort of personalised and responsive user experience that has become an expectation of life online.

2.3 Operational targets

Central to the mission and everyday business of post-compulsory education, there is clear potential for analytics in enabling managers to derive and act upon pre-emptive indicators and ‘actionable insights’ gained from activity data and associated analytics.

It is important to be grounded in the business of the institution, avoiding the temptation to focus on IT infrastructure as a means to get going with analytics. While tools are necessary, they are available in abundance and therefore represent a second order problem. The starting point is to ask questions about how analytics can improve efficiency or effectiveness. Consider three levels of practical impact:

Assessing Performance – efficiencies, economies and effectiveness:

» Student success and satisfaction

» Research productivity

» Staff performance management

» Alignment of enterprise resources with mission and customer interests
Monitoring other indicators such as brand recognition and reputation

Informing audience segmentation and targeting:

- Pricing and other value offers
- Applications processing
- Course design
- Learning style
- Personal interventions to support students, researchers and staff

Identifying trends and business models:

- Student marketplace
- Research landscape
- Resources procurement
- New products and services

Of course, these groupings should not be regarded as silos. Activity data accumulated in one context may be used to inform decisions and interventions elsewhere. For example, student indicators that provide early warning ‘signals’ could also inform choices (right course, level, study mode, learning style), potentially adding value to applications and offer processes.

Early targets for analytics leading to tangible benefits might involve:

- Student lifecycle, especially retention and achievement
- Personalisation of learning services, including resource recommenders
- Library and resource management
- Operational, specialist and personal IT – availability, performance
- Marketing and surveys – satisfaction, reputation
- Campus services improvement, notably retail and catering

### 2.4 Analytics involves everyone

Consultation undertaken by EDUCAUSE in developing its analytics maturity model has confirmed that an effective analytics implementation requires the buy-in, skills and ongoing attention of a significant cross-section of the higher education workforce. Our illustration, based on potential criterion statements in the EDUCAUSE model, highlights the range of actors engaged in maximising the opportunity – senior leaders, administration, faculty, IT professionals and business/domain experts. Not least, it will be essential that students and researchers recognise, as they may habitually do in social networks and online purchasing, that the institutional practice benefits them.

Our Open University case study illustrates something of the range of interest and ownership that might typically become associated with the potential of activity data. The Recommendations Improve the Search Experience (RISE) project originated in the library and consulted with learners to establish the value of the available activity data as the basis for a resource recommendation service. RISE also engaged with corporate developments led by the pro-vice chancellor for teaching and learning, as well as offering value to the library itself in informing resource management.

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**The Open University – enhancing the student experience**

The quality of the student learning experience has never been more important. Therefore the Open University wanted to understand whether activity data generated by over 100,000 unique users of online resources each year could be used to provide useful recommendations along the lines of ‘students on my course are...’
It is evident that different business functions may require differing approaches to analytics, especially in the cycles of data collection, analysis and enactment. It is important to understand the interactions and feedback loops required to support different aspects of a business.

looking at these resources’. The vital starting point and catalyst for analytical thinking was to evaluate the readily available activity data as the key to being able to draw in contextual data from other local and sector sources.

The RISE project has helped to identify how data from the library plays into the world of institutional data warehousing, business intelligence and learning analytics. This development also illustrates the potential of using activity data in a way that goes beyond its use as a business intelligence tool and contributes to an enhanced learner experience by providing real time personalised feedback.

However, we should not be put off by the potential breadth and depth of such undertakings. Implementations can initially be bounded by business unit or domain (for example, resource efficiency in the library, student retention in a particular faculty), as illustrated in our Roehampton University case study.

2.5 One size fits all?

It is evident that different business functions may require differing approaches to analytics, especially in the cycles of data collection, analysis and enactment. It is important to understand the interactions and feedback loops required to support different aspects of a business.

This is as true in higher education as it is in any consumer-facing service. Currently progress in learning analytics and early warning indicators appears particularly encouraging. A recent EDUCAUSE statement suggests that ‘the strategic value of analytics includes improved institutional productivity, decision-making, and learner success. While better decision-making about campus operations is an important aspect of analytics, its potential to support students is of paramount interest’.

As highlighted in our case study from Michigan State University, learners are likely to benefit from (and to expect) close to ‘real time’ feedback. This might take the form of timely guidance or automated just-in-time resource recommendations (eg ‘Students on your course who accessed this e-resource also accessed that’).
Contrastingly, finance teams may require data and analysis on a periodic basis (e.g., daily, weekly, monthly, depending on function).

