



Next generation [digital] learning environments: present and future

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Introduction

Co-design 2016 saw the launch of the Next Generation Digital Learning Environments challenge asking:

- » What would an environment do for staff and students?
- » What kind of learning experiences would an environment need to support?
- » What learning and teaching practices aren't currently supported in environments?

The changing nature of student and staff behaviours was something highlighted by many commentators; technology-led pedagogies, and emphasis on system features was another; and of course many people in the sector were commenting on the rise of analytics and the role that data may play in future systems. This retrospective of Jisc's co-design work is therefore focused on technology and practice now, and what is emerging. It aims to inform the sector and provide a base from which new developments may emerge.

In order to create an accessible document, we have reduced the discussions to seven broad themes:

- » Current good practice
- » Large enterprise approaches
- » From institution to individual
- » Self-starter and individual approaches
- » Analytics and learning environments
- » Emergent models
- » Disruptive approaches in online UX futures

However, the themes are not in silos and many issues are crosscutting. The co-design process was driven by the community, they centred the discussion on what could learning environments be, and what the motivations are for those trends. The community did not offer large discussions around infrastructure, interoperability and standards, or in-depth technical specifications, and therefore this report does not provide a blueprint to develop a system, rather it provides discussion points upon which to build the conversations needed before embarking on technical builds.

As Technology Enhanced Learning continues to develop, it is clear that some form of digital learning environment will remain core to institutional practices; the levels of integration, features and porosity will continue to change, driven, and potentially driving the behavioural shifts we see in staff and students.

The role of analytics, in monitoring of students, and possibly staff in the future is clearly something that both vendors and institutions are investing in, and the sector should be mindful of how, where and why the data is used. Additionally, the emergence of systems that use analytics to provide adaptive learning pathways, and automated "chat" style responses will need to be evaluated deployed appropriately.

Jisc's co-design challenge brought to the surface many issues, both cultural and technological. This report and the associated work is made possible by the commitment of the community that engaged with the challenge for which we are grateful.

Themes

Current good practice

Most Universities and Colleges that are using the current accepted technologies, including virtual learning environments (VLEs) are adept at using them, eliciting good value and providing a platform for staff to develop their digital teaching skills and an environment to innovate in their practice.

In 2016, the Universities and Colleges Information Systems Association (UCISA) published a “Survey of Technology Enhanced Learning for higher education in the UK”. The survey included investigating the current state of learning platforms across the sector and institutions future plans.

The state of play and likely trends

Key in the UCISA report was identifying that all institutions provide a virtual learning environment and that the market is dominated by very few suppliers. Blackboard and Moodle are offered at 49% and 53% of institutions respectively, illustrating that a number provide more than one learning environment.

However, there are some trends identified since the 2014 survey. These include:

- » Moodle has dropped in popularity (down from 62%)
- » Some new vendors are making inroads into the market (including Canvas and Futurelearn)
- » Most institutions still host their own platform (57%) but a growing number are moving to third party hosting or Software as a Service models, often provided through cloud based solutions

Another development taking place is the increasing range of types of provision of teaching being made available using learning platforms, these include blended learning, distance learning and open education (such as

Massive Open Online Courses (MOOCs)). The increase in open education provision has led to an increase in the uptake of specialist platforms such as FutureLearn and Blackboard’s Open Education. The growing importance of this type of learning has led to the Open University piloting the accreditation of learning acquired informally through its *OpenLearn: Making your learning count module*.¹

To innovate, or not

From the institutional viewpoint, and looking at the major VLE vendors, it appears innovation is more through evolution rather than revolution, with new tools being added as they are developed. Some innovation is driven by tools that are becoming popular outside the learning platform. Examples include social media, blogging tools, lecture capture facilities and mobile apps. This “feature creep” has long been a characteristic of the market. Even relatively new vendors such as Canvas, which make a feature of being simple to use with a wide range of app based tools, is still recognisably a “VLE” with many features in common with better known products.

It should be noted that during Jisc’s consultation with the sector this feature creep is not always welcomed. Simon Wood (<http://blog.simonwood.info/2016/10/31/taking-back-ownership-from-the-vle/>) succinctly articulated many people’s comments on his blog:

“The VLE vendors have been stuffing more and more tools in there (each one of them just about “good enough”). Maybe to create a Swiss army knife, or perhaps as yet another “sweetener” to encourage institutions to pick their product. But we can’t blame them; it works – the institutions buy it.”

[1]

1 A USB port for informal learning
<http://blog.edtechie.net/oer/a-usb-port-for-informal-learning/>

In the near future, in part based on demand, it seems likely that the list of features and tools offered as part of traditional learning platforms will continue to grow (see below for representative listing). Even though institutions renewing their licences with current learning platform providers will obviously benefit from this increased functionality, it is possible that the systems may become increasingly unwieldy and inflexible with high costs, in terms of resources and time, if migration to a new system is considered.

The plans for new developments at a typical university over the coming months identify features including:

- » A floating submit button
- » Tools for teachers to make multiple courses available quickly including sending email and announcements
- » Availability of student photographs
- » Dragging and dropping files from computers
- » Receipts for submitted assignments
- » New language packs
- » Better interface to third party application such as plagiarism detection

All of these features can be considered useful, if not essential (eg plagiarism detection), but in part they can also be considered “patches”, upgrades that should not be considered as substantial changes to core provision.

System integration

Another increasing trend is for learning platforms to be integrated with other systems. The UCISA survey found that learning platforms were being integrated with:

- » Library systems (80% of institutions)
- » Student records
- » Registration and enrolment
- » Submission of assignments and coursework
- » Lecture capture and media servers
- » Portfolios
- » Timetabling systems
- » Learning analytics

As the tendrils of the VLE weave their way through more of the university systems, the level of “lock-in” will undoubtedly increase, impacting on both the cost of migration to a new system and the breadth of disruption if a new system is required.

So is this business as usual?

It seems that much of the innovation in teaching and learning technology, for example: augmented reality, artificial intelligence, gamification or personalisation through social media, is not featuring heavily in learning platform development. It may be that the virtual learning environment is now so mission critical to institutions that future development will, of necessity, be gradual. Slow development and conservative changes suits most institutions. A focus on organisational and administrative efficiency may be the sensible route. However, the UCISA survey did note that many units and departments within institutions were running their own systems, as well as

the organisation wide system. These smaller installations may allow for more innovation and for greater risks to be taken, and therefore provide a route for possible game changing developments to take place. Institutions are under pressure to provide excellent, measurable, teaching quality, and with students quantifying their experience through, for example the National Student Survey (NSS). It is therefore difficult for both institutions and staff to find the right balance in the drive for innovation and change and the current established good practice.

Features and services

The following list is provided to illustrate the range of features and services frequently provided by virtual learning platforms which could be at risk if institutions move away from the “current good practice”:

- » Content management - creation, storage and use of learning resources including text, audio, video, presentations etc
- » Curriculum development and planning - lesson plans
- » Assessment and submission - assignments and coursework, including anti-plagiarism tools
- » Personalisation of the learning experience particularly through learner analytics
- » Learner administration - management access to learner information and tracking of progress and achievement
- » The course **syllabus** (<https://en.wikipedia.org/wiki/Syllabus>)
- » Administrative information about the course: prerequisites, credits, registration, payments, physical sessions, and contact information for the instructor
- » Notice board for current course information
- » Additional resources, links to outside resources, supplementary reading etc
- » Self-assessment quizzes normally scored automatically
- » Formal assessment - such as examinations, essay submission or projects
- » Support for **peer assessment** (https://en.wikipedia.org/wiki/Peer_assessment)
- » Communication including email, threaded discussions, chat, notices, RSS,
- » Social media including twitter
- » Collaboration such as wikis, groups and blogs
- » Management of **access rights** (https://en.wikipedia.org/wiki/Access_control) for teachers and lecturers, their assistants, course support staff, and students
- » Documentation and statistics as required for institutional administration
- » Authoring tools for creating the necessary content by the teacher or lecturer, and submissions by the students
- » Lecture capture facilities
- » Provision of e-Portfolios and learning analytics
- » Mobile apps

(The list above is partly based upon the Wikipedia definition of virtual learning environment²)

[1]

² Wikipedia: Virtual Learning Environment
https://en.wikipedia.org/wiki/Virtual_learning_environment

Large enterprise approaches

The big commercial players in the online and software world such as Facebook, Google, Microsoft, Amazon and Apple could also become huge players in the future of learning environments, and there have already been moves made in this direction such as Google Classroom, Microsoft Teams and Amazon's purchase of TenMarks. They might simply buy one of the current leading suppliers or take over a promising startup and put their financial muscle behind it. Perhaps more interestingly, they seem to already have most of the tools in place to provide the main services and facilities that comprise a traditional learning environment. Components such as:

- » Content creation and management, including multimedia
- » Storage and online delivering
- » Mobile access
- » Collaboration
- » Communication including email, messaging and social media
- » Group and/or discussion forum creation (courses or classes)
- » Interactivity
- » Personalisation
- » Administrative functions

While these components may not currently be packaged as learning environments, individuals and institutions have, in some cases, taken them and created their own systems.

It is worthwhile looking at the current, and possible future, offerings from these major players, as well as start-ups and open source solutions, that might challenge the status quo in learning environments.

Facebook

The world's best known social networking platform has the potential to offer a range of learning environment possibilities. It is easy to create collaborative groups, to make content available and to participate in online discussions. Exchanging information and ideas is simple in a friendly, social, environment. The platform is available anywhere, anytime and on mobile devices. It is also very low cost in terms of upfront fees.

There has been, however, speculation, and some evidence, that students are reluctant to use Facebook as part of their studies. They may prefer to keep their online social lives separate from their academic work. As with many online systems, social media can be distracting, as well as engaging, so some discipline may be required to keep student's attention on academic work. Additionally tutors will have little control over the environment in comparison to traditional VLEs.

As with many commercial platforms there are a range of ethical issues that will need to be discussed and resolved if systems like Facebook are to move into the mainstream of learning environments. Not least of these issues is the gathering and use of data about individuals by Facebook and the need for participants to create a personal profile on the system.

Despite these issues there are many examples of tutors using Facebook to enhance the learning experience for particular courses or programmes. Queen Mary University of London are using Facebook quite extensively in this way as outlined in the case study below.

However Facebook don't appear to be planning to launch a managed learning platform suitable for institution wide use.

