

# Building an evidence base for teaching and learning design using learning analytics

## PROJECT REPORT

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This report and related resources were developed from the Ako Aotearoa co-funded project: Building an evidence base for teaching and learning design using learning analytics data.

More information about this project is at:  
[www.akoaooteaoroa.ac.nz/using-learning-analytics](http://www.akoaooteaoroa.ac.nz/using-learning-analytics)

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# Executive summary

*Building an evidence base for teaching and learning design using learning analytics* was a two-year research project that aimed to promote positive changes to tertiary teaching and learning design practice. Recent developments have made the prospect of using students' digital footprints to inform teaching and course design more realistic. However, a gap between research and practice needs to be addressed for this to happen. Changing established practice to reap the benefits of technology-fuelled innovations is a complex task that requires a systematic approach, and involves multiple stakeholders in institutions where teaching is core business. Policies and acceptable use guidelines need to be written and synergies between policy and practice encouraged. Professional development and support, data access, analysis and reporting tools are also required. More importantly, evidence of the potential benefits and practical strategies to implement change must be available to teachers who are expected to take ownership of that change. Collaboration is a key to success for such initiatives.

Extensive resources have been devoted to learning analytics research and development in recent years. The project described in this report used an approach that was grounded in practice to build capacity from the bottom up to complement and inform institutional initiatives working from the top down. A primary aim was to address an acknowledged gap between the potential benefits identified by researchers, and adoption of learning analytics in teaching practice. An initial survey distributed to staff at three New Zealand tertiary institutions, 16 interviews and 6 case studies exploring the experience of early adopters of learning analytics practice informed the dissemination and professional development strategies that were implemented in the second year of the project. Conclusions were that the following actions would help to move the field of practice forward in a positive direction:

- Different stakeholders use different language and approaches to data handling for learning analytics. Collaboration across user, research and development roles is required to generate common understanding and a shared vision, to define teaching and learning support goals, and to provide suitable tools and implementation strategies;
- There are different, and sometimes conflicting drivers for learning analytics initiatives, including technical, pedagogical and administrative. Roles, objectives and priorities need to be clarified in each area so realistic targets can be set and resources allocated;
- Levels of expertise in data analysis and interpretation vary, as do opinions on which stakeholders should acquire the skills to access, analyse and interpret data. Upskilling for teachers is important, and user-friendly tools are required to present relevant data in usable format. Teaching support staff, course coordinators and administrators also play important roles;
- Many teachers need support to identify specific questions and learn ways that these can be answered using learning analytics data. One suitable form of support is to present the possibilities through familiar scenarios, easy to follow steps and fit for purpose tools;
- As with any significant change initiative, a number of organizational, policy and ethical roadblocks need to be addressed. Promoting synergies between institutional and practical issues and engaging reflective processes will produce the best solutions;
- There is a risk that any approach to learning analytics research and dissemination will be seen to promote a particular stance. Collaboration among stakeholder groups will help to mitigate this risk, and it is important that teachers, as users of learning analytics are able to participate.

At the present time, learning analytics can offer benefits to teachers and learners through basic approaches that allow teachers to answer questions about learning through independent use of data analysis tools and reports, or working as part of a team on more complex research and development projects. The latter option is more challenging and requires more resources.

There are many options for teachers, course teams, faculties and institutions to use learning analytics for different purposes. This research team chose to focus on teaching and learning practice because this is where we found the most obvious gap. It is also where we believe the biggest differences can be made for the benefit of teachers and learners.

## Background

*Building an evidence base for teaching and learning design using learning analytics*, a collaborative initiative for two New Zealand universities (Auckland and Massey) and one polytechnic (The Open Polytechnic), was supported by Ako Aotearoa's National Project Fund for two years from 2015-2017. Learning analytics is an emergent and often controversial field of practice in higher education. While online systems record learner interactions as a matter of routine, questions about informed consent and ethical use of these data require a policy framework and acceptable use guidelines, which tertiary institutions in New Zealand and elsewhere are working at varying speeds to implement. Meanwhile, research and development in learning analytics is advancing at a rapid pace. Parallel developments in user data mining and modelling in both the wider public sector and the commercial sector provide insights into what is possible and what might be acceptable for the education sector. The range of possibilities extends from simple descriptive statistical reports to complex adaptive tutoring and recommender systems.

Tertiary institutions have used student data to monitor trends and outcomes for many years, so in one sense, current developments are an incremental step forward for business intelligence. However, it is now possible to monitor learner activity throughout a course to gain deep insights into student learning and generate actionable insights in real time. Even at this early stage, research exploring the potential for learning analytics to illuminate the relationship between teaching and learning has produced some promising results. One popular area of application is to identify and target support for students who are not making good progress in the early weeks of a course. Other basic options include testing student knowledge outside of a formal assessment regime to sharpen the focus of teaching, and monitoring student presence and performance as a form of feedback on the effectiveness of teaching and course design. Linking learning analytics to learning design is seen as a critical step towards evidence-based course design. For a number of reasons, which are familiar to learning technology researchers, early results have not yet had a significant impact on educational practice. Hence, the main aim of the project *Building an evidence base for teaching and learning design using*

*learning analytics* was to narrow the gap between research and practice.

