Complexity Leadership in Learning Analytics: Drivers, Challenges, and Opportunities

Abstract
Learning analytics (LA) has demonstrated great potential in improving teaching quality, learning experience, and administrative efficiency. However, the adoption of LA in higher education is often beset by challenges in areas such as resources, stakeholder buy-in, ethics and privacy. Addressing these challenges in a complex system requires agile leadership that is responsive to pressures in the environment and capable of managing conflicts. This paper examines LA adoption processes among 21 UK higher education institutions using complexity leadership theory as a framework. The data was collected from 23 interviews with institutional leaders and subsequently analysed using a thematic coding scheme. The results showed a number of prominent challenges associated with LA deployment, which lie in the inherent tensions between innovation and operation. These challenges require a new form of leadership to create and nurture an adaptive space in which innovations are supported and ultimately transformed into the mainstream operation of an institution. This paper argues that a complexity leadership model enables higher education to shift towards more fluid and dynamic approaches for LA adoption, thus ensuring its scalability and sustainability.

Structured practitioner notes

What is already known about this topic
- Prominent challenges of learning analytics adoption include the need for financial, human, and infrastructure resources, ethics and privacy policies, and buy-in from stakeholders across the university.
- Learning analytics adoption models acknowledge social factors in a complex adaptive system.
- Complexity leadership theory describes entrepreneurial, operational, and enabling leadership behaviours that enable organisations to learn to adapt.

What this paper adds
- Presents the dynamic relationships of a complexity leadership model in the adoption of learning analytics among 21 UK higher education institutions.
- Demonstrates the tensions between innovation and operation pertaining to learning analytics activities.
- Illustrates activities that manifest enabling leadership in addressing challenges associated with learning analytics adoption.

Implications for practice and/or policy
- The inherent tensions between innovation and operation lead to challenges that impede LA adoption. The success of LA depends on a strategic engagement with the tensions through resource allocation and network bridging.
- Policy process provides opportunities to address tensions between 'exploring' what is possible with data and 'exploiting' what is feasible with data.
- The use of existing LA adoption models needs to consider the dynamic interactions among entrepreneurial, operational, and enabling leadership.

Introduction

The uptake of technologies to support learning, teaching, and administrative activities has enabled access to new sets of learner related data, leading to the emergence of learning analytics (LA). LA is broadly defined as 'the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs' (Long, Siemens, Conole, & Gašević, 2011). The potential of LA to bring insights into factors that influence student behaviours and performance with real-time data (Gašević, Dawson, & Siemens, 2015) has motivated increasing investments in LA technologies among higher education institutions (HEIs), which are constantly under the pressure to improve teaching quality, learning experience, and administrative efficiency (Ferguson, 2012). In the UK, similar drivers have been identified as the higher education sector faces tensions introduced by funding cuts, institutional quality metrics (e.g., teaching quality, learning environment, student outcome and learning gain, student satisfaction, graduate employment, and international reputation), the marketisation of higher education (especially in England), and Brexit upheavals (Universities UK, 2018). Although, LA is frequently noted as an area of strategic interest for higher education (HE) in the UK (Higher Education Commission, 2016; QAA Scotland, 2018) and elsewhere in the world (EDUCAUSE, 2018), institutional adoption of LA is often beset by social, cultural and technical challenges. Prominent barriers to institutional adoption include (Tsai et al., 2018): 1) the demand on technological, financial, and human resources, 2) issues of ethics and privacy exacerbated by the tension between personalisation and data anonymisation, and 3) securing buy-in from a wide range of stakeholders within existing power structures and organisational culture. To date, adoption has mostly been constrained to basic levels of extraction and reporting of data, instead of prescribing personalised and timely support strategies that can aid teaching quality and improve student learning experiences (Colvin et al., 2015; Siemens, Dawson, & Lynch, 2013). Moreover, current practices of LA are yet to demonstrate the effectiveness of LA in improving learning, teaching, and education (Ferguson & Clow, 2017; Kitto, Shum, & Gibson, 2018; Tsai & Gašević, 2017). In view of the various tensions introduced by LA and building upon the work by Dawson et al. (2018), we argue for a model of leadership that can turn the dynamics of tensions into opportunities to scale up innovations of LA in HE and ensure its pedagogical and ethical soundness.

Complex systems, as previously contended by Uhl-Bien, Marion, and McKelvey (2007), require multi-dimensional leadership to enact changes and explore innovations, while maintaining its operational order. Following the line of complex theory, Uhl-Bien and colleagues (*ibid*.) proposed complexity leadership theory (CLT), which contends that complex systems require leadership that is dynamic, relational and frequently extends beyond the capabilities of a single individual. CLT has subsequently been used to explain the process of formal and emergent adoption of LA in higher education (Dawson et al., 2018). However, little has been done to explore LA adoption challenges and enabling strategies through the lens of CLT. In this paper, we explore the presence of complexity leadership model in activities related to LA deployment among 21 UK HEIs and identify tensions introduced by challenges that are commonly associated with LA. We argue that CLT enables higher education to shift towards more fluid and dynamic approaches for LA adoption, thus ensuring its scalability and sustainability. The paper contributes insights into research, policy and practice of LA deployment in a complex educational system.