Google

Google has a range of tools and services that it markets to the education sector including gmail, docs, drive and calendar. Additionally, Google Classroom is an app based product that provides a free to use, collaborative tool for teachers and students on and off the campus. Tutors can create classes, set and mark assignments, make content available, provide feedback, set up discussions groups, send announcements and share resources. In addition, Google's Course Builder offers an online course creation service which is based on the Open xD format and includes features such as student feedback and tools for analytics. Once again we see many of the components of a learning environment being made available without being packaged as such. Google also has an Arts & Culture Experiments website that utilises innovative navigational tools and approaches to interacting, learning and curating Museum and Art archives from around the world. Within this site called arts experiments.withgoogle.com (<https://experiments.withgoogle.com>) there are a range of remarkable 2D and 3D navigational tools to explore different ways of making connections, curating insights or searching content through pattern or thematic mechanisms experienced or analysed through machine learning algorithms.

Microsoft

With its suite of well-known applications including Sharepoint, Office, Onedrive, Skype and Onenote, Microsoft has all that is required to build a traditional learning environment. Microsoft has also been promoting a number of education related initiatives including:

- » Microsoft Teams, which is part of the Office 365 for education package and provides a group or class communication and collaboration facility³
- » Microsoft Education brings together a range of offers including hardware, applications and cloud based services which provide building blocks that could form a learning environment

- » Microsoft Classroom provides tools to help manage classes and create assignments, it is now part of the Office 365 Education offering

Apple and Amazon

Other large enterprises such as Apple and Amazon have from time to time discussed their provision for the education sector but have tended to be focused on using their current product range. Apple's offer is based around their hardware products with related apps, resources such as iBooks and iTunes U.

Amazon's AWS Educate initiative offers many of the resources, for free, to provide a cloud based learning platform, including collaboration tools and a content management platform as well as training and support resources. The latest version of Amazon's TenMarks, an online instructional tool, is TenMarks Writing which aims to help students plan and create written assignments while providing teachers with feedback and assessment tools⁴.

[1]

³ Microsoft Teams

<https://education.microsoft.com/courses-and-resources/resources/meet-microsoft-teams>

⁴ Amazon TenMarks

engadget.com/2017/08/23/amazon-tenmarks-writing/

Summary

In looking at the likely future offers from the largest of enterprises there seems to be no appetite for developing an out of the box learning environment for the HE sector. Also, what they do offer to education is often targeted more at the schools sector.

It is clear that many of the large players already provide the apps, tools and services to deliver most, if not all, of what a current learning platform supplier offers. However, their offering is a “toolkit” or the “building blocks” that an institution would need to pull together to create a customised platform, involving considerable investment in terms of staff time and resources, however considerations that will further improve the UX and build a more immersive and engaged learning opportunity for learners are crucial to furthering inclusive digital student cultures and enabling greater social mobility.

Additionally, any learning platform solutions based upon Google and Facebook will be cloud based making the move from a traditional VLE to these platforms more radical, increasing concerns regarding security and privacy particularly in relation to the handling and storage of student and staff data. The advertising that funds many of these services may also be a serious concern for many institutions.

So, while the up front and licensing costs could be very low, or even zero, but there is still a major resourcing issue in terms of development and support staff. Also this model may not fit well on an institution wide basis where the platform will become critical to the whole organisation.

Risks and opportunities

Risks include:

- » This enterprises are not education specialist and may not having the understanding or commitment required
- » Ethical risks including carrying intrusive or inappropriate advertising
- » Concerns over privacy of student, staff and institutional data
- » Mixing of social and academic environments - including multiple confusing profiles
- » Lack of tutor control
- » Special educational needs may not be catered for
- » Likely to need high level of local support and resources

Opportunities include:

- » Introducing new players and encouraging competition
- » Large enterprises with existing scale and infrastructure
- » Wide range of tools and apps available
- » Known and trusted brands
- » Possible low costs
- » Large R&D programmes
- » Familiarity with systems
- » High level of mobility catered for
- » Integration with existing systems eg Office 365

From institution to individual

Personalised learning environments; connected spaces

Introduction

The increasing use of social media has led to conversations, collaborations and sharing of knowledge and experiences outside of the institutional VLE. In some cases this is encouraged by tutors keen to engage learners using familiar tools and services. In other cases, the activity is adhoc and learner-driven, in part due to limitations of existing institutional learning systems.

Personalising learning

These approaches, most often driven by individual staff and students, support a more personalised view of teaching, allowing learners the autonomy to manage a space of their own composition. In this scenario both staff and students would be connecting their own networks of peers and having greater choice over the format of their content. Key to a student focused immersive UX, content can then be aggregated from different sources, shared in different places with different groups and stimulate collective knowledge generation. The types of social media tools available range from communication, discussion and reflection, multimedia content publishing and sharing, and also time and work management tools.

Shifting control

Institutional VLEs provide some of the functions listed above, for example for discussions, posting content or showing calendars. However, the provision and access to such tools are controlled by the institution not always aligning easily with either the student or staff experience.

In some institutions and certainly amongst any cohort of learners it is possible to identify a shift from centrally provided and controlled systems towards a more individualised approach; sometimes referred to as a personal learning environment (PLE). This may have particular benefits for addressing individual needs and providing enhanced accessibility, but how feasible is it to manage by teachers, and could it lead to exclusion of students less able to adopt the technologies used?

Changing learning, changing teaching

One of the challenges for those who teach or support teaching is how to provide effective guidance on an undefined collection of tools and services, which may be used in different combinations according to need and personal preference. With the somewhat transient nature of apps and data, current trends and popular tools and services could quickly become obsolete, leaving the institutional staff struggling to keep up, and if services disappear or become “charged for” students may lose access to their content or data.

The role of the teacher could also shift significantly to one who facilitates and guides. So-called hyper-personalised learning already being **tested in US schools** ([edweek.org/ew/articles/2017/03/29/curriculum-playlists-a-take-on-personalized-learning.html](https://www.edweek.org/ew/articles/2017/03/29/curriculum-playlists-a-take-on-personalized-learning.html)) has each student with their own “playlist”, managing their own content and

moving through it at their own pace, with the teacher in the role of monitoring for when help is needed. Programmers developing responsive algorithms could work alongside educators to design effective teaching, and perhaps eventually the algorithms could themselves learn to adapt and enhance the learning experience.

As with many discussions around educational technology, there is the perennial fear of staff being replaced by technology. This approach provides a framework for staff to adapt and change to carve out a role where they moved away from content providers to coach, mentor or bespoke learning advisor. The facilitation role already present in some classroom activities could become more dominant, guiding the collective wisdom of the group, supporting experimentation and reflection. Providing expert feedback could be one of the key roles.

To avoid isolation of students, teachers would need to encourage (or require) interaction, sharing of ideas and experiences. Skills in curation of content - the ability to organise, interpret and translate - could become significant in the teacher's repertoire, in helping the students collect and draw connections from content in collaboration with others. These activities give student the opportunities to exercise and develop their digital capabilities.

Challenges of personalisation

There is no one definition of PLEs and the term can mean many things, covering a broad range of tools and approaches. Common themes include a shift not only of control but of responsibility away from the teacher and to the learner. With autonomy comes a need for self awareness of effective learning processes, taking charge of managing content and tools, and also skills in installing, managing and working safely. In addition, questions arise about the balance between learning that is targeted at the individual and the benefits of shared experiences that by necessity are less personalised.

Underlying personalisation is the need to collect and "measure" information (data) on progress or performance, how else do we know what the current status is and how/where to move next? There may be significant challenges in terms of data ownership and management from an individualised app-based approach. Permissions for data sharing may be accepted by the student on installation of an app, with data made available to the app developer, but not to the institution. This would limit the potential for aggregation of data by the institution to support and enhance learning more widely. There is also a need for general education and support in technology usage, including the challenges around security and safe management of data.

Becoming more social

Aggregation and syndication of content is now routine, and sharing from one app to another is established within common vocabulary. Apps such as Facebook, Instagram and Youtube are widely used for creating and sharing content and communicating with networks of friends and colleagues. Institutional VLEs offer limited opportunities to capitalise on the popularity of these apps and to integrate with everyday practice. This can often lead to teachers setting up groups and spaces outside of the institutional platforms.

One example of a learning platform that is more socially oriented is Known. This allows publishing of content, sharing feedback and communication using social media. Familiar tools such as controlling access to groups, providing status updates and location, and sharing files and photos fit within a seamless syndication framework linking to popular social media tools.

Linking applications

The concept of personalised learning environments has existed for some years without a major impact on mainstream practice (although there is and always has been elements of personalising within good teaching). The current increase in usage of mobile devices and app-based tools and services has led to a renewed interest. With apps as discrete units that can receive inputs and produce outputs, and APIs as the defining interfaces, the emergence of connecting tools has led to new opportunities.

A step on from aggregation or sharing is the identification and linking of events or triggers and a subsequent action. One example of this is the IFTTT (if this then that) service that allows the creation of chains of conditional statements. These can be used to pass data from one app to another to create new content in new formats and set up sequences of events that create actions. One example could be when a maps app identifies your location as approaching your home, or leaving work, a signal is sent to your home heating thermostat to turn on the heating. How this applies to education we explore in the case study on [page 36](#).

Implications for analytics

The shift of control/responsibility from institution to individual could lead to fragmented data collected from different sources for each student. Additionally, applications outside of institutional control may not even share some of the data. Consent from students and interoperability of systems and applications will be become more critical, but this is a arguably an inevitable direction regardless, with the new General Data Protection Regulation (GDPR) and the push towards seamless integration.

Risks and opportunities

Risks include:

- » Learner's challenge of managing appropriate collection of apps
- » Teacher's challenge of coordinating across the class
- » Difficulty adapting to changing role of teacher to facilitator
- » Looser security and safe management of content and data
- » Fragmentation of data and loss of control for analytics (and possibly content)
- » Difficulties of integration of tools and apps, and availability of open APIs

Opportunities include:

- » Learner choice and more individualised learning experience
- » Closer collaboration between technology developers and teachers
- » Improved awareness and skills of content curation

Self-starter and individual approaches

Embracing the chaos

There's a long history of both individual students and individual teachers building their own learning environments. Indeed the first platforms were invariably homemade either from scratch or adapting existing file sharing systems.

Today almost all institutions are using products from established vendors or open source systems, primarily Moodle, to provide an organisation wide learning environment. It is very difficult for new entrants to enter the market and to shake up the status quo. This is illustrated by the number of interesting systems that have either been "retired" or taken over in recent times. Examples including LearningStudio, Lore, MyEdu, GoingOn and eCollege are no longer available.