**Michigan State University – shaping up for real time analytics**

The key to the institutional analytics mission is quality of data. You cannot derive valid actionable insights if the data are unreliable. Our emphasis is therefore on establishing ‘systems of record’ that ensure that key shared data items used by many different systems – such as names and addresses – are entered and managed in one place.

To date, we have been principally focused on developing sound analytics capabilities around finance and human resources systems. However, we are attentive to a new wave of developments in the area of learning support, focusing ‘in time’ personalised support at the point of need. We need to remember, however, that developing a set of useful learning analytics tools isn’t enough. To be truly effective they need to be embedded in effective overall pedagogic designs, along with having effective means of intervention when students are discovered to be struggling. Furthermore, it is essential that students perceive this greater degree of active measurement of their work as helpful and not as an invasion of their privacy.

Doug Clow of the Open University illustrates such business differences in speed (velocity) and scale (volume) in his feedback model.

It is therefore essential that analytics strategies should recognise these varying cycles, cadences and business motivations, whilst they may ultimately seek integration of a large variety of data.

### 2.6 Analytics is a journey

The value of institutional strategy and centralised underpinnings of standardisation across data sources is emphasised in our Cornell and Michigan State University case studies. Nevertheless, the realisation of benefits from analytics is necessarily incremental and iterative and is unlikely to be a straight line from a perceived problem to an evidence-led solution – just like any research process.

This is illustrated in the iterative cycle from ‘mission’ to ‘enactment’. That cycle should be expected to generate new insights into the narratives and benefits that might be derived from the accumulation of data – thus leading to a refinement or expansion of the analytics mission.

As highlighted in our case study from Michigan State University, learners are likely to benefit from (and to expect) close to ‘real time’ feedback.
The origins and the outcomes of analytics are the most important: determining the strategic questions to which data can be applied and using the results to make improvements.

Susan Grajek, Vice President, EDUCAUSE

For example, the University of Huddersfield started its activity data journey with a library-centred mission relating to resource utilisation and recommendation – beneficial in themselves, however, the data narrative unfolded to identify the potential for the same data to provide early warning indicators of student achievement.

Cornell University – setting the records straight

Determining the place to start with embedding analytics in corporate practice is a key issue for any institution, raising challenges relating to governance, coordination and culture. In order to catalyse our institutional requirement to develop analytics capabilities, we set ourselves the target for 2012–2013 of refining existing administrative and financial dashboards to better meet the needs of our trustees. This has allowed us to take some mission critical steps that will benefit our subsequent development of analytics in other areas – to identify systems and data elements of record, to engage data owners as stewards and co-contributors and to agree data governance principles.

Learning analytics do not yet represent such an immediate priority, partially on account of the tradition and style of the institution. However, that situation is changing rapidly as new generations of students come through and there is little doubt that expectations about feedback will be changing.

We are only at the beginning of a journey towards mutual understanding of our data and embedding analytics in institutional practice. However we’re confident that our starting point will create a solid foundation. We’re also clear that the journey is essential.

2.7 Tools for the journey

We have reflected little about technology in this advisory paper. This space has historically suffered from conflating the benefits of analytics with the implementation of enterprise-scale data warehousing solutions or some other technology panacea. There is no doubt that data organisation, accumulation and preservation to meet unpredictable objectives is an important focus of analytics that is well served by enterprise scale data platforms. However, a consistent theme of this paper is that ‘for the journey’ there are a variety of starting points and means of getting there.

» Familiar desktop applications.

Because related skills are highly developed and the tools are widely licensed, there is a tendency to shoehorn storage, analysis and presentation in to desktop tools, notably spreadsheets. These may represent a realistic starting point for early investigations but run out of steam at scale. The challenge is to know when to facilitate change to more appropriate platforms, as illustrated in the University of Pennsylvania Libraries case study

» Open source tools. The IT community has spawned a wide range of open source and low cost tools that are particularly suited to the type and scale of activity data
(for example NoSQL databases, indexing engines and visualisation processors). Furthermore some tools, such as Google Refine, have a low entry threshold. Such tools will be popular amongst the technically adept for developing agile experimental approaches, which are very valuable in this space. The challenge will be ensuring the necessary standardisation of data formats and coding frames to ensure long term value above and beyond the originating application

» **Vertical product extensions.**

Education takes advantage of some substantial vertical applications in areas including financials, admissions, course management and libraries. In most cases, the vendors are keen to demonstrate analytical opportunities by introducing new features or integrating partner applications within their particular application ‘silo’. This is a notable tendency in the VLE market. The challenge is to weigh the benefit of such ‘off the shelf’ solutions against the likelihood that key indicators will be derived by combining data from multiple systems, as illustrated in the Huddersfield, Pennsylvania and Roehampton university case studies.