Adopting learning analytics in a complex adaptive system
Dynamic adoption models

Early attempts in implementing LA were based on similar techniques applied in IT management. In this context, LA was predominantly considered a technical process (Colvin, Dawson, Wade, & Gašević, 2017). Although very few large-scale LA instantiations emerged, the learnings gained from these linear and prescriptive processes have since seen institutions employ more dynamic models that attempt to consider cultural as well as social-technical facets of LA (*ibid.*). For instance, Greller and Drachsler (2012) emphasised the 'soft issues' that are tied to social elements of individuals and institutional interests alongside the strategic motivations to implement LA. Siemens, Dawson, and Lynch (2013) stressed that any successful LA adoption must consider the technical, cultural, and social aspects that bring significant intertwined challenges. In light of this, Macfadyen et al. (2014) and Ferguson et al. (2014) proposed an iterative model to help formulate strategies and policies for LA adoption in higher education where institutional contexts constantly change and evolve – the Rapid Outcome Mapping Approach (ROMA). The authors adapted the original ROMA model proposed by Young and Mendizabal (2009) to highlight six inter-related dimensions after the initial goal setting process:

1) identifying drivers in the political context;
2) addressing the needs of relevant stakeholders;
3) identifying expected changes;
4) developing an engagement strategy;
5) assessing internal capacity to effect change; and
6) developing a monitoring framework for continuous learning.

ROMA has been further adapted and empirically tested in the context of LA via the SHEILA framework (Tsai et al., 2018). In contrast to the previous works, the SHEILA framework highlights the interaction and fluidity that occurs between the noted dimensions. Based on direct engagement with a wide range of stakeholders in European HEIs, the SHEILA framework expands on the ROMA model to include three core elements: 1) key action plans, 2) prominent challenges, and 3) considerations of policy development (Figure 1).
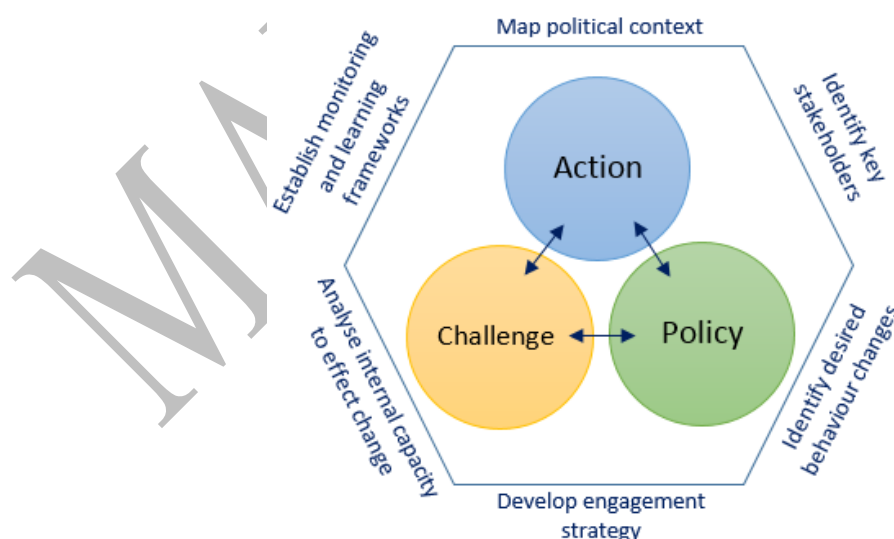

Figure 1. The SHEILA framework structure

The learnings from the evolution of various LA adoption models have made it clear that systematic adoption requires leadership that is capable of facilitating collaboration among different stakeholders, strategic planning towards the goals, policy development to govern data processes, and an adaptive culture to embrace and balance tension between

innovation and operation (Colvin et al., 2015; Ferguson et al., 2014; Tsai et al., 2018). Importantly, adoption models can only be effective when they have been fully integrated into institutional operations, grounded in educational practices, and aligned with the values upheld by HE (Biesta, 2010). The need for new forms of leadership emphasises the movement from tackling challenges with localised solutions to the development of a system change that acknowledges the complex nature of higher education. In the next section, we present a complexity leadership model to drive a system change for LA innovations.

Complexity leadership and LA deployment
Higher education institutions (HEIs) are complex adaptive systems (CAS) comprised of independent agents combining in diverse organisational relationships and networks. Given the dynamic and non-linear nature of such systems, scholars have argued that HEIs need change management that focuses on emergent, flexible, and adaptable change rather than on planned change (By, 2005; Dumas & Beinecke, 2018). That is to say, HEIs need to be prepared for unanticipated consequences of innovations internally and fast-changing environments externally. This is particularly pertinent to HEIs in the UK where funding policy and metrics of success have been noted to discourage innovation and risk-taking among HEIs (Norton & Carter, 2017); and where Brexit turmoil has worsen the situation further (Universities UK, 2018). Considering current changing environments, studies have suggested that leadership should move away from being hierarchical and leader-centred, to being participative, dispersed, and collective, so as to shift the attention from individual leaders to organisation processes (Bento, 2011; Dumas & Beinecke, 2018). Instead of convincing people to follow a visionary leader, institutions should seek innovations to address pertinent challenges by distributing power across sub-networks and support subordinates to take leading roles in their areas of influence.

Institutional adoption of LA involves multiple levels of stakeholders and the interwoven social, cultural, and technical issues are seldom straightforward. In light of this, Dawson et al. (2018) championed the use of CLT to navigate university deployment of LA. At the core of CLT is the argument that organisational tensions emerge between *the need to innovate* (the process of exploring new ideas and creating new knowledge to sustain future viability) and *the need to produce* (the process of exploiting existing knowledge and skills to produce results for current success). Given the divergence between these two needs, senior leaders are required to enable productive and adaptive spaces where emergent leaders (network influencers) can enact and drive the stability and change dynamics through a process of negotiation and innovation. In this context, leaders need to develop a level of organisational ambidexterity whereby the organisation balances the tensions between the need to innovate and the need to produce or maintain systems (Uhl-Bien & Arena, 2018). In practice, creating such adaptive spaces for negotiation involves openly engaging with conflicts and tensions so as to allow ideas and innovations to emerge and be scaled up to the operational system.