New approaches

However, a few individuals are still trying new approaches - adapting existing systems or starting from scratch. In part the impetus behind this work is that some individuals feel traditional learning environments primarily support the teacher's activities and focus upon transmitting information. They feel that what is needed is a platform that is more supportive of student activity and interaction, that it should be student centred with discussion and collaboration at its core.

A number of new products, such as Aula and Canvas (both discussed in this report), aim to focus on student activity and being student centred. Also, individual self-starters are also adapting other products in an effort to bridge this gap.

Slack-ers: An example of a new approach

Slack (slack.com) in many ways is a good example of a product these self-starters, have taken an interest in. It is even seen by some as the future of learning environments⁵.

It is described by Wikipedia as: "...a cloud-based set of team collaboration tools and services. The name is an acronym for "Searchable Log of All Conversation and Knowledge". "

It is aimed primarily at the business market and helping teams to run projects. However, a number of individuals in the education sector are adapting Slack to perform the functions of a learning environment. A range of articles have been written discussing some of their experiences.

Learning from Social Media

In general Slack is being used by teachers and lecturers who are looking for an approach that is much more focused upon student activity and collaboration rather than for transmitting information. There is a feeling that students frequently look outside the institutional learning environment to become more engaged with their learning, using social media platforms for this. While most learning platforms provide tools for discussion and collaboration they are often included as additional features rather than being at their core. Whereas social media platforms, like Facebook, have discussion and collaboration at their core they do not generally make it easy for the teacher and course leader to intervene and guide the class. There are also privacy issues associated with systems that are cloud hosted and may wish to use individual's data for marketing purposes. Slack supporters feel that it provides the collaborative environment with a level of appropriate control from the teacher.

Getting started

Individuals looking for something new in learning environments find that Slack ticks many of the boxes for them:

- » Its very easy to set up
- » Getting started is very low cost
- » Little technical knowledge is required
- » It is very flexible
- » The basic installation is simple and clean, but additional features are available if needed
- » The interface has a familiar feel

The focus on activity and collaboration provided by Slack does not mean that the other facilities are not available. Creating student groups, file sharing, student work submission and feedback, and making class announcements are all easy to provide.

Zach Whalen, Associate professor in the Department of English, Linguistics and Communication at the University of Mary Washington, has been using Slack with his Digital Studies students.⁶ He says of the experience:

"I like it. I look forward to getting online in the morning to see what's been added in my classes, and I find myself in DMs (Direct Messages) late at night helping work stuff out or answering questions. There's a sense of community from Slack that I don't think I would ever get from the college VLE, because sometimes it's just fun, and that's part of what makes it work."

Examples like Slack illustrate how the sector continues to look for a new approach in digital learning environments. While many innovative new approaches and products fall by the wayside, the lone wolves and self-starters continue in their efforts. This will inevitably, eventually, change the learning environment market, either through the success of a new product, a paradigm change or by forcing the existing platforms to adapt and evolve.

[1]

⁵ Tim Monreal - Is Slack the new LMS?
<https://medium.com/synapse/is-slack-the-new-lms-7d1c15ff964f>

⁶ Zach Whalen - Notes on Teaching with Slack
zachwhalen.net/posts/notes-on-teaching-with-slack

Risks and opportunities

Risks include:

- » Possibly requires considerable resourcing for development and support
- » May not fulfil expectations
- » Dependence on enthusiastic and creative individuals
- » Difficulty of long term maintenance, support and development
- » Security and privacy requirements

Opportunities include:

- » System development tailored to institution's requirements
- » Support for new or different pedagogies, such as student centred learning
- » Lean system providing only required functions and facilities
- » More flexibility than bought in systems
- » Lower initial costs eg may not need commercial licences

Analytics and learning environments

Many universities and colleges are starting to explore ways of collecting and analysing data to inform or influence learning and teaching. A large amount of data already exists and a variety of ways of using it are being implemented. Some describe analytics as the “next big thing”, but does that assume that systems and environments continue to develop as they have done for recent years?

Much has been written about **learning analytics elsewhere**, (jisc.ac.uk/reports/learning-analytics-in-higher-education) including ethical issues, but questions for next generation digital learning environments include:

1. Are aspirations for analytics supported by current learning environments?
2. Will alternative learning environments disrupt or enhance the current analytics work?
3. How can analytics be used in interesting ways with different types of learning environment?

Analytics landscape

Analytics with current VLEs

Currently when students use a VLE they generate a large amount of data on their activities, progress, assessment and other learning. However, VLEs are not the only source of data, and student information systems for example also hold potentially useful information about students and activities. The power of analytics is in the integration of data to inform decisions, and this is recognised by the providers of analytics services. **These services** (<https://ji.sc/what-type-of-products>) are provided not just by **VLE vendors** (<https://ji.sc/VLE-vendors>), but also student information systems/MIS, library systems and business intelligence suppliers. Each looks to interrogate data from a range of sources.

Future directions

This creates an interesting landscape within which both data and learning environments sit. A landscape which will inevitably change at some point, but in what direction? It is far from inevitable that analytics will become the next new feature in VLE, in fact it is conceivable that analytics could in some ways replace the VLE or render major parts of it redundant. Equally, a new form of learning environment could hamper the effective collection or use of data at an institutional level or nationally such as the development of a **learning records warehouse** (jisc.ac.uk/reports/learning-analytics-in-higher-education).

Other studies (<https://net.educause.edu/ir/library/pdf/eli3035.pdf>) have identified the need for analytics in future digital learning environments to address multiple levels (student empowerment, instructional improvement, institutional oversight), the importance of integration and standards, and widening the scope of data.

Adaptive analytics

Adaptive analytics refers to the way data is used to not only understand the learner’s current situation or progress, but to use this information to adjust and personalise the subsequent learning activities or content. In this way individual pathways through learning are created in response to data captured. If the VLE is the primary tool through which learning activities are coordinated then the analytics process must integrate data from other sources and provide this such that the VLE can deliver tailored content or feedback.

Access to data

Data types can include demographic, learner activity and learner outputs/content and analytics relies on a variety of data which may sit in other systems. Whilst system interoperability has greatly improved in some cases, the availability of open APIs and other standards and interfaces is a key factor for services that source data. Of course if the analytics service is provided by the VLE then access to the VLE logs are straightforward and VLE providers often

have proprietary learning analytics capabilities. Otherwise, analytics services are reliant on the VLE allowing access to data (or the data existing somewhere else!). This varies between providers, with open source, hosting and commercial solutions in common use, but has proved a stumbling block in some cases, not least for experimentation with new approaches. A lack of interoperability standards in use and difficulty in negotiating with suppliers can hamper progress, although some are now adopting Learning Tools Interoperability (LTI).

Focus on the VLE

For many students, the use of the VLE is the primary online interaction with the institution. However, the way in which the VLE is used will impact on the type of data collected and the useful insights able to be interpreted from it. If the VLE is simply a repository then data could show who downloads content and when. It might also be used for assessments or discussions, showing for example the level of interaction with a discussion forum. For an institutional or national approach to analytics however, a wide variance of VLE usage between courses might limit the power of analytics to influence effective interventions.

Outside the VLE

Student visits to the library, class attendance or participation in other activities may in some ways be more revealing in terms of identifying and providing support to struggling students than the access of content. Many systems exist across the institution, some of which collect data that can be aggregated. However, where teaching staff are using innovative approaches to learning environments, perhaps driven by better engagement with students, it is not always clear that this feeds into the wider knowledge of student behaviour through analytics. Innovation often happens at a smaller scale within a local context and the experience may not be being shared.

Social interaction

One example would be the use of Facebook in a learning activity. Ownership and access to data here is not under the control of the teacher/institution, so any learning activity using Facebook as a platform will currently have limited input to analytics. The choice of digital learning environment may be heavily influenced by how much control the institution has over data, if analytics is prioritised. As **pilot projects** (jisc.ac.uk/reports/learning-analytics-in-higher-education) have shown elsewhere, sophisticated analysis of various aspects including social interactions, quality of discussions, use of emoticons to reflect mood and effectiveness of teacher facilitation can provide useful insights. Experimenting with analysis techniques alongside new types of digital learning environment makes for an interesting but potentially unpredictable path for future directions.

Features within learning environments

If the next generation of digital learning environments could look radically different (or not) how does this impact on our understanding of analytics? Some seemingly simple “enhancements” of VLE usage, for example **using the adaptive release feature** (<https://ji.sc/adaptive-release-case-study>) to control access to assessment relating to completion of quizzes, have been shown by analytics to improve performance. Does this suggest sharing of good practice within existing features is sufficiently powerful to have a significant impact on learner engagement and achievement? Alternatively, if quality of interactions, independent thinking or creation/curation of content is more important for successful learning, where does that leave us with our current data collection and analysis strategies? Possible future scenarios may suggest that adaptive pathways through content or natural language analysis of conversations is the “next big thing” within analytics that require new skills and new thinking. However, with the increasing demand for data and scope of its use, are institutions preparing themselves in terms of policy and strategy to manage this effectively?

Risks and opportunities

Risks include:

- » Increasing complexity of the tools and systems providing data
- » Competition between system vendors to capture the analytics space
- » Managing diverse data safely and securely
- » Managing expectations and concerns of students

Opportunities include:

- » Increasing sophistication of analytics to inform teaching
- » Improved knowledge and experience of the potential uses of analytics
- » Availability of richer data from wider sources
- » Improved learning experience through personalisation

Emergent models

Technology enhanced teaching

Blended learning, technology-enhanced learning and other terms in common usage suggest there is conceptually a move away from static digitised content to something more engaging and intuitive. However, to what extent is this hampered by fairly fixed models of institutional learning systems that can sometimes be seen as demotivating for lecturers and students alike from engaging with virtual tools? The increasing divide between mobile devices with transient social media apps and the increasingly heavyweight institutional systems suggests there is an opportunity to introduce something completely new. What this new direction may be has no single clear answer, and advances in a range of different approaches are evident, as described in brief in this section.

Collaboration not classes

Mainstream VLEs tend to organise content and activities around the boundaries of classes and modules. Access to the online “courses” is typically restricted to those formally registered as students, or those teaching on it.

Research and other collaborative pursuits however, recognise the value in crossing boundaries, inviting participation from other groups and individuals to stimulate new ideas and original approaches. The diversity of input is a key strength in interdisciplinary research for example, setting out to address big societal challenges. Such “borderless” approaches are also **gaining interest in teaching** (<https://ji.sc/borderless-journeys>).