» **Above-campus services.** Significant activity data and wider analytics datasets are being compiled above-campus – by shared services (for example, the Journal Usage Statistics Portal or the OpenURL Router), by sector-related agencies (notably the Higher Education Statistics Agency and UCAS) and also by central and local government (such as demographic and employment data). Each source will present its own challenges in terms of data licensing, data protection and technical integration. It is therefore important that institutions work together through networks such as the Universities and Colleges Information Systems Association (UCISA) to access these datasets for local analytical purposes and to develop any technical tools on a once-for-all basis.

» **Enterprise Solutions.** Finally there is the range of enterprise level business intelligence products available from suppliers such as IBM and Oracle. These include data warehouse and archiving solutions, geared for tight integration into enterprise architecture, plus dashboard products for providing the necessary variety of reporting views. Such products are likely to be expected by managers and practitioners in areas such as finance. However, there is real danger that the institutional strategy is driven by such implementations. Strong governance of the analytics mission is therefore required to balance the pressures for long term enterprise solutions with the potential benefits of local innovation.

The development of Metridoc has been a direct response of the University of Pennsylvania libraries team to diversity of data sources and of analytical purposes, balancing flexibility with sustainability. Metridoc is a software framework for ingesting activity data from multiple sources and transforming it in compatible formats that can feed standard reporting and visualisation tools. It takes the burden away from local transaction systems (such as library, course and student management) whilst offering considerable flexibility for experimentation.
University of Pennsylvania – implementing scalable and sustainable processes

Metridoc has been developed by Penn Libraries to provide an extensible framework that supports library assessment and analytics, using a wide variety of activity data collected from heterogeneous sources. The framework supports the integration of activity data across audiences, systems and services with the potential to act as an ingestion and data curation engine for activity metrics anywhere in the institution. Data points are currently derived from fund accounting systems, discovery tool logs, publisher reports and authentication logs. These are only the beginning of potential targets, which Penn is gradually expanding, guided by management and planning needs.

This approach eases the burden of generating business intelligence by providing scalable and sustainable aggregation processes and a normalised data repository. The approach isolates extraction, transformation and repository services from the functions of specialist IT systems. This architecture reduces the cost and complexity of start up, and also allows for creation of new data collectors with manageable technical effort.

2.8 Balancing approaches

There are tensions between different approaches to collecting, connecting and analysing activity data (or any other analytics data sources) [16]. These might be broadly described as ‘top down’ and ‘bottom up’.

Typical positions are caricatured in our illustration – the adventurer [collect the data together and, using readily available tools, let it tell its stories], the action type [act now to leverage existing activity data to address priority issues such as student retention] and the forest guide [data can play tricks and waste time, so start by rigorously identifying significant indicators].

The nature of the opportunity suggests that a higher education business should seek to harness all these types and their approaches – perhaps creating an analytics ‘black belt team’ that can seize an immediate opportunity (e.g. student library experience), using it to validate the significant indicators (library turnstiles tell us nothing) and to look for other hidden narratives (early warnings of student success).
If we are serious about analytics we need to be thinking about both exploratory data analysis and confirmatory data analysis.’

Adam Cooper, CETIS

Our case studies from Huddersfield, Roehampton and the Open University reflect a fruitful dynamic tension between answering known questions and discovering new narratives, Bottom-up data narratives draw on the potential for data capture rather than being driven down from established KPIs. Narrative ‘connectors’ will include student and staff cards/ institutional IDs, places, IP addresses and times.

Furthermore, as discovered by both Huddersfield and Roehampton universities in the case of library turnstile data, it is only through experimental collection and statistical analysis of a range of possible indicators that we can establish those of genuine significance [17] and thereafter refine our data collection strategies.

The University of Huddersfield have been bold explorers and have engaged six other universities in that approach in the library impact data project. Their ideas were developed from investigating the narratives waiting to be disclosed by over ten years of library circulation data. This catalysed not only new approaches to the student resource discovery experience but also insights into possible indicators of student success, as the potential of the data revealed itself.