Complexity leadership was first proposed by Marion and Uhl-Bien (2002) who contended that leadership is the outcome of interdependent interactions in a complex network, according to complexity theory. Complexity leadership fosters connections among different agents in the network and moves the focus away from an influential leader to 'leadership behaviours' that need not be associated with managerial roles. A framework of complexity leadership theory (CLT) was later developed by Uhl-Bien, Marion, and McKelvey (2007), and updated recently by Uhl-Bien and Arena (2018) to highlight three components – *entrepreneurial leadership*, *operational leadership*, and *enabling leadership*. In this framework, entrepreneurial leaders emerge from processes related to the *need to innovate* and advance novel ideas that may be seen to be in conflict with operational

efficiencies. In contrast, operational leaders are in charge of efficiency and refinement of existing processes, related to *the need to produce.* The presence of entrepreneurial or operational leadership alone is insufficient for organisational adaptability. This is also the case if both of these leadership groups are present but fail to interact with one another. Conflicts and tensions are inevitable in the interactions between entrepreneurial and operational leadership, which often result in a dilemma between exploration and exploitation (March, 1991). Enabling leaders, therefore, are responsible for creating opportunities to unpack and resolve tensions in these interactions. Guided by clear organisational strategy (e.g., allocating resources and steering emergent solutions towards organisational priorities), enabling leadership helps connect new emergent solutions to the operational core, scaling innovations into the mainstream organisational practices.

It should be emphasised that the three types of leadership do not assume a hierarchical process, but rather refer to any agents that can drive entrepreneurial, operational, or enabling activities. CLT builds on distributed leadership models, which attribute equal importance to bottom-up and top-down leadership, also understood as 'emergent' and 'devolved' leadership, respectively (Bolden, Petrov, & Gosling, 2009). Importantly, CLT acknowledges the importance of supporting emergent leadership (bottom-up) as part of the process to build change readiness (By, 2005) by embracing varieties of expertise and perspectives found in individuals members across an institution (Bento, 2011). This is especially important for the implementation of LA in that its sustainability and scalability require collective inputs from ground-level teaching staff with their pedagogical expertise and from students who are in the best place to tell us what they need and what works for them (Dollinger & Lodge, 2018).

When it comes to LA deployment, it is important to note that the notion of LA and what it means to succeed may vary among different individuals due to their institutional roles and experiences. This often results in unmatched expectations of LA (Tsai & Gašević, 2017) and the difficulty to form a shared vision or produce systematic outcomes. In light of this, Siemens et al. (2018) highlight social coordination and feedback sensitivity as complexity principles that allows ideas and information to flow across multiple networks in an institution. These principles also make sure that an articulated vision is responsive to feedback from agents in an institutional system so as to improve its efficiency and intelligence. Although Siemens et al. (*ibid.*) outline a framework of principles based on complexity science to understand and manage change in higher education, it remains unclear how LA deployment can be managed using CLT. Existing research on the application of CLT in LA adoption is pioneered by Dawson et al. (2018) who mapped 32 Australian cases of LA adoption to two groups based on their adoption approaches – top-down or bottom-up. Based on the characteristics identified from each group, they recommended CLT as a strategic framework to balance the two approaches. Although Dawson et al. (2018) empirically connected what could be loosely described as entrepreneurial and operational leadership in LA adoption processes, their analytical lens did not focus on capturing enabling leadership or presenting the tensions between entrepreneurial and operational activities related to LA initiatives. In light of this gap, the current study specifically focuses on identifying these aspects and exploring how CLT may help address challenges associated with LA adoption. As explained earlier, CLT has evolved over the years. In this article, we adopt the framework recently updated by Uhl-Bien and Arena (2018).

Methodology

This work explores the presence of complexity leadership among UK HEIs related to the adoption of LA so as to identify systematic and sustainable solutions to the noted challenges associated with LA adoption. To this end, we analysed data collected from 23 interviews with institutional leaders from 21 universities between August 2016 and February 2017.

Convenience sampling (Tracy, 2013) was used to take advantage of the researcher's existing network in the UK. In addition, we sent invitations to all nineteen universities in Scotland. The final study sample is as follows: Scotland (9), England (10), Wales (1), and Northern Ireland (1). Among the institutions that participated in the study, 16 were implementing LA at various scales and the remaining were exploring ways to further engage with LA. The participants in the interviews ranged from Vice Principals/Deans of Learning and Teaching to Heads of IT, Directors of E-learning Centres, and positions established specially for LA research and development. Each interview lasted approximately 60 minutes. The number of participants in each interview ranged from 1 to 3, and some participants from the same institution attended the interviews separately, resulting in a total number of 33 participants.

The interviews were semi-structured (Robson, 2002) and consisted of ten interview questions (accessible at http://bit.ly/interview_questions_SHEILA) to allow the investigation of 1) institutional plans for LA, 2) motivations for LA, 3) adopted strategy, 4) strategy development processes, 5) readiness preparations, 6) success and evaluation, 7) success enablers, 8) challenges, 9) ethical and privacy considerations, and 10) the perceived essential elements in LA policy. The data was subsequently analysed using a coding scheme (accessible at http://bit.ly/interview_coding) that captures the diversity of LA implementations and institutional readiness. The coding scheme builds on a large-scale Australian study (Colvin et al., 2015), which focused on investigating institutional readiness and strategy for LA. We further developed the coding scheme based on a systematic literature review about institutional adoption of LA (Tsai & Gašević, 2017) and the themes that emerged when we examined the raw data. In total, 99 codes were developed and organised into 21 themes. Two researchers individually worked on the same interview using NVivo, and compared the coding results subsequently to reach an agreement. This process was iterated twice before the rest of the interviews were coded independently. Following that, the principal researcher checked through the interview transcripts that have been coded by the assistant researcher, to ensure the consistency of the analysis. Based on the components of CLT (Uhl-Bien & Arena, 2018), we extracted 13 thematic groups of codes (each contains at least two sub-codes) from this coding scheme and the coded data to examine the presence of CLT in institutional adoption of LA in this paper(Table 1).