From content to conversations

There are many examples of current VLEs is being used simply as repositories of content. Despite attempts to move away from this, the reality is that many lecturers see their VLE as a place to put their presentations and other material (and VLEs designed primarily for this). Discussion fora and other features exist and are used, but typically the model is about digitising what is already there, with content being the main focus. Other practices rely on innovative instructors trying hard to use platforms they and their

students find less intuitive than they would like. The VLE becomes a place to go to when you have to, not because you want to. In addition, enterprise-wide VLEs are becoming strongly embedded into institutional systems and administrative processes, arguably making them more difficult to move away from. So what exists that could fundamentally challenge the status quo, potentially making a convincing case for shaking up current provision?

We consider here three different directions for future digital learning environments that take a completely different model, the first looks at gamification, the second at connectivity and spaces, the third is about conversation-led learning environments.

Gamified learning environments

In recent years, there has been some interest in the use of gamified learning environments in higher education. Gamification is the “use of game design elements in non-game contexts” with the primary aim of increasing users’ motivation to engage with a system. These game design elements commonly include the use of explicit quests or challenges, points or levels to show progress and goals, rewards such as badges or achievements, and ways of comparing progress with others such as profiles or leaderboards. Gamified learning is distinct from ‘game-based learning’ or ‘serious games’ in that it augments an existing learning system with game mechanics rather than using a game as the means to teach content or skills. Sometimes a broader definition of gamified learning is used in the literature to encompass a more general use of game thinking but that is not what is being considered here.

The primary motivation for using gamification is to motivate users to engage longer, and more deeply, with a system, and the obvious potential benefit of a gamified VLE is that it could motivate students to carry out tasks on the system (although whether this equates to learning is a different matter). It can be argued that the abilities of virtual learning environments to offer analytics as well as a range of activities, communication and resource-

sharing tools makes them ideal environments for gamification. However, in practice, the integration of non-standard gamification tools into existing VLE set-ups may be problematic, particularly when there is not yet a robust set of evidence of their efficacy or a significant groundswell of need from academics.

Overall, the use of gamification of VLEs in higher education has been limited, and there is little evidence of its effectiveness in the research literature, although there has been some success with engaging students with gamified library systems. The idea that gamified systems are universally motivational is open to challenge, and does not appreciate the diversity and nuance of motivations within the student population; for example, motivation to engage in competitive aspects of a gamified VLE may be heavily gender- or culture-dependent. While gamified learning environments might be motivational for some, a key criticism of this form of design is that they harness extrinsic motivation (ie driven by external rewards) rather than intrinsic (ie taking part in the activity for its own sake) and drive superficial behaviours rather than deep engagement with learning. Some aspects of gamified systems, such as clear goals, personalised challenges, prompt feedback, and visible progression, could be argued to support deeper learning processes; but could be countered with the argument that these elements are characteristics of good pedagogy, and not unique to gamified systems. (One might also argue that Higher Education, with its assessments, grades, and public degree classifications, is already a gamified system.)

Connectivity

Encouraging visitors

Even in teaching, having a student “drop in” for a few lectures or even just one, as a taster, to identify links to their own work, or simply out of interest, does happen in physical classes. Often it is encouraged near the start of the semester while students finalise module choices, and sometimes lecturers will welcome “visitors” throughout the course.

In comparison, the VLE approach is sometimes referred to as being in “silos”, deliberately excluding those not on the class list - in fact causing difficulties near the start of a module as the student membership is in flux. How can we move to a more “welcome visitor” approach, and is it desirable?

Open but not too open

Arguably access restrictions are introduced partly for technical control, and partly to reassure individuals concerned with privacy or protecting their own content. In the same way that the open research agenda can challenge long established cultures of protectionism in some areas, opening up learning content and activities also challenges the status quo. However, MOOCs and other open education activities have shown such an approach has interesting benefits, including public engagement and course recruitment, so can the institutional digital learning environment stretch its boundaries further?

Safe spaces

The idea of anyone having access to anything perhaps is a step too far for some and leads to reasonable concerns - where are the safety measures, the quality controls, who provides the support? Is it appropriate for anyone to join in the activities, and what standards of behaviour are acceptable? Of course institutions already have processes for support, codes of conduct and acceptable use policies and, perhaps, a shared set of values in learning with common goals. So what if the institution was the boundary, but within its “walls”, students and staff were free to observe or participate across subjects and courses, secure in the knowledge that someone was there to provide a safety net.

Social networking

As a technology, social networking platforms provide the desired functionality of making connections across disciplines, and recommendations of people and things. Other platforms such as Yammer successfully provide similar functionality for workplaces, but lack the relevant educational context.

Conversation-led learning environments

Robots and AI

In the future robots will deliver lectures!

Probably not, but can artificial intelligence be used to handle routine questions, freeing up the lecturer or support staff to focus on facilitating critical thinking or supporting more complex needs? Artificial intelligence refers to the concept that computers can emulate humans, including adapting and learning, to the point where an interaction with a computer may appear to be with a human. In other contexts the “intelligence” simply refers to the automation of a task or activity, perhaps based on data it collects to inform decisions. Whilst it is less likely that physical robots with moving limbs will be standing in front of the lecture theatre any day soon, artificial intelligence may well feature strongly in future tools. This isn’t as far into the future as you might imagine, and some of our everyday interactions are already handled in this way, such as customer service enquiries or speech-based search tools.

Chatbots

Virtual assistants, chatbots and conversational agents/apps typically use natural language processing to understand questions posted, and then use artificial intelligence to seek answers from a knowledge base. Examples in common usage include Siri and Cortana on mobile phones, but also Facebook messenger can make available a chatbot API to develop customer interactions for businesses, and communication tool Slack incorporates bots too. So next time you type in a query to a chat box looking for an answer to a query, it may not be obvious whether it is a human or computer answering! Examples are beginning

to appear in education, with Georgia State University introducing a **chatbot** (<https://ji.sc/chatbot-blog>) to assist new students in the process of starting at university. Ranging from questions about housing and financial aid to student life, the service uses artificial intelligence and supervised machine learning. From the 50,000 messages handled in the first month, less than 1% were passed on to a human.

Virtual learning?

So can this really be used in learning environments? Whilst chatbots and virtual assistants are increasingly common in customer service applications, their use in education is less obvious. Examples do exist, such as virtual assistants handling admission queries or helping a lecturer collect feedback on the module from students, although they are more administrative than pedagogic. We can draw a distinction here between placing the conversation at the heart of an interface or platform, and the automated responses to questions. The latter of course is relatively easy to add in once you have the former, so by exploring conversational based learning environments we can begin to see where this may take shape.

Conversational teaching

Conversations are a natural way of communicating, many lecturers like to hold conversations with students in the classroom, to discuss, challenge and explore topics. It is arguably more interesting and engaging than “presenting”, and stimulates more independent thinking and critical analysis. Some modules now are based around seminars/tutorials with group activities and discussion, so a conversational starting point is in keeping with changes in the physical classroom. The “flipped” classroom also fits with this shift in focus, characterised by content being viewed and digested independently, reserving contact time with the tutor for discussions, activities, projects etc.

Conversational interfaces

Interfaces that are based around conversation have been described as frictionless communication, or having frictionless adoption paths. This means that they are so intuitive you can just get started on your conversation without having to think about what to do where. This is in stark contrast to increasingly feature-heavy VLEs that users sometimes find difficult to navigate. We can also think of this as reducing the “mental load” needed to interact with the system. Once a conversation is started, it becomes easy to introduce supporting resources or activities, such as posting of multimedia content within the conversation, or linking to other apps.

Conversational platforms

As an example of conversational platforms, **Aula** (<https://aula.education>) is described as an education-focused communication platform. In contrast to Slack, used by teams typically in a commercial setting, Aula concentrates on education, claiming to connect “learners and educators in a space powered by the tools they already use”. The platform features a conversational interface at its core but within “an ecosystem of integrations”.

The Aula approach is to see the conversation between lecturer and students, and between students, as the core of the learning activity. Content is introduced to support the conversation, and the lecturer is able to focus on high value activities such as critical thinking and discussion.

Aula is new to the market, originating from a student innovation project at Oxford University. Initially using the name uBlend and focusing on connecting a community through events and discussions, it has developed the conversational interface as a key difference from other learning platforms.

Implications for analytics

The rise of the “internet of things” will lead to ubiquitous devices throughout the institution, as described in the Jisc work on Intelligent Campus. Such devices are able to collect various data about individuals for processing and interpretation. Stretching the boundaries of access to courses may add diversity to the “class” data, requiring more careful interpretation, but also providing a richer source of student experience data to give insights to the value of such “visitor” activity. Similarly, analysis of conversational data is complex and open to interpretive inaccuracies. Natural language analysis can take large amounts of unstructured data about emotions, attitudes, likes and dislikes and make judgements about the context. This may require significant human oversight, at least while the technology matures, but the addition of such data to the wider data set about learners opens up significant opportunities to enhance the student experience.

Risks and opportunities

Risks include:

- » Complexity of managing safe access
- » Challenge of effective AI and natural language processing use
- » Adapting to changing styles of teaching to managing conversations

Opportunities include:

- » More openness of access crossing boundaries
- » Breaking out of the content repository culture
- » More intuitive interfaces
- » Improved accessibility through alternative interfaces
- » Richer analytics data

Disruptive approaches in online UX futures

User-Experience (UX) is about creating systems that people want to use and enjoy the experience of using. From the perspective on online learning this is where the experience of interaction is achieved through beautifully crafted functional interface design that enhances engagement in learning.

The potential in the evolution of User-experience to facilitate learning in online environments

Engagement in online communities is changing dramatically, from a generation of desktop computer users to mobile online-users engaging with new forms of collaboration and interaction. Consequently, there is a growing need for innovation in contemporary online learning design. It is within this area that innovation design to enhance User-experience might learn from game design, enhancements in usability and functionality can be dramatically improved.

UX in screen size / mobility

There are major and disruptive changes effecting the interaction of computer screens through touch-screen technology and enhancements in screen quality due to the enormous increase in the use of smartphone and tablet technology on the market. The market has experienced seismic shifts in screen functionality, increased display quality through millions of pixels presenting imagery, film and consumer-led content into remarkable high definition output. In contrast to the user-experience of the desktop environment it is now no longer the sole interactive and landscape learning environment but relegated to a generic place with the smartphone offer swallowing market share.

Changes in screen real-estate come in to two clear areas: traditional landscape from desktop/laptop computers and the mobile interaction from Smartphone and Tablet screens using both portrait and landscape to view content. Interface design is carefully crafted for both small and medium screen mobile interaction with touchscreen enabling a more haptic and gestural experience.