Key tasks were to quantify some of the benefits that research has identified, and present these to teachers and learning designers in the form of practical strategies they could easily adopt. A broad range of data literacy levels within the target group meant it would be necessary to demystify what is often perceived as a high-tech field of business analysis with little value to teachers. Key strategies were to 'translate' raw data into meaningful information for teachers, and to present the possibilities through familiar case studies, tasks and scenarios. In theoretical terms, what we did was to aim for the 'zone of proximal development' for target users, i.e. the space where support from more experienced colleagues could scaffold teacher knowledge development through the addition of new information to what is already known. This capacity development approach reflected the belief that the findings from leading edge research were too far removed from the understanding of many teachers and learning designers to impact on their practice without structured and targeted support. It also reflected the researchers' experience of promoting adoption of learning technology innovations, and the knowledge that synergies arise when a critical mass of users are fluent enough to shape research and development.



# Goals

The project goals were to:

1. Identify the learning analytics data that is currently available to teachers through common online learning management systems (LMS) such as Canvas, Moodle and Blackboard and elearning tools used for various forms of learning and assessment;
2. Develop a framework to guide educators in the selection of learning analytics data appropriate to the questions about learning they are seeking to answer at different points in time;
3. Demonstrate ways that analytics data can illuminate the relationships between a) learning design, i.e. a teaching plan with intentions and assumptions about what students will learn; b) intermediate learning outcomes, i.e. the study strategies that students use, their engagement in activities and construction of new knowledge; and c) final learning outcomes, i.e. what students can demonstrate they have learned;
4. Initiate sustainable changes in learning design and teaching evaluation practice within the institutions represented by our research team and promote similar changes in others;
5. Promote the principle that data is an objective and context specific form of evidence about learner behaviour and an important input to teaching and learning design.

This report describes the research approach and methods, the extent to which goals were achieved within the two-year timeframe, and ongoing activities related to the project. Links to creative commons licensed resources and open source code are provided in Appendix A, and research outputs to date in Appendix B.



# Project overview

The emergent field of practice referred to as learning analytics typically involves teachers and learning designers generating actionable insights from data held by institutions (enrolment details and progress records) and captured in real time as students interact with online learning systems to complete tasks. Institutions have always used student data to monitor various trends. The novelty of learning analytics is that key data is recorded automatically, e.g. when students log in or access resources on a course website, or generated by students themselves, e.g. as they enter quiz answers, submit assignments or contribute to online discussions. Datasets represent entire cohorts rather than samples, and sources can be combined to present a holistic picture of learner information and interactions. While acknowledging that learning analytics research extends far deeper than this broad description might suggest (Lang, Siemens, Wise & Gašević, 2017) the purpose of the study described in this report was to explore ways that learners' 'digital footprints' can inform decisions at practice level about effective teaching, learning design and learner support through actionable insights.

The ease of capture and increasing availability of large data sets, the rapid growth of online learning and a culture of performativity have all been identified as key drivers of learning analytics (Ferguson, 2012). The twin goals of learning analytics are to illuminate the learning process and optimise the environments in which learning takes place (Ferguson, 2012, Siemens, Dawson & Lynch, 2013). Learning analytics can be used wherever learning takes place, i.e. in informal or formal settings and in online, blended or face-to-face modes.

While the research literature is clear about the drivers and goals of learning analytics, perceptions, awareness and levels of adoption among target users vary widely across the sector. An emerging discourse among practitioners<sup>1</sup> uses language suggestive of technical wizardry and the need for high-level data wrangling and statistical analysis skills. Genuine concerns have been raised about the use of automated methods, complex data mining and predictive modelling techniques (Prinsloo & Slade,

2017; Selwyn, 2015; Eynon, 2013). Target users, i.e. teachers and learning designers, tend to use simpler language and seek access to data that will help them answer fairly basic questions about what students are doing and what helps their learning. Perceptions of technical complexity are a deterrent to some potential users and raise ethical concerns about using data that may be collected and analyzed without learners' explicit knowledge or consent (Beattie, Woodley & Souter, 2014). On the positive side, early results have demonstrated benefits such as increased retention rates, deeper insights into student learning, evidence informed course design and clearer communication between students and teachers (Clow, 2013).

Against this backdrop, researchers from three New Zealand tertiary institutions worked together to find ways to demystify the complexities of learning analytics and bring the benefits of data informed practice within reach for teachers and learning designers. We adopted a practice-focused approach, and aimed for the 'zone of proximal development' for target users. We conducted two surveys, one to provide a snapshot of target users' perceptions and another to explore how the results related to the ways researchers and practitioners talk about learning analytics. Our findings were similar to a European survey (Drachsler & Greller, 2012), which found no established definitions and various meanings ascribed to terms as basic as 'learning analytics' and 'data'.