Table 1. Codes extracted to examine LA adoption under the CLT framework

CLT	Thematic groups
Entrepreneurial leadership	Goals, stakeholder involvement
Operational leadership	Challenges, analytical culture, evaluation, policies, stakeholder involvement
Enabling leadership	Strategy development, analytical culture, technology, funding, analytical capabilities, success, stakeholder involvement

As entrepreneurial leadership is concerned with the need to *innovate*, we reviewed the stated LA goals so as to understand the internal and external pressures for change behind these strategic motivations. We also inspected the involvement of key stakeholders to understand the main agents that were driving LA instantiations. For operational leadership we analysed the existing evaluation and policy processes, as Hazy and Protas (2018) suggest that operational leadership is characterised by activities that drive accountability and setting up metrics for success and failure. We also inspected the relevant stakeholders involved in these processes and the occurrence of tension between the need to *innovate* and the need to *produce* raised when leaders discussed their adoption challenges and institutional culture.

Finally, to identify the presence of enabling leadership, we inspected institutional strategies for LA (including adoption strategies and the approaches to dealing with resistant culture), resource allocation (including technology, funding, and analytical capabilities), success (focusing on success enablers), and stakeholder involvement (focusing on identifying the agents that enabled the adaptive space and the agents that were involved in a social integration process as a result). In the following sections, the responses from different institutions are labelled by numbers following the letter U (University), and the respondents are represented by a decimal number. In cases where decimal zero is used, the respondent is the only participant from the given institution. For example, U1.1 denotes Participant 1 from University 1, whereas U3.0 denotes the only participant from University 3.

Results
In this section, we present the dynamic relationships between the three CLT leadership types in activities related to LA deployment in UK higher education.

Learning analytics as an entrepreneurial movement
Entrepreneurial leadership seeks to generate new knowledge and skills by pushing for creativity, learning, and growth in response to internal or external pressures (Arena & Uhl-Bien, 2016; Uhl-Bien & Arena, 2018). Our study observed that institutional leaders were particularly driven to improve institutional performance by using LA as an innovative approach to explore solutions to existing problems, such as retention and student satisfaction, or to enhance student experience and success. The general perception was that LA would provide information useful to improve the flexibility and inclusivity of course design. Moreover, it was commonly recognised among the interviewees that LA would enhance learner agency by developing their decision-making skills with data-based evidence. In this way, learners were expected to increase a sense of ownership of learning and responsibility for one's decisions. Nevertheless, several interviewees expressed a sense of uncertainty about the return on investment of LA. For example, U17.1 and U1.2 pointed out:

> *We could have had a little black box instead of an expensive piece of software. The wrapping around the project, the energy, the commitment, the targeted actions, how much of that would have just delivered some change anyway? – U17.1*

> *Learning analytics is at an early stage and so over time it may be able to do a lot more things than we can do now. In fact, it will but there is this problem that if things don't deliver what people expect quickly, they then say, 'oh there's no point in doing that', and it gets a bad name. – U1.2*

The responses above suggest that entrepreneurial activities related to LA adoption are susceptible to risks and may conflict with organisational management processes attempting to exploit current and existing resources and systems more efficiently (Uhl-Bien & Arena, 2018). However, it is also in this initial discovery phase where innovations are likely to evolve. Among the study cases, senior managers were identified as the main agents to drive changes, although two institutions indicated that LA adoption has been an institutional response to the requests from academics and IT units. These are the cases where both top-down and bottom-up leadership drove LA.

Tensions between operation and innovation
Operational leadership involves the efficient and effective use of existing resources to produce 'current results' (Uhl-Bien & Arena, 2018, p. 92). In short, this form of leadership in

HEIs is commonly responsible for organisational stability, policy and efficiency. The adoption of LA can be resource demanding and requires new forms of infrastructure, system processes and expertise (Tsai et al., 2018). When implementing LA, the need for stability and consistency generates tensions with entrepreneurial leadership, as noted earlier. LA implementations require institutions to develop new skills and scale up existing capacity in lieu of simply exploiting existing skills and resources. Although various issues around the availability of data have been raised among the interviewees, including interoperability, data held in silos, and access to data, the core barrier to facilitating learning analytics is the constraint of funding. About half of the institutions explicitly pointed out this challenge, and the explanation from U4.0 reveals the tension between exploitation and exploration:

> *Money is tight, and we've got lots of other initiatives, so it's around what's the most important one at this time, what can we afford to do? – U4.0*

In addition to financial constraints, the lack of appropriately trained and skilled staff was also highlighted as a significant impediment to adoption. The essential elements to consider in LA adoption include the time to develop capacity, the time to leverage highly skilled staff, and the allocation of time to follow up on the results of analytics to close the feedback loop (Clow, 2012). For example, U17.1 pointed out:

> *The problem is if you suddenly switch on automatic alerting for 12-13,000 students, it will either cease to be effective very quickly because there isn't the manual follow up, or you just commit yourself to a massive programme, massively resource intensive programme. – U17.1*

The challenges linked to insufficient resources are made all the more acute when buy-in from staff members is low or when staff members lack core data literacies to understand and act on LA recommendations. In addition to the perception of time, as mentioned above, the reluctance to change teaching practice and the lack of confidence in working with data all contribute to an institutional resistance to LA. For example, U20.2 pointed out that the perceived lack of human resources is closely tied to staff beliefs and attitudes related to workload, skills and priorities. The organisational culture can either facilitate or impede exploration in new domains such as LA. In the example below, the tension between workload and experimentation is clearly an impediment to LA adoption and the development of new staff capabilities:

> *If we say to staff, 'go and find a way to play to make it work', they would say, 'this is going to take me x number of hours'. They don't have the IT skillset, and they also don't have the learning and teaching culture to play. So there's the two factors that actually in their mind say, 'we can't, it's gonna take up too much time'. If you gave them a TV flicker and sat them in front of the TV and said, 'play', they'd happily play. But they associate it with work and so they say, 'we can't play'. – U20.2*

An added barrier to staff buy-in pertains to the view of LA as a mode of surveillance and a managerial tool to identify poor performance. For example, we heard from the interviewees that LA has been criticised for profiling, demotivating, datafying, and monitoring students (and staff). These issues need to be effectively addressed under the guidance of existing data regulations (e.g., GDPR) to cultivate trust, initiative and innovation, or LA runs the risk of being underused, overused, or misused (Kitto and Knight, this special

issue) and institutions lose the opportunity to support students to achieve better learning outcomes.