'Always-on'

An 'always-on' connectivity mindset from the context of smart technology is experienced in the way people are able to communicate with each other. Part of sweeping cultural changes in online activity and the shifts from a static engagement with online content has moved to an 'on-the-go' culture of interaction witnessing dramatic increases in engagement with online content. Access from around the home, when travelling, at work and when shopping or socialising..... activities all being part of an ecosystem of multiple conversations - locally, nationally and globally.... Conversations have become topic focused customisable chapters of social interaction rather than experiences that begin and end with a friend when meeting. The technological 'always-on' culture enables ongoing streams of communication that have pauses for a day-job, night-job, timetabled events, meals, socialising and entertainment.

Increasing personalisation in online learning environments and a choice for accessing Virtual Learning Environment's (VLE's) open up diverse options for user-engagement through increased resources for 'content-snacking', access to library content, museums and social media discussions with enthusiastic user-experience ratings being part of a hierarchical feedback culture.

Disruption in UX for search and retrieval

The search and retrieval function in any online learning environment is crucial to the user experience. Seamless access is the user expectation when using current online and mobile technology from operating systems like the latest Apple or Android operating systems. Search and retrieval methods such as; logical association, Fuzzy-logic and 'Serendipity searching' are all needed to create different ways to interact between user and diverse content for learning. An enhanced toolkit for this could use 'Deep clauses' in search algorithms to enable specific sets of search terms (and customisable searches that could exclude headings/words too). Crowd-sourced knowledge, human centred Interface design that curates searches would also further build opportunities to improve search and retrieval.

Learning from online interaction design in games

Leaders UX is immersive and specialised. Can these be pointers to a more immersive UX for online learning?

Contemporary game design is increasingly popular due to the quantity of visionary narratives that captivate players and the imaginative navigation and graphic interface design that is utilised to guide users around their environments. Highly sophisticated interaction design being essential to the behavioural and responsive user-experience. In comparison, traditional and current online learning environments are rarely remarkable in terms of their interaction design, way-finding or user experience. Recent advances in Technology Enhanced Learning software (for example platforms like Aula and Canvas) have supported shifts in mobile learning through the building of a more visual culture to connect and engage students and new learning communities.

By re-designing online for mobile in the light of insights gleaned from specialist mobile game design environments the functional fixedness/fixidity in design that restrains UX innovation being piloted can enhance user experience, with a view to improving the nature of immersion in online learning and engagement interactivity.

UX in feedback loops - (assessment and feedback tools)

Improvements to feedback and the seamlessness of direct feedback have been central to both student and academic staff across the education sector. A Content ranking algorithm in feedback circuits would also enable very needed feedback loops in a sequence of moves to solve puzzles (and published cheats) or achieve a level of competition.

Learning from the successes of interaction design, immersive engagement and the cycles of discovery in the highly diverse and successful global online Games industry where users teach themselves how to use 'navigational passages' by building a knowledge emotionally, mentally and physically. This autodidactic knowledge could further immerse learners in greatly improved navigation around learning environments and consequently enhance opportunities (often latent) in VLE's and their archives.

Conclusion

Concluding remarks

This report has been generated with the UK higher and further education sector, in one of Jisc's widest and deepest consultations to date. Even as this goes to publication the Next Generation of Digital Learning Environments continues to be a pressing topic as institutions develop their learning and teaching strategies, and look to future technologies and the impact they may have on the student experience. Rather than provide a solution, this report is intended to inform and provoke more discussion. In the following section, the people working in the sector who contributed to the content of the report have been invited to sum up their reactions, and offer commentary on what they find most compelling. Their comments range from in depth technology predictions to discussions of the nature of education. As an artefact, this report serves as reflection of a moment in the Jisc Co-design process, but as a set of ideas, discussed and debated, it will continue to frame what the next generation of digital learning environments may look like.

Peter Bryant, Head of Learning Technology and Innovation, London School of Economics

"The criticality of the debate about the future of learning environments has never been more important. The challenges facing higher education are existential. Policy, competition and the marketisation of learning open up the sector to the influence of platforms and practices that argue they have all the answers. The important question for all of us who lead educational change, who teach classes both face-to-face and online, who have skin in the game of the future of higher education is; what kind of experience do we want for our students? The kinds of experiences we help to facilitate, the engagement with practices that make learning better and connections that are made between learners, teachers and their networks through learning will decide what kind of learning environment we need, not the other way around."

Nicola Whitton, Professor of Professional Learning, Manchester Metropolitan University

"The development of safe social spaces is at the heart of building meaningful and inclusive learning environments. Online spaces that support learner community -building and facilitation of deep and trusting relationships are necessary for a feeling of safety in the presence of peers. In these learning spaces students can engage with others in new and playful ways, take risks and learn from failure, build resilience and confidence, be creative, and learn to work with others to solve problems in truly innovative ways."

Simon Thomson, Head of Digital Pedagogy, Leeds Beckett University

"In order to ensure that the next generation of digital learning environments are fit for purpose we need to engage users in meaningful collaboration of it's design and development. Within this publication we have started to identify the complexity of such a task and as part of the PULSE project we have begun to acknowledge a lack of understanding with regards the needs of our learners in the development of these spaces. If we want our staff and students to use these "tools" more effectively, they have to be spaces where they want to be, not just spaces they have to be.

The focus for me should be on developing digital tools and services which are interconnected, providing increased flexibility and choice, whilst maintaining a common environment where collaboration can take place in it's many forms. These digital tools should not be a replacement for the highly valuable human interactions that take place both in both physical and digital environments, but an enhancement to them.

In Paul Le Blanc's article for Educause (2015)⁷ he suggests we should approach this human-technology intersection with the following three questions:

- 1. What human interactions are most critical for student success?*
- 2. How can technology enable better versions of those interactions?*
- 3. Where can technology replace people so that human resources can be redirected to accomplish more of those interactions?*

If we started our journey of developing next generation digital learning environments with these three questions at the forefront of our minds I'm sure this would provide a strong basis upon which to build spaces where people want to be.

We are now supposedly entering a post-digital world, if that is the case then this should be reflected in the "environments" where we learn and teach, moving closer towards effective human-technology intersection."

Aftab Hussain, Strategic ILT Leader, Bolton College

"The use of machine learning in the education sector is making personal learning environments smarter as they advance the delivery of personalised, adaptive and contextualised services to students. This marks the start of an exciting period where schools, colleges and universities in partnership with technology companies will take their first steps towards developing a personal digital teacher for every lifelong learner.

Educational institutions who are skilled at acquiring, creating and organising information and whose employees are able to share the knowledge that transpires from it are better placed to support their students. Better still, they can also generate new knowledge which can be applied to the design of new products and services, enhance existing services and improve organisational processes to better support the student."

[1]

⁷ Le Blanc, Paul. "The Human-Technology Intersection: A Framework." *Educause Review*, 2 Mar. 2015. <https://er.educause.edu/articles/2015/3/the-humantechnology-intersection-a-framework>

Anne-Marie Scott, Head of Digital Learning Applications and Media, The University of Edinburgh

“Learning analytics approaches have significant potential, but institutions need to move past the dominant focus on retention use cases and data dashboards to realise this. Analytics need to take into consideration the context in which learning is occurring, and better support all students. Single institution-wide analytics solutions may not be the answer, or the only answer.

Whilst students have some expectations that data are used to inform improvements to their learning experiences, the potentially “chilling” effects of always-on data collection in digital learning environments needs to be attended to. In the same way as there need to be open and closed learning spaces, there need to be surveillance-free or ephemeral spaces.

We have an opportunity to use our digital learning environments to develop critical data and digital literacy skills. In the spirit of co-creation, students in particular need to be more regularly and routinely involved in the discussions and decision-making around platforms. -

It has never been the case that a single VLE platform can provide all the features that we want from a digital learning environment - it is quite normal to have assessment and media tools “plugged in” for example. The ability to innovate in this space will be determined by the availability of APIs and integration technologies, by institutional capacity and capability, and by the implicit maintenance costs of managing this complexity. However, we must also not underestimate the potential for continuing to include trailing edge technologies and simple integrations in our digital learning environments”

Damian Chapman Deputy Head of London School of Film, Media & Design, University of West London.

“The remarkable range of technological developments and appetite to interact both with a growing diverse student voice and diverse approaches to learning are evident in every aspect of cyberspace and our world of analogue.

Expansive functionality for mobile UX from operating systems across platforms has been particularly interesting through engaging and immersing consumer interaction in conversation styled platforms, bespoke cultural genres of communities (as seen here in this report) and games based learning design. Through improved navigational and interaction design and cybernetics we can further apply the leaps in digital technology and software development into knowledge for learning environments that are often slow to benefit.

However, having said this, there is a profound need for inclusivity for the many who still remain excluded from the digital multiverse due to their lack of resources or social mobility. The next generation of digital learning environments must reach deeper and further into supporting deprived areas of the social spectrum. New cultures of collaboration and participation need to engage, connect knowledge flow... and enable increased diversity of lifestyles and the richness they bring to learning and knowledge acquisition.”

**Steve Rowett, Digital Education Developments Team
Leader, University College London**

“The Jisc work on NGDLEs Environments comes at an appropriate time for UCL as our Connected Curriculum model becomes embedded in our education and we embark on a new education strategy.

When we review survey data from staff and students, we are often asked for more consistency in how our VLE is used, more timely uploading of resources by teachers, or improvements to the user interface to make it easier to navigate. Comments from colleagues around the sector make me think these are not atypical responses.

These comments are valid as far as they go, but our work on the Connected Curriculum has encouraged us to think more deeply about the underlying paradigm and assumptions baked into our VLE. The two that have stood out are:

- » *Students and teachers see only the modules on which they are enrolled. Everything else is hidden and unavailable*
- » *Teachers have full control of VLE resources and activities. Students are passive recipients of tasks set up for them to do*

We see a social network model as having potential to enable cross-discipline communication, community-forming, sometimes-unexpected exploration and discoverability but to do so still within the ethos and rules of a university. We don't propose replacing the VLE, but augmenting it with a new type of academic social network, aimed at education rather than business or personal social life.

It can be argued that the use of VLEs in education has narrowed, not broadened the education experience for many students. The Latin root of university – totality or whole – suggests something broader and deeper than a collection of independent, unconnected modules. We would like to see technology used to support that sense of the whole university education.

I would like to thank Dr Eileen Kennedy for her contribution to this work.”