A basket of indicators highlighted that Huddersfield students who do not use the library are more than seven times more likely to drop out of their degree...7.19 times to be precise.

University of Huddersfield – exploiting library impact data

The library impact data project (LIDP) tested the hypothesis that ‘there is a statistically significant correlation across a number of universities between library activity data and student attainment’. The project used the student’s final grade, course title and variables relating to library usage: books borrowed, library e-resources access and entry to the library. At the
end of the project the hypothesis was successfully supported for e-resources and books borrowed for all eight institutional partners.

The second phase of the project investigated possible causal aspects. We can now say that, based on those dropping out in the third term of study, if students do not use e-resources they are over seven times more likely to drop out of their degree. Although we cannot say that non-usage causes students to drop out, it could be used as an early warning system. If students are not using the library’s e-resources, it is likely to be worth checking to make sure all is well. These data could be exploited to concentrate staff resources at points of need, and to examine whether students from different backgrounds have different needs when it comes to library and learning content services.

Roehampton University was driven by an urgent requirement for action, for mechanisms to address the specific challenges of low student retention and progression as highlighted in psychology undergraduate programmes.

The university’s response was to trial an early warning system with a view to identifying and refining advance indicators. The first year of operation saw clean student progression to Year 2 Psychology rise from 71.8% to 85.5%.

Subsequent developments under the Jisc Customer Relationship Management programme helped the university to take on key lessons about developing economic and effective analytics capabilities – especially about the structural issues of leveraging data across systems. Informed decisions about what sources provide a relevant and sufficient set of data for analytics purposes are crucial. Meanwhile, the benefits of these early efforts to cohere data about student activity are clear and therefore the student performance system is being deployed for the start of academic year 2012–2013.

2.9 Measuring progress

We have presented the adoption of analytics as an iterative process where questions and analysis not only lead to enactment and but also open up possibilities for refinement and reveal new insights. We have also recognised that this demands an organisational culture based on clear governance and shared data standards, whilst encouraging local innovation and initiative. We might describe these requisite factors in terms of readiness or maturity.
In developing assessment criteria for an analytics maturity model, EDUCAUSE has identified factors impacting and indicating organisational progress. The key factors are summarised in the table below:

This type of framework provides a useful checklist for assessing progress and setting targets. Such vigilance and self-assessment is especially important for the analytics mission, which is necessarily complex and malleable simply because it seeks to dig deeper than previously possible into the composition of the organisation and its processes and into the behaviours of its ecosystem.

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<thead>
<tr>
<th>Factor</th>
<th>Measure of maturity</th>
<th>Challenges</th>
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<tbody>
<tr>
<td>Culture</td>
<td>Buy-in and understanding is required across the range of faculty, service and management levels</td>
<td>What are the cultural issues around buy-in and adoption of analytics?</td>
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<tr>
<td>Governance</td>
<td>Clear data policies and responsibilities will ensure legal and ethical obligations are fulfilled</td>
<td>What institutional policies need to be updated or put in place in response to analytics initiatives?</td>
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<tr>
<td>Process</td>
<td>Process must support identification of target outcomes, moving from what the data says to making decisions and enacting change</td>
<td>What are the barriers to evidence-based decision making?</td>
</tr>
<tr>
<td>Data</td>
<td>The outputs can only be as good as the data so the right data needs to be captured in a clean and consistent form</td>
<td>What needs to be done locally and/or centrally to ensure data can be exploited to address real business challenges?</td>
</tr>
<tr>
<td>Infrastructure and tools</td>
<td>Capability and capacity is required for storage, processing, analysis, reporting and visualisation</td>
<td>Are there barriers in terms of availability of or access to the necessary hardware and software?</td>
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<tr>
<td>Expertise</td>
<td>Staff development must compensate for the shortages of professional analysts across all industries expected to continue for some years</td>
<td>What are the existing technical and business capabilities (central and local) and what is the role of the IT service in analytics?</td>
</tr>
<tr>
<td>Investment</td>
<td>The critical enabling investment will be in practical business-facing initiatives underpinned by clear governance and skills development</td>
<td>How is analytics investment approved and appraised? Does the process enable development of local/central synergies?</td>
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</table>

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In developing assessment criteria for an analytics maturity model, EDUCAUSE has identified factors impacting and indicating organisational progress.

Further information and resources


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