It was highlighted by several interviewees that reaching a common understanding of LA across a big institution is a 'big deal' and can take years. Perceptions, knowledge, and skills of LA vary significantly among different stakeholders, such as senior managers, IT professionals, teaching staff, and administrative staff. The cognitive and skill gaps cause tension when scaling LA-based innovations across the institution.

> *When you start getting technical and talking to the individuals who are the IT experts, they need to know information from you but you don't necessarily understand the form of that data that they need. Or they don't quite get the question that you're asking…. So there's lots of room for misunderstanding… And also, I think we quite often misunderstand technical people. When they say that something can be done, we quite often assume that means it's easy and straightforward to do. – U8.1*

The various challenges noted illustrate the range of tensions that emerge in the interactions between entrepreneurial activities of LA and the institution's capacity (funding, infrastructure, culture, skills, and ethical accountability) to produce results. Effective adoption of LA depends on how leaders engage with the tensions and create an enabling environment to allow innovations to emerge in these tensions and to transform into a new order in the institution.

Strategic engagement with tensions
Enabling leadership creates adaptive spaces to nurture and sustain the capacity for adaptability, and helps negotiate the tensions between exploration (innovation) and exploitation (control and efficiency) (Uhl-Bien & Arena, 2018). In other words, enabling leadership engages with conflicts and work with both entrepreneurial and operational leadership to encourage a culture of change and learning. In so doing, enabling leadership fosters interactions and collaborations among different levels of stakeholders at an organisation (Uhl-Bien et al., 2007). These dynamic capabilities were observed among the interviewed cases in a number of ways.

The analysed interviews revealed the importance of developing relationships between internal sub-units in the organisation and external or industry-based partnerships. The establishment of internal and external relationships can help generate efficiencies (financial, technological, and human resources) and assist in developing skills and capacity. For instance, a number of interviewees indicated that the establishment of an external partnership with the not-for-profit organisation, Jisc[1], allowed for the exploration of LA to commence. These institutions either participated in an assessment carried out by Jisc consultants to assess institutional readiness for LA or joined the Jisc pilot programme to use their LA systems. For example, U10.0 explained the strategic decision to partner with Jisc:

> *I think that would allow us to create a meaningful baseline without a huge resource outlay… That seems to be quite a logical way for us to go given the fact we were quite limited in terms of staff resources and financial constraints. – U10.0*

Internally, all but seven of the institutions have taken various approaches to initiating interactions and sharing of knowledge among different stakeholders in the adoption of LA by

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[1] Jisc supports the use of technology in pre-tertiary and higher education in the UK.

raising awareness and gauging interests or concerns through open meetings, focus groups, survey, and pilots. For example, the pilot project at U14 helped foster interactions between stakeholders and improve the institutional culture.

> *We've worked with pilot groups and they've had the chance to contribute and they can see that we've responded to points they've raised, that's helped in terms of that ownership and buy-in. And they're going out and also communicating and cascading the message to their colleagues. – U14.0*

A number of institutions used an 'ambassador' approach to facilitate interactions among stakeholders pertaining to the adoption of LA:

> *The people we're getting on board are people that are gonna be the Evangelists. The people that are gonna enthuse about it [LA] when they're back in their faculty. – U20.1*

> *We set up a series of focus groups with what we define as programme ambassadors who are students in the senior years at University and they cascaded and actually chaired focus groups themselves.... We had done a lot of work with the student-staff partnership working.... [We] take time to understand concerns and fears and potential opportunities that we hadn't thought about. – U21.0*

A distributed leadership model emerged in U20's and U21's approaches to engaging stakeholders in spreading the innovation of LA across the institution. This has also been observed among other nine institutions that have established working groups to incorporate views from a diversity of stakeholders and through whom to promote LA.

In order to nurture and sustain the adaptive capabilities, eight institutions had appointed researchers/ research teams to work on LA, and nine institutions had offered training to staff and students or were considering doing so. Moreover, a culture of trust and support to engage with conflicts and change was a notable factor that enabled some institutions to adapt and learn. For example, U21.0 pointed out the positive interactions between entrepreneurial and enabling leadership:

> *I think the institution's trust in individuals innovating and taking forward ideas and the support for that has been central. For anything we need early adopters, we need innovators. – U21.0*

To promote and maintain adaptability, enabling leadership needs to work with operational leadership to scale up innovations and ensure their sustainability (Uhl-Bien & Arena, 2018, p. 90). The most notable strategies among the interviewed cases were 1) embedding LA into the university's wider strategy, 2) taking incremental steps to adopt LA, and 3) governing LA activities with a policy. It was noted that by positioning LA under the university's wider strategy, institutions could better align LA innovations with institutional priorities and further inform wider strategies. For institutions that particularly encountered clashes between adaptive dynamics and operational capacity (funding, infrastructure, culture, and skills), an incremental approach was believed to be a way to 'win hearts and minds' (U20), especially when dealing with ethical and privacy concerns. The study also observed

policy development among seven institutions for the purpose of managing tensions between 'exploring' what is possible with data and 'exploiting' what is feasible with data.