Simon Wood, E-Learning Officer, School of Social Sciences, Cardiff University

Engaging in digital practices for learning is something students will need to be able to do beyond graduation, not just whilst on a formal programme of study. Scaffolding the development of crucial digital literacies will enable students to transition from institutional to personal platforms during their studies. The next generation of digital learning environments must embrace a mixed economy of tools and services that may be brought to the table by institutions, teachers or students. That's not just about using tools that students are familiar with now. It's about students critically engaging with the choice of technologies to deploy effectively for learning, collaborating and, in due course, in their future employment or study.

In order to meet these challenges, institutional systems need to become ascetic, altruistic and nurturing. We need to question the assumption that the spaces used for reflection, collaboration, and networking should be institutionally owned by default. Whilst engaging with these spaces, students may be putting into them years of work. Must they leave behind the ideas, connections and records they have developed? Instead of providing tools just because they can, institutional systems could focus on the services that the institution is uniquely placed to provide. These systems might offer integrations to enable students to exchange data and connect with peers, helping us to foster greater autonomy in their digital practices and ensuring that the data they generate, the content they create, and the networks they build can all continue with them as they leave the institution behind and take the next step on their learning journey.

Anders Krohn, CEO, Aula

"Would you tell me, please, which way I ought to go from here?"
"That depends a good deal on where you want to get to," said the Cat.
"I don't much care where-" said Alice.
"Then it doesn't matter which way you go," said the Cat.
"-so long as I get SOMEWHERE," Alice added as an explanation.
"Oh, you're sure to do that," said the Cat, "if you only walk long enough."

"After reading the report, Alice's relentless search springs to mind - 'would you tell me, please, which way I ought to go from here?'"

There's no clear answer, obviously, and I can guarantee you that we're not going to run out of new technologies promising to be the 'next generation'. I hope, however, that in our search for a destination, we think long and hard not just about where we want to go, but why we want to go there. Doing so will help us challenge assumptions and think differently - not just at the periphery, the new immersive, personalised out-of-body textbooks, but also at the core, the daily PowerPoint karaoke.

Despite its focus on the horizon, I'm sure this report will enable us to think deeply about the teaching and learning that all students - in the current generation - are receiving now.

It's exciting and important to think about where we should go from here, but we should take care to not settle for just ending up SOMEWHERE."

Recommendations

Recommendation one

Working with vendors, institutions and student bodies to explore both the technological and social aspects of the use of analytics.

During the co-design consultation and through the development of this report it is apparent that the increased use and the increased diversity of data analytics is a major factor in the development of learning systems. It is essential that Jisc acts as an independent source of knowledge and exploration into what may be possible and what the implications may be, both technologically and socially.

Recommendation two

Provision of an entry level dashboard in the Jisc Learning Records Warehouse

With the wider adoption, and increased use of analytics within the education space it is important that institutional staff have the opportunity to experiment with data and analytics and in addition look to incorporating any institutional innovations in both technology and practice into those data sets. In addition, many small educational start-ups lack sufficient technology support to incorporate analytics data into their systems in the early development phases. An entry level dashboard for both start-ups and institutional staff engaged in innovation will enable upskilling around use of analytics and a base upon to build technology innovations. In addition new teaching practices can be explored in relation to how they may be recorded through data collection.

Recommendation three

Exploration of APIs and API ecosystems, and social media analytics, to allow for greater innovation in learning and teaching technology.

Many third party tools in education now use APIs as a way of integrating with other systems. The IFTTT approach discussed in the report was seen as many as a desirable state for local innovation and personalised learning. Through the report it became apparent that whilst many tools and social media applications allowed for integration in this way, large vendors were reluctant to open up their system APIs and, in one example, meant the project was hamstrung in its aspirations. With staff increasingly using third party apps and tools it is essential these can be integrated into practice, and the data usefully harvested and used in analytics engines.

Recommendation four

Exploration of 3D, “visual” and immersive learning environments.

Through the co-design consultation practice emerged based on 3D and visual interfaces to data and in the use of immersive learning environments and gamification. This is an area that Jisc may usefully provide guidance for institutions looking to explore these emergent tools as a way of accelerating development, and toward mainstreaming their use. Additionally, it would be desirable for Jisc to further explore the field and identify any viable shared services as opportunities.

Recommendation five

Exploration in the integration of physical and digital spaces.

Physical learning spaces and digital learning spaces can now be linked in a variety of ways, through for example, the internet of things. Through the co-design consultation it emerged that Jisc's work on the intelligent campus should lead on identifying opportunities where physical and digital learning spaces can be linked to create greater efficiency and innovation in teaching, research and learning. As institutions renew infrastructure and the physical estate exploring this area in more depth is important to identify whether a Jisc service could be built to assist universities and colleges in exploiting the opportunities afforded with the emergent technology.

Recommendation six

Development of an incubator and innovation cluster for institutional driven technology development in learning spaces.

Through co-design and associated events it emerged that institutions are providing less support for small scale innovations (for example the loss of the ring-fenced Teaching Quality Enhancement Fund, and HEA small scale grants). In addition several use cases emerged of good innovations happening at local level. These innovations appear to be driven by the passion of individuals or small groups working on specific areas, for example gamification or 3D environments. Provision of an incubator to support and disseminate this work would enable Jisc to identify ideas that could be scaled up and delivered across the sector. The innovation cluster, as well as providing an environment where developers could come together for support, would provide Jisc with outputs could be published as part of Futures horizon scanning and feed into futures development by early identification of tools and products that may be useful to the sector.

Recommendation seven

Contextual Inquiry into academic teaching practices and student learning

An early outcome of the co-design process was the lack of information about contemporary teaching practices, a literature review identified that there was a gap and Jisc commissioned a comprehensive study into the teaching practices and motivations of staff. This is essential in providing an evidence base for further learning environment development. The themes, as they emerge from the study will provide Jisc with opportunities to develop projects and tools addressing gaps and opportunities in teaching. This study is already underway and will report in late spring 2016. As Jisc launched the contextual inquiry into academic teaching practices it became apparent that a subsequent companion piece that, using the same methodology, would be useful around the behaviours of students.

Case studies

Hull University and Canvas

As a more recent entrant to the learning environment market the Canvas learning environment aims to offer something new. A number of UK institutions have decided to move to Canvas, these include Birmingham University, London Business School and Hull University.

Hull University choose Canvas after an extensive evaluation process and because of its strong support for interactive learning and its high level of learning functionality. It forms a major part of their virtual campus allowing staff and students to connect and learn, anytime, anywhere.

Canvas gives students and staff with a simple to use and familiar learning environment interface making first use straightforward. While it provides many of the features common to most traditional learning environments there are a number of areas that it focuses on to differentiate it.

Firstly, it is a completely Cloud based system, while this can cause concerns around reliability, security and privacy, it also provides a number of advantages including the release of regular, free system upgrades.

Canvas provides all the functionality expected of a learning environment in terms of content creation, assessment, quizzes and basic communications. The Speedgrader tool is a major feature of the system allowing lecturers to efficiently view and mark assignments using a range of techniques, and to provide feedback through text or audio.

The system claims to be very flexible, and this does appear to be the case, allowing the support of a range of pedagogic models. It particularly focuses on a student centred approach with a number of features available to support this.

These include:

- » Lecturers are able observe student work and assignments as they are created providing feedback at any time. Assignments can be submitted on multiple occasions allowing the student to benefit from and integrate the feedback that the lecturer is providing in real time
- » The provision of assignments is also enhanced through the ability to open, annotate, and submit assignments from a mobile ap
- » The integration of multimedia means that students can view lectures, hold video conferences and receive video or audio feedback from lecturers
- » The aim of providing anytime, anywhere learning is made more possible through the provision of tools and apps for mobile devices
- » The use of third party, “best in breed”, applications is catered for with social media, blogging and wiki systems being easily accessible
- » Students can be encouraged to create their own content outside Canvas. They submit a URL linking to their own web workspace. Lecturers can still use the Speedgrader tool for assessment and take a snapshot of the assignment for record keeping

The flexibility that Canvas offers should also enhance blended learning and the extension of learning outside the classroom. For example, online group discussion is offered that can encourage a wider range of students to participate than may happen in the classroom, with or without the lecturer taking part.

A small feature that is often an annoyance for students and staff when using a learning environment is the time it takes to achieve simple tasks. Canvas claims to have helped with this by the use of “drag and drop” facilities and reducing the number of “clicks” required. The Open Source nature of the Canvas software has created an environment that allows better integration with other systems and the availability of a wide range of apps that enhance the learning environment.

An additional Canvas feature that makes it attractive to institutions like Hull University is that it is relatively fast to install and implement. This is clearly an issue for many large institutions which may be reluctant to move away from their present system because of the time and resources needed for migration.

The need for up to date learning analytics is increasingly important and, as might be expected, Canvas provides a range of graphical tools to assess student activity, submissions, grades and records.

In being one of the first large UK institutions to move to a provider that is relatively new to the UK market, Hull University has taken a bold step. However, it seems that Canvas is positioning itself as a “safe pair of hands” while still being innovative. A large university needs to be confident that the provider of a product, that is mission critical, has a stable platform that does the basics well. It needs to be straightforward to roll-out, have good integration with existing systems and a familiar interface. Additionally the new platform needs to offer a degree of innovation and a step up from previous or competing systems.

Newcastle University

Newcastle University is a typical large university that uses Blackboard Learn across its faculties and schools. It installed the most up-to-date version earlier this year and is licenced until 2020.

Their current learning environment use is generally quite traditional with content delivery being the most used feature. The e-learning team provide university schools with customised templates to support this and ensure levels of consistency.

Considerable efforts have been made to integrate Blackboard with other university systems such as their own eportfolio system, the NESS assessment and grading system, the Medical School's Learning Support Environment and the OLAF online assessment and feedback system.

The level of embeddedness of the learning environment is illustrated by the fact the the process of reviewing their requirements and needs, in order to plan for beyond 2020, has already begun. They aim to be in a position to tender in 2018. Along with Blackboard it's likely that systems such as Canvas, Moodle and Desire2Learn will be investigated.

In looking to the future, while needing a reliable and stable platform that fulfills the basic requirements at a large institution, there are a number of developments that are likely to take place. These include the move to a cloud based platform - it is felt that this may be the only option from vendors in future. The self hosted options already tend to lag behind the cloud versions. Other features include the increased provision of mobile apps for both students and staff.

There is considerable interest in Blackboard developments such as Ultra and Ally, and what these may offer.