We foresaw that there would be concern amongst staff and students at the time. And that we needed to head that concern off kind of up front and meet head on by creating a policy in that area. That was a key part of that preparation [for LA]. – U3.0

Despite the observation of strategic engagement with tensions among the interviewed cases, we noticed the lack of concrete plans for evaluation in many cases, which is usually driven by operational leadership (Hazy & Prottas, 2018). Nevertheless, institutions that have developed or have had plans to set up a monitoring framework tended to align success indicators with (1) the milestones of implementation, (2) university key performance indicators (KPIs), and (3) user satisfaction. This reaffirms the previously-mentioned point that institutional adoption is driven by senior managers who are mostly concerned about institutional performance. It also shows that LA initiatives among the institutions were progressive and not yet mature or stable.

Discussion

The study explored LA adoption processes among UK HEIs through the lens of CLT (Uhl-Bien & Arena, 2018) to identify tensions between innovation and operation, and strategic approaches that institutions have taken to enable LA. The results suggest that entrepreneurial leadership in LA manifested predominately among the senior manager group and largely as a response to external expectations to demonstrate and improve institutional performance. Although entrepreneurial leadership can emerge from grass-roots uptake of LA among teaching staff, only two cases explicitly reported to have supported and turned this initiative into an institutional effort. This observation draws our attention to the seemingly evidence-driven culture (e.g., measuring the quality of education by metrics of student engagement, progression, performance, satisfaction, and employability) among UK HEIs and the need to refocus LA as a value-driven solution that is educationally desirable and meaningful (Biesta, 2010; Kitto et al., 2018). For example, LA could be used to uphold the values of HE in developing students to be critical thinkers and problem solvers through the process of reflecting and acting on data, rather than simply a tool to generate evidence for quality assurance.

The study revealed a variety of tensions between entrepreneurial and operational agendas when introducing LA to HEIs. Overall, nine broad topics of tensions were identified, and the manner in which these challenges were addressed manifest two prominent characteristics of enabling leadership among the interviewed cases (Table 2):

Table 2. Addressing LA adoption challenges with enabling leadership

Enabling leadership	Challenges
Allocating resources and seeking external support	funding; skills and expertise; staff workload allocation; data literacy; uncertainty of returns on investment
Brokering boundaries of internal networks	staff workload allocation; staff buy-in; institutional culture; perception gaps between stakeholders; ethics and privacy

First, institutional adoption of LA requires a high level of negotiation skills to re-allocate or assign financial, infrastructural, and human resources. For example, the ability to

leverage similar projects or identify particular skills sets, training needs, and funding opportunities to aid implementation is required for enablement. While this process may work within the constraints of internal funding models, additional resources can be leveraged through external partnerships. For institutions that had low capacity or financial availability, external support from a not-for-profit service provider (i.e., Jisc) proved to be effective in terms of shaping an environment that is safe to experiment in (without the uncertainty about returns on investment) and to formulate a strategy for LA. Moreover, the interviewed cases have predominantly embedded LA initiatives into the wider university strategies (e.g., digital strategy or teaching and learning strategy), which helps legitimise the allocation of resources for LA and enable leaders to connect LA solutions to the operation core, thus scaling the innovation into the mainstream practices at the institution (Uhl-Bien & Arena, 2018).

Second, bridging network boundaries between internal stakeholders (e.g., establishing a diverse working group and facilitating consultations with primary stakeholders) has allowed leaders to address challenges related to attitudes, perceptions, knowledge, and expectations. By bringing together aggregated agents across the institution, the network effects allow knowledge to transfer (*ibid.*), elaborate and generate ideas (Perry-Smith & Mannucci, 2017), distributing power across the network (Siemens et al., 2018), and seeking feedback to improve the operational efficiency and complexity (*ibid.*). The social process through the brokering of networks enables individuals to take on leadership roles informally, acting as change agents to facilitate LA adoption through ad-hoc, formal, and personal relations. For example, several institutions identified staff and student 'ambassadors' to facilitate communications of institutional visions and emerging interests or concerns among stakeholders, thus increasing buy-in and ownership of LA. This process builds a network of power that can break down silos in HEIs (Higher Education Commission, 2016), provide the necessary impetus for change, and enhance it with feedback from the network agents (Siemens et al., 2018). As the Deloitte Global Human Capital Trends report indicated, speed, adaptability, and agility are key features of successful organisations in the digital era, and the network power is crucial to developing such capacity (Walsh & Volini, 2017).

Despite the observed network-brokering activities among the interviewed cases, the limitation of staff time, capability, and willingness to engage with innovations has been highlighted constantly as a barrier. This issue is rooted in the current success measurement and funding models in the UK, which arguably discourage institutions and academics from risk-taking and innovations (Norton & Carter, 2017). CLT positions an organisation (its vision, mandate, culture, staff skills and resources) as adaptive and responsive in the face of rapid and dynamic change. However, effective adoption of LA requires enabling leaders to create time and a culture for staff to experiment with new, risky ideas without fear of punishment (e.g., negative student feedback or performance reviews), as well as cultivating an appetite among students for pedagogical innovations.

CLT maintains that power for change and innovation are driven through networks or interacting agents. It applies a systems level approach to addressing unpredicted and complex challenges. This is especially pertinent to the deployment of LA, which inherently involves complex issues around ethical and meaningful uses of data, the power play in an institutional ecosystem, and the institution's accountability for public interests. The dynamic interactions among the three leadership components in CLT are important in ensuring the efficacy of any LA adoption model. Take the SHEILA framework (Figure 1) for example; entrepreneurial leadership plays a critical role in mapping the political context to identify opportunities for the institution to engage with LA (Dimension 1) and thereby identifying desired changes to pursue (Dimension 3). Enabling leadership is critical in the identification of relevant stakeholders to engage in the planning and implementation phases of LA initiatives (Dimension 2), as well as in formulating an engagement strategy to negotiate the tensions

between exploration and operation (Dimension 4). Operational leadership is particularly important in assessing internal capacity to implement LA (Dimension 5) and developing a monitoring framework for organisational learning (Dimension 6). As indicated previously, the six dimensions of the SHEILA framework interact with each other, as will the three roles of leadership. For example, the development of engagement strategy (Dimension 4) to pursue changes with LA will require a dynamic interaction among entrepreneurial, operational, and enabling leadership. This is also the case observed among the 21 UK HEIs.

Conclusion

The study showed that several prominent challenges associated with LA adoption derive from the inherent tension between the need to *innovate* and the need to *produce*. Operational leadership requires a form of justification to any change. However, as LA is an emerging innovation (or experimentation process for some), uncertainty inevitably exists in resource allocation, returns on investment, and its potential values and harms. The study reveals a number of intents to address these tensions by securing required resources and bridging networks of change agents. The collective experience of the 21 UK HEIs pertinent to LA adoption illustrates the dynamic interactions among entrepreneurial, operational, and enabling leadership. Through the lens of CLT, proposed by Uhl-Bien and Arena (2018), we argue that the identified challenges associated with LA deployment are inevitable, yet the scalability and sustainability of LA depends on the availability of an adaptive space that allows agents in the institutional network to engage with tensions and develop a common vision. This adaptive space needs to be maintained and nurtured through brokering activities, resource allocation, network building, and a culture to experiment new ideas. We suggest that institutional employment of LA adoption models can be leveraged by CLT. We also highlight the importance of scaling initiatives from teaching staff and align them with the institution's values, so as to ensure that LA is adopted in an educationally desirable way.

This paper is not intended to define leadership, but to draw upon a particular leadership theory to enhance our understanding of issues around institutional deployment of LA and possible ways to address tensions introduced by LA related innovations. The analysis is based on data collected from a relatively small sample in a particular region, and thus the results are not generalizable. The study presented in this paper is primarily based on inputs from senior managers who have the best overview of the institutional operation. This strength is also the weakness of the paper, as CLT depends on the dynamic interactions between members in different networks of an institution. Our future study seeks to triangulate the perspectives presented in this paper with those of other stakeholders to further understand how CLT might be able to support effective adoption of LA.

Statements on open data, ethics and conflict of interest

The interviews collected for this research involve institutional leaders that can be easily identified based on descriptions of learning analytics adoption activities. Therefore, the interview data is deemed unsuitable to be made openly accessibly. The research was carried out under BERA Ethical Guidelines for Educational Research. The study has been approved by the ethics committee at Moray House School of Education at the University of Edinburgh. No potential conflict of interest in the work has been identified.

References

Arena, M. J., & Uhl-Bien, M. (2016). Complexity Leadership Theory: Shifting from Human Capital to Social Capital. *People and Strategy*, *39*(2), 22–27.

Bento, F. (2011). A Discussion About Power Relations and the Concept of Distributed Leadership in Higher Education Institutions. *The Open Education Journal*, *4*(1). Retrieved from https://benthamopen.com/ABSTRACT/TOEDUJ-4-17

Biesta, G. J. J. (2010). Why 'What Works' Still Won't Work: From Evidence-Based Education to Value-Based Education. *Studies in Philosophy and Education*, *29*(5), 491–503. https://doi.org/10.1007/s11217-010-9191-x

Bolden, R., Petrov, G., & Gosling, J. (2009). Distributed Leadership in Higher Education: Rhetoric and Reality. *Educational Management Administration & Leadership*, *37*(2), 257–277. https://doi.org/10.1177/1741143208100301

By, R. T. (2005). Organisational change management: A critical review. *Journal of Change Management*, *5*(4), 369–380. https://doi.org/10.1080/14697010500359250

Clow, D. (2012). The Learning Analytics Cycle: Closing the Loop Effectively. *Proceedings of the 2Nd International Conference on Learning Analytics and Knowledge*, 134–138. https://doi.org/10.1145/2330601.2330636

Colvin, C., Dawson, S., Wade, A., & Gašević, D. (2017). Addressing the Challenges of Institutional Adoption. *Handbook of Learning Analytics*, 281–289.

Colvin, C., Rogers, T., Wade, A., Dawson, S., Gašević, D., Buckingham Shum, S., & Fisher, J. (2015). Student retention and learning analytics: A snapshot of Australian practices

and a framework for advancement. *Sydney: Australian Office for Learning and Teaching*.

Dawson, S., Poquet, O., Colvin, C., Rogers, T., Pardo, A., & Gasevic, D. (2018). Rethinking learning analytics adoption through complexity leadership theory. *Proceedings of the 8th International Conference on Learning Analytics and Knowledge*, 236–244. ACM.

Dollinger, M., & Lodge, J. M. (2018). Co-creation Strategies for Learning Analytics. *Proceedings of the 8th International Conference on Learning Analytics and Knowledge*, 97–101. https://doi.org/10.1145/3170358.3170372

Dumas, C., & Beinecke, R. H. (2018). Change leadership in the 21st century. *Journal of Organizational Change Management*, *31*(4), 867–876. https://doi.org/10.1108/JOCM-02-2017-0042

EDUCAUSE. (2018). *NMC Horizon Report Preview: 2018 Higher Education Edition* (pp. 1–10). Retrieved from https://library.educause.edu/resources/2018/4/nmc-horizon-report-preview-2018

Ferguson, R. (2012). Learning analytics: drivers, developments and challenges. *International Journal of Technology Enhanced Learning*, *4*(5/6), 304–317.

Ferguson, R., & Clow, D. (2017). Where is the Evidence?: A Call to Action for Learning Analytics. *Proceedings of the Seventh International Learning Analytics & Knowledge Conference*, 56–65. https://doi.org/10.1145/3027385.3027396

Ferguson, R., Clow, D., Macfadyen, L., Essa, A., Dawson, S., & Alexander, S. (2014). Setting learning analytics in context: overcoming the barriers to large-scale adoption. *Proceedings of the Fourth International Conference on Learning Analytics And Knowledge*, 251–253. ACM.