Ally was a product recently purchased by Blackboard and now being offered for an additional fee. It assists with accessibility and inclusive learning providing guidance on the quality of content. Checking for accessibility issues and generation of alternative accessible formats are features of Ally. Instructors are provided with guidance on improving course content accessibility, and institution-wide accessibility reports are created.

Ultra is the latest upgrade to Blackboard. It is only available on the cloud based SaaS platform and provides an improved interface and user experience. Blackboard claim Ultra provides a personalized, proactive, and intuitive experience for learners and educators.

In discussing what students would like to see in terms of development it is felt that the priorities are:

- » Better mobile access
- » Improved consistency of content
- » More interactivity
- » Better collaboration tools

One area that is a current issue for the elearning team is the need to enhance blended and fully online learning. The current licence provision does not help in this area, for example, the provision of pre-registration courses for new students is problematic when the student does not have a registered login.

The wish list

The range of developments and improvements that would be beneficial include:

- » Better integration with other systems such as Office 365, assessment and grading systems, video systems etc
- » Simple content creation tools, for example changing of text size and colour
- » Better diagnostic and feedback mechanisms
- » Support for double blind marking (this is mainly a UK technique so north American systems tend not to use it)
- » Better collaboration tools - allowing students to create groups, share content and use drop boxes
- » Support for online exam style assessment
- » Need for online summative assessment on own devices
- » Improved blended learning support
- » Video capture of lectures within the VLE

A number of these features already exist in some learning platforms, or are planned, but they will need to be an integrated and simple to use part of the platform, rather than “add ons” for them to be successfully deployed.

Lastly, in large universities there will need to be confidence that new developments will not compromise the stability and reliability of the platform when the learning environment is a mission critical system right across the institution.

Queen Mary University of London

a Russell Group institution using Facebook to enhance its teaching

Queen Mary University of London's E-Learning Unit provides encouragement to staff using Facebook to enhance their teaching. Their advice shows that Facebook can be used to fulfil many of the functions provided by a traditional virtual learning platform. These functions include:

- » Setting up public or closed groups for courses
- » Various communication methods such as:
 - › Using a "wall" for group and general comment style communication
 - › Messaging for personal communication
 - › Newsfeeds for the latest activities and course information
- » Galleries for images and graphics
- » Sharing course content, references, links and resources
- » Additional apps for a large range further functionality

Student familiarity with Facebook is seen as a key benefit. They don't need to learn to use something new, it is usable from the day they enrol and is already part of their daily routine. At Queen Mary, Facebook is being used for induction, assessment, providing feedback and helping time management.

Facebook enables teachers at Queen Mary's to extend their classroom in a number of ways. As a social network tool Facebook is designed to enable communication, collaboration and network building which can be focused around a discipline or specialism. In a more structured way it can be used at course level to build activities. The E-Learning Unit feels that *"this supports a form of 'social learning' – constructing learning in a social setting."* Additionally Facebook is promoted as an aid to the administration and management of courses across year groups or departments. For example, seminar timetables and deadlines for essays can be communicated and managed.

Returning to student familiarity with software, their high level of understanding of its use means that many students use it for revision and arranging group or project work. Also Facebook's integration with the mobile devices allows students to engage with course discussions and materials anytime, anywhere.

A number of examples of classroom practice have been identified by Queen Mary's E-Learning Unit across a range of disciplines including engineering, English, modern languages and computing science. They have also identified some key issues that need to be addressed in using Facebook, such as:

- » Whether Facebook is duplicating an existing college service
- » As a discussion forum there is a lack of threads to conversations
- » The need to understand security settings when setting up groups
- » How to moderate the site, assess student contributions and review posted content
- » The use of advertising within the Facebook
- » Student may have different academic and personal profiles
- » The need to comply with University Guidelines on such issues as harassment, abuse, bullying and copyright
- » The ownership of posted content
- » Backing up and storing course data, and what happens after the course has finished
- » The level of access for students with Special Educational Needs?

Many of these issues are not unique to Facebook and are relevant to using other online platforms.

The Queen Mary E-Learning Unit's guidance on using Facebook to enhance teaching can be found at: <https://elearning.qmul.ac.uk/enhancing-your-teaching/using-social-media/using-facebook-in-your-teaching/>

Leeds Beckett PULSE project

Leeds Beckett University are exploring personalised learning spaces in a Higher Education Funding Council for England (HEFCE) funded project, PULSE. They sought to connect existing personal spaces used by students with institutional spaces, integrating the formal and the informal. Rather than create a new platform, they set out to develop an architecture through which to connect existing spaces.

The **Known** (<https://withknown.com>) platform was used as a “hub” to which students connected their established personal social media accounts such as Twitter and Facebook, SoundCloud, Flickr and LinkedIn. Previously the students’ discussions, assessment and feedback were held within the institutional VLE. This meant that their contributions were entirely independent from their social media activity, and also under the control of the institution, including ceasing access at the end of the course.

Using Known, the students pre-authorized access to their personal accounts so that when a piece of coursework was submitted to the hub, it could also be shared to their social media spaces. An example is graphic design students who wish to publish content to Flickr and LinkedIn, to showcase their work and connect to professional and commercial networks.

Using PULSE, their work can both reside in the institutional formal work space, including for assessment, and also be immediately shared across other networks and spaces. Simon Thomson, Head of Digital Pedagogy at Leeds Beckett, described how students and staff alike have different audiences and different spaces, but there were differences in practice. Students tended to be more comfortable with a single identity across social and work spaces, whereas staff often chose to set up a different identity in social media to separate their social and professional identities.

These differences were one reason why the project tried to connect across different spaces, maintaining the sense of organisational management of coursework and assessment, but also allowing the content to reach out to other spaces under the control of the students.

The sense of ownership for students was a big driver for the project, although Simon described how students lacked the confidence and capability to implement some of this themselves, for example through an IFTTT approach. Instead, the central hub using Known moved them close to this goal, making it easier to manage from within a familiar central space.

The aim was to connect up this hub to the institutional VLE, providing the necessary link to the formal systems used for holding content and submitting assessed work. However, despite initial enthusiasm from the vendors, the lack of open APIs meant that this was still some way off. Instead, the project aims to provide a proof of concept by connecting with an in house departmental learning environment.

IFTTT for education, the challenges of integration

The Jisc co-design consultation on next generation digital learning environments explored the topic of connecting institutional technology and user-owned tools. A wide variety of tools was recognised to be in use, both those focused on education such as VLEs and e-portfolios, but also social media and individual tools for personal organisation. A popular idea was that connecting these together would bridge the different digital spaces and identities to provide a more coherent and integrated set of tools, and more individual flexibility.

The if this then that (IFTTT) approach described above was identified as a concept that would support the connection of different tools and systems. In principle this would allow data to be exchanged between tools and systems. In addition, content from web tools could also exist within the institutional system and data and analytics could be maintained to support learner activity and institutional functions. This combination of more personalisation and control to the learner whilst keeping institutional management seemed a perfect solution.

However, no substantive examples could be found. A number of challenges were seen to arise when efforts are made to implement this concept.

1. IFTTT in practice relies on a portfolio of compatible apps which whilst allowing interesting combinations, are not currently focused on education. They excel firstly in supporting personal efficiency such as logging activity and transferring records and secondly in interacting with home systems such as heating and appliances
2. VLEs are not always particularly open to integration. They may not make open APIs available, relying on close collaboration with developers from the supplier. This limits the options for those wanting to experiment with connecting
3. As identified at Leeds Beckett University, the expectation on students to select, install and manage the appropriate combination of apps may at this stage be unrealistic. The shift of control is perhaps too far towards the student, lacking the necessary institutional “comfort” of having a managed space and clear direction from tutors
4. Similarly, the expectation on teaching staff to support students in how to combine and use a set of apps may be beyond the current comfort and capability levels. IT services equally may not be setup to handle many diverse requests about devices and apps. Often the move is the other way, to a standardised set of tools and services that can be supported in a professional and efficient manner

A number of potential future options arise from this discussion to move this scenario forward:

- » The IFTTT portfolio of apps expands to substantive education-specific tools and services that are more relevant to managing learning “environments”
- » Innovative use of IFTTT sequences of triggers and actions begin to demonstrate applications of real value and relevance to supporting learning in a coherent way
- » VLE and other platform suppliers develop more open APIs that allow closer integration and interaction
- » An analytics ecosystem is developed to support the collection and manipulation of learner data without relying on heavily embedded institutional systems such as VLEs

Aula conversational platform

Challenging the status quo - interview with Anders Krohn

Aula CEO Anders Krohn argues that teaching is changing, with a fundamental shift to blended approaches and, in physical spaces, a greater focus on flexible rooms for activities that value the critical interaction between tutor and students. He believes that the evidence shows that current learning systems are failing to achieve the student experience and learner engagement desired. The focus is too much on static content with a lack of contextualisation. Where learning systems have been best used, he argues this is down to the effective discussion-led activities, with other parts of the VLE interface and additional functions complicating the navigation and experience.

The Aula interface

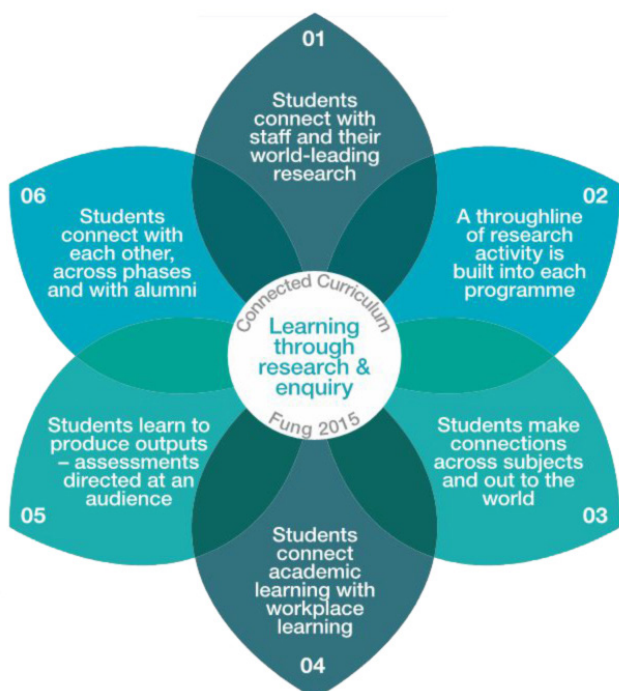
Krohn points to the huge popularity of wechat in China, and Facebook messenger worldwide, as a trend towards simpler interfaces that are based around conversations. Moving away from the practice of sending emails out to students, classes in Aula have a class feed and are also able to message others directly in the platform. The class feed is used for discussions, questions and sharing content, with support for various forms of content including mathematical equations, music notation and coding within the feed. Instructors can easily move between classes and each class has a space for organising files, links and other content.

Integrating

The integration 'ecosystem' refers to the API based approach that allows linking seamlessly to other apps such as polling tools, forms or cloud storage. An API approach is becoming common, including with other communication-based systems such as Slack, but Aula claims to offer both APIs and the educational infrastructure connections for example to support analytics or plagiarism detection tools.

Aula in use

Aula has been piloted with 200+ classes across 30 universities during the past year and is now being used in institutional pilots at the first Founding Partner Institutions, namely Oxford University's Saïd Business School, Ravensbourne, and Sky School (a high school for refugees). Over the next year, they expect at least another eight universities to start institutional pilots of Aula as a conversational alternative to traditional LMSs/VLEs. Different classes can use the platform in different ways such as peer discussion, video content, or sharing articles they have read. An MBA instructor asked students to reflect on their own experience of work and post a summary relating to the themes of the class.



Connected curriculum at UCL

The UCL Education Strategy⁸ highlights research-based education, connecting teaching with research, and connecting across disciplines through the concept of the “Connected Curriculum”⁹. It aims to “change the nature of the dialogue between staff and students”, with objectives of students becoming “well-prepared for future career success in a global economy and for a lifetime of intellectual and personal development through further academic study, research and life learning courses.”⁸

Steve Rowett leads the Digital Education Futures team at UCL. Their VL - Moodle - is used across all taught programmes, with guidance provided through an e-learning baseline¹⁰ which sets out minimum expectations for provision. Like many institutions, the VLE is linked to the student records system, so that tutors and students see only the list of modules in which they are enrolled or teaching. Some more generic study skills courses, are open to everyone, but in general modules are locked down to particular year cohorts.

This personalisation provides obvious convenience for students, but has a side-effect that is often not discussed. Steve notes that the lack of browsability and discoverability limits a student’s ability to explore around the university see what is going on, glimpse disciplinary differences or just learn something new out of sheer interest.

A safe environment

Steve sees technology as a way of providing a sense of community and engagement, and observes a convergence of previously separate sector groups sharing common interests in learning technology, student engagement and student wellbeing. UCL has been thinking about how to provide technology environments that encompass the feeling of being part of the university, where students could mix and share experiences, educational or otherwise, within a safe and supported environment. Steve reports that “defining the area that is safe for students and teachers to try things, and make mistakes in a safe environment, has been a big part of our thinking.”

Social networking options

Steve and his team looked at social networking platforms such as Facebook as an obvious fit for developing more connectivity. However, they found that these were often not places that students and staff co-exist and work together, with the Facebook ‘friend’ relationship seen as inappropriate in an educational context. There were also some issues raised about social networking sites more generally, including anxieties such as FOMO (fear of missing out) or the need to be highly visible with an ‘interesting; life.. Such influences on psychological well-being are believed to be a factor in increased referrals to mental health support services. In addition, students view social networks as very much a personal space out of the public view, and fear that employers or potential employers might find things out about them.

Implementing a new environment

UCL are part way through a process of scoping a new digital learning environment that captures their need for connectedness and better discoverability. One aspect being considered is learning analytics, which becomes more complex in a more exploratory technology landscape. One possibility is to use analytics to support student welfare and wellbeing, identifying at-risk students and provide suitable interventions for them.

[1]

⁸ UCL 2017, UCL Education Strategy 2016-2021, accessed 3 December 2017, [ucl.ac.uk/teaching-learning/education-strategy](https://www.ucl.ac.uk/teaching-learning/education-strategy)

⁹ Dilly Fung, A Connected Curriculum for Higher Education. London, UCL Press, 2017.

<https://doi.org/10.14324/111.9781911576358>

¹⁰ UCL 2016, Introducing the new UCL E-Learning Baseline, accessed 3 December 2017,

[ucl.ac.uk/news/staff/staff-news/July/270716-new-elearning-baseline](https://www.ucl.ac.uk/news/staff/staff-news/July/270716-new-elearning-baseline)

Bolton College - adaptive learning

At Bolton College, teachers create content that uses the VLE. However, in contrast to the typical VLE approach of making available standard homogeneous content to all students, they use analytics to provide a personalised pathway through the content. Aftab Hussain, Strategic ILT Lead at Bolton College described how they aim to mirror the classroom approach of teaching that is differentiated, contextualised and personalised, but within the digital learning environment.

Integrating data

Information about the student is retrieved from the student management information system and other sources, and the VLE effectively becomes just another database that is interrogated for content and activity. SCORM packages in the Moodle VLE have been linked to an underlying data set that is accessed by a business intelligence layer. The data is combined, tidied up and interpreted, with decision making presented back to the VLE interface.

Adaptive pathways

Students are differentiated according to the dataset about them, and presented with targeted content and assessment materials. Adaptive algorithms mean that every student sees something different. A wide set of variables can be accounted for such as how they performed in previous tutorials, leading to more stretch and challenge if they did well, or something less difficult if they didn't. The data may also suggest a preference by that student for certain style of learning - a particular media format or time of day when content is typically accessed. Historical data and algorithms can thus suggest long term patterns, needs and preferences, combined with knowledge of the student's goals and future plans and their current performance. Teachers are involved in the development alongside data and systems specialists and Aftab feels that this cross functional teamwork is crucial.

Digital assistants

A key interface to students and staff is the online digital assistant at Bolton College, Ada. Ada, referred to as a "cognitive service", can provide updates, notifications and respond to queries, drawing from the same data set(s), including for teachers such as asking Ada for a list of students who are falling behind. Natural language generation (NLG) is also used for example when a teacher posts a new item on the VLE, the student receives a transcript describing what has happened. Ada sits on top of the VLE so is easily accessible and is seen as the main medium for accessing learning services.

Conversational tutorials

The Ask Ada service is also used within online tutorials at Bolton College, providing "conversational services" to assess students. In contrast to using multiple choice quizzes to assess student understanding, the conversational service enters into a dialogue with students. Questions and answers are exchanged between the student and the cognitive assistant, using natural language processing. Teachers can then monitor the questions from each student to inform the classroom activities. This application of the technology particularly suits the diverse student group participating in the employability course.

Future of the VLE?

In some ways the platform has become somewhat secondary to the data and algorithms that drive the learner pathway. Conceivably, the VLE could be replaced by a different content host, or even in future be relegated to a storage function, from which content is retrieved and displayed through another interface, although at this stage Aftab believes the services are not mature enough to completely replace the VLE. Some functions that can be performed by the VLE are now delivered by Ada however. Students can hand in an assignment, or find out when the next one is due through Ada. Previously this would have required accessing the VLE and clicking to the relevant page.

Just ask Ada

Performing the activity through Ada is easier and more natural, Aftab explains. They simply ask Ada “when is my next assignment due”, and Ada knows who they are, what courses they take and the status of all assignments. It even knows if they are planning to go to university, and what assignment marks they need to be sure of achieving the entrance grades. This is far more context rich than the VLE itself is aware of, and the traditional approach would require the student to know the dates of assignments across their courses, look in the right place in the VLE, and process all the contextual information themselves. In fact Ada can even be proactive, knowing that you have an assignment due shortly, it can prompt you what you need to do next.

Bolton College’s Principal Bill Webster states:

‘we are using a generation of new technologies that help us to simplify and transform the way we support all our students. Students receive contextualised and personalised online learning and assessment materials which adapt and respond to their unique needs. We have reached a point where students simply have to talk to an online digital assistant to gain insights into their studies which is transforming the student experience in a manner which was unimaginable a few years ago.’

The University of Edinburgh - values and historical patterns

Learning analytics products have commonly been used to identify “at risk” students, with a strong focus on retention. Activity on the VLE is often seen as a proxy for engagement and activity more broadly across the course, predicting student performance. Anne-Marie Scott, Head of Digital Learning Applications and Media at The University of Edinburgh described how retention is not in general a significant issue at the university, but that different types of courses (particularly online distance learning vs on-campus blended courses) can have significantly different profiles, leading to questions about the nature and scale of data available from VLEs and elsewhere, and what can be meaningfully interpreted from it.

Operational activities at Edinburgh have focussed on two key areas. One was to explore via a pilot, a set of historical data about distance based online courses, to determine if a predictive retention-focussed approach might be useful. The other was to produce policy at a high level, developing greater awareness and a more robust policy framework to support future analytics activity.

Learning about analytics using historical data

Anne-Marie outlined how there is often an assumption with analytic tools that certain types of data are more meaningful, such attendance, but this might not be the case. Students may come to the university with well-honed study strategies and VLE data may not provide useful insights. The analytics pilot worked with a set of anonymised data and used historical modelling to identify patterns, in other words to observe the experience of “people like you” in the past as a way of predicting future likely trajectories. What is predictive for one student might be different for another. Interaction with the VLE is one of the data sets, but it could also be activity over time or relative to average, country of origin or how long they’ve been on the programme. The pilot project led to useful insights around areas such as digital literacy, and built institutional capacity, but critically it did not provide any new insights into student performance

and many sample sizes were too small to have statistical significance. The pilot has helped understand where and when a predictive type of analytics model using VLE data might be useful, and where it is not even where there is felt to be a rich data-set.

Policy

With the General Data Protection Regulation (GDPR) set to apply from May 2018, institutions will require a documented understanding of how information is collected, why it is held, who can access it and when it will be anonymised. This, combined with expected technological changes and increases in the amount of data available, means that there needs to be robust policy to support future activities.

Values

The University of Edinburgh initiated a policy conversation within the institution about analytics, focusing on agreeing values and principles, with the implementation details to be developed in a second phase. This approach meant that there were no assumptions about specific technologies and future changes in digital learning environment or other systems would not impact on the integrity of the policy. Principles around quality, equity and personalisation were identified, along with digital skills and efficiencies. In particular they were conscious of issues around bias and supporting all students, not just those at risk. This activity was also informed by Edinburgh’s participation in the EU-funded SHEILA project, supporting institutional development of learning analytics policy.

Future directions

The development of values-based policy and an analytics strategy that draws on a broad set of data is a combination that may well future-proof activities, withstanding future changes in the digital learning environment. The policy sits above any technological implementation and the analytics tools piloted were independent of the learning environment. Anne-Marie questioned whether interactions with the library such as retrieving references and sources may provide more meaningful insights to student engagement and performance than VLE analytics. She noted the tension over future directions between the desire to collect more data and the negative impact of perceived surveillance by students.

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