Gašević, D., Dawson, S., & Siemens, G. (2015). Let's not forget: Learning analytics are about learning. *TechTrends*, *59*(1), 64–71. https://doi.org/10.1007/s11528-014-0822-x

Greller, W., & Drachsler, H. (2012). *Translating learning into numbers: A generic framework for learning analytics*.

Hazy, J. K., & Prottas, D. J. (2018). Complexity Leadership: Construct Validation of an Instrument to Assess Generative and Administrative Leadership Modes. *Journal of Managerial Issues*, *30*(3), 325.

Higher Education Commission. (2016). *From Bricks to Clicks - The Potential of Data and Analytics in Higher Education | Higher Education Commission* [Policy Connect]. Retrieved from http://www.policyconnect.org.uk/hec/research/report-bricks-clicks-potential-data-and-analytics-higher-education

Kitto, K., Shum, S. B., & Gibson, A. (2018). Embracing Imperfection in Learning Analytics. *Proceedings of the 8th International Conference on Learning Analytics and Knowledge*, 451–460. https://doi.org/10.1145/3170358.3170413

Long, P. D., Siemens, G., Conole, G., & Gašević, D. (Eds.). (2011). In *Proceedings of the 1st International Conference on Learning Analytics and Knowledge (LAK'11)*. Retrieved from https://tekri.athabascau.ca/analytics/

Macfadyen, L., Dawson, S., Pardo, A., & Gašević, D. (2014). Embracing Big Data in Complex Educational Systems: The Learning Analytics Imperative and the Policy Challenge. *Research & Practice in Assessment*, *9*, 17–28.

March, J. G. (1991). Exploration and Exploitation in Organizational Learning. *Organization Science*, *2*(1), 71–87. Retrieved from JSTOR.

Marion, R., & Uhl-Bien, M. (2002, December). *Complexity v. Transformation: The New Leadership Revisited*. Presented at the Conference on Complex Systems and the Management of Organizations, Ft. Meyers, Florida. Retrieved from https://www.researchgate.net/publication/228599074_Complexity_v_transformation_The_new_leadership_revisited

Norton, P., & Carter, J. (2017). *Report: One size won't fit all: the challenges facing the Office for Students* (pp. 1–84). Retrieved from Higher Education Commission website: https://www.policyconnect.org.uk/hec/research/report-one-size-wont-fit-all-challenges-facing-office-students

Perry-Smith, J. E., & Mannucci, P. V. (2017). From creativity to innovation: The social network drivers of the four phases of the idea journey. *The Academy of Management Review*, *42*(1), 53–79. https://doi.org/10.5465/amr.2014.0462

QAA Scotland. (2018). *Use of Institutional Data: Thematic Report Update 2018* (pp. 1–8). Retrieved from QAA Scotland website: https://www.qaa.ac.uk/scotland/reviewing-higher-education-in-scotland/enhancement-led-institutional-review/thematic-reports

Robson, C. (2002). *Real world research: a resource for social scientists and practitioner-researchers* (2nd ed.). Oxford: Blackwell. (3139146).

Siemens, G., Dawson, S., & Lynch, G. (2013). *Improving the quality and productivity of the higher education sector: Society for Learning Analytics Research*.

Siemens, George, Dawson, S., & Eshleman, K. (2018). *Complexity: A Leader's Framework for Understanding and Managing Change in Higher Education* (No. 53(6); pp. 27–42). Retrieved from https://er.educause.edu/articles/2018/10/complexity-a-leaders-framework-for-understanding-and-managing-change-in-higher-education

Tracy, S. J. (2013). *Qualitative Research Methods: Collecting Evidence, Crafting Analysis, Communicating Impact*. Retrieved from https://www.wiley.com/en-gb/Qualitative+Research+Methods%3A+Collecting+Evidence%2C+Crafting+Analysis%2C+Communicating+Impact-p-9781405192026

Tsai, Y.-S., & Gašević, D. (2017). Learning analytics in higher education — challenges and policies: A review of eight learning analytics policies. *Proceedings of the Seventh*

International Learning Analytics & Knowledge Conference, 233–242. https://doi.org/10.1145/3027385.3027400

Tsai, Y.-S., Moreno-Marcos, P. M., Jivet, I., Scheffel, M., Tammets, K., Kollom, K., & Gašević, D. (2018). The SHEILA Framework: Informing Institutional Strategies and Policy Processes of Learning Analytics. *Journal of Learning Analytics*, *5*(3), 5–20–25–20. https://doi.org/10.18608/jla.2018.53.2

Uhl-Bien, M., & Arena, M. (2018). Leadership for organizational adaptability: A theoretical synthesis and integrative framework. *The Leadership Quarterly*, *29*(1), 89–104. https://doi.org/10.1016/j.leaqua.2017.12.009

Uhl-Bien, M., Marion, R., & McKelvey, B. (2007). Complexity Leadership Theory: Shifting leadership from the industrial age to the knowledge era. *Leadership Institute Faculty Publications*, *18*(4), 298-318.

Universities UK. (2018). *Policy priorities to support universities to thrive post-exit* (pp. 1–5). Retrieved from Universities UK website: https://www.universitiesuk.ac.uk/policy-and-analysis/reports/Pages/policy-priorities-post-exit.aspx

Walsh, B., & Volini, E. (2017). *2017 Deloitte Global Human Capital Trend: Rewriting the rules for the digital age*. Retrieved from Deloitte University Press website: https://www2.deloitte.com/cn/en/pages/human-capital/articles/global-human-capital-trends-2017.html

Young, J., & Mendizabal, E. (2009). *Helping Researchers Become Policy Entrepreneurs-How to Develop Engagement Strategies for Evidence-based Policy-making* (pp. 1–4). Retrieved from Overseas Development Institute website: http://www.alnap.org/resource/8431