Another early step was to identify frequently asked questions about teaching and learning that could be at least partially answered by the data captured as a matter of routine by online learning tools. Key information was gleaned from six case studies and fifteen interviews with early adopters of learning analytics practice. This offered insights into the kinds of questions teachers were asking about students and learning, and identified practical ways that analytics data could help to provide answers if data was accessible and in readable format. The case studies involved close collaboration between researchers and tertiary teachers to maintain the focus on practice. In some cases, institutional IT Services staff were involved, as tools to collate, analyse and present data were developed, tested and revised based on feedback from teachers and other stakeholders. The case studies offered authentic examples of how using learning analytics data as a source of primary feedback could increase teachers' understanding of student learning in a range of

<sup>1</sup> ... Wolff & Zdrahal (2016) define a practitioner as a researcher or developer of learning analytics systems, and a user as a teacher or learning designer applying practitioner-developed tools to answer questions about learning.

contexts and circumstances. They showed how this information could be used to inform teaching and learning design, and to provide personalised support to students, which is particularly important in large first year classes. A review of common online learning tools revealed relatively simple ways to combine the data they generate with student information from institutional databases and present this in easy to read reports for teachers to base actions and decisions upon.

As a key aim of the project was to encourage teachers to adopt learning analytics in their practice, dissemination was another critical step. We presented different stages of the work in progress and received constructive feedback from delegates at learning technology conferences in New Zealand and overseas. To reach the widest possible local audience, we invited tertiary institutions around New Zealand to co-host a series of workshops, seminars and panel discussions in October 2016. A total of around 200 people attended events in five locations. Seminars and workshops were designed to raise awareness and offer hands on experience with learning analytics tools and practices that featured in our case studies. Panel discussions provided an opportunity to explore perspectives on learning analytics with IT services, administrators, data scientists, teachers and learning designers, and to a lesser extent, institutional managers. The practice-focused approach to learning analytics adoption thus received feedback from a wide audience of researchers and potential target users. It also helped to reveal institutional barriers and enablers, so that key stakeholders could be identified and relevant steps taken to foster a supportive institutional environment for teachers to adopt learning analytics.

In terms of progress within the two-year project timeframe, our study found that, with a few notable exceptions, the development of learning analytics systems, policies and practices at New Zealand tertiary institutions was still at the proof of concept stage. While it was possible to use learning analytics data as an evidence base for teaching and learning design, and to identify individuals and groups of students who may benefit from different forms of support, it may not be easy to access the relevant data in usable format. Professional development and incentives for teachers are required to promote both the benefits and the methods of data informed teaching, learning design and learning support. Institutional commitment to provide effective data

management and access protocols, user-friendly reporting systems, supportive policies and acceptable use guidelines is a critical factor. Many institutions are working towards this, though collaboration with target users is limited, so there is no guarantee that systems will be fully integrated, fit for purpose or easy to use. Within the broader context, there are 'institutional readiness' assessment tools<sup>2</sup> a UK national initiative to support institutions through development and change<sup>3</sup>, and nationally funded learning analytics initiatives in Australia<sup>4</sup>.

While the principal aim of our study was to facilitate the adoption of data informed teaching and learning design practice within supportive institutions, the project also contributes to the evolution of research methods for learning technology. Many researchers, including e.g. Bennett & Oliver, (2011) and Tamin et al. (2011) have identified a gap in understanding of what constitutes effective design for online and blended learning. This is partly due to a lack of reliable evidence of what works and why (Gunn & Steel, 2012). Hattie & Timperley (2007) noted the importance of closing a feedback loop from learners to teachers, yet the effective means to do this remained elusive until recently (Kennedy et al., 2014). Now, learning analytics adds a new dimension to an evidence base for online learning by providing teachers with critical feedback in the form of 'digital footprints' for entire cohorts of learners (Elias, 2011). The outstanding challenges are providing timely access to data in readable format, and influencing the practice of teachers and learning designers so they can reap the benefits.

2 ... <https://analytics.jiscinvolve.org/wp/files/2016/08/jisc-Learning-Analytics-Readiness-Questionnaire-Version1.4Aug16.docx>

3 ... <https://www.jisc.ac.uk/rd/projects/effective-learning-analytics>

4 ... <https://utscic.edu.au/projects/olt-projects/learning-analytics-in-australian-higher-education/>



# Presenting learning analytics to teachers

Definitions of learning analytics commonly used by researchers and practitioners remain contested, and may contribute to the problem of low rates of adoption by teachers.

*Learning analytics is an emerging field in which sophisticated analytic tools are used to improve learning and education. It draws from, and is closely tied to, a series of other fields of study including business intelligence, web analytics, academic analytics, educational data mining, and action analytics. (Elias, 2011)*

*Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs. (Siemens & Gasevic, 2012)*

*Learning analytics are rooted in data science, artificial intelligence, and practices of recommender systems, online marketing and business intelligence. The tools and techniques developed in these domains make it possible to identify trends and patterns, and then benchmark individuals or groups against these trends. (Mor, Ferguson & Wasson, 2015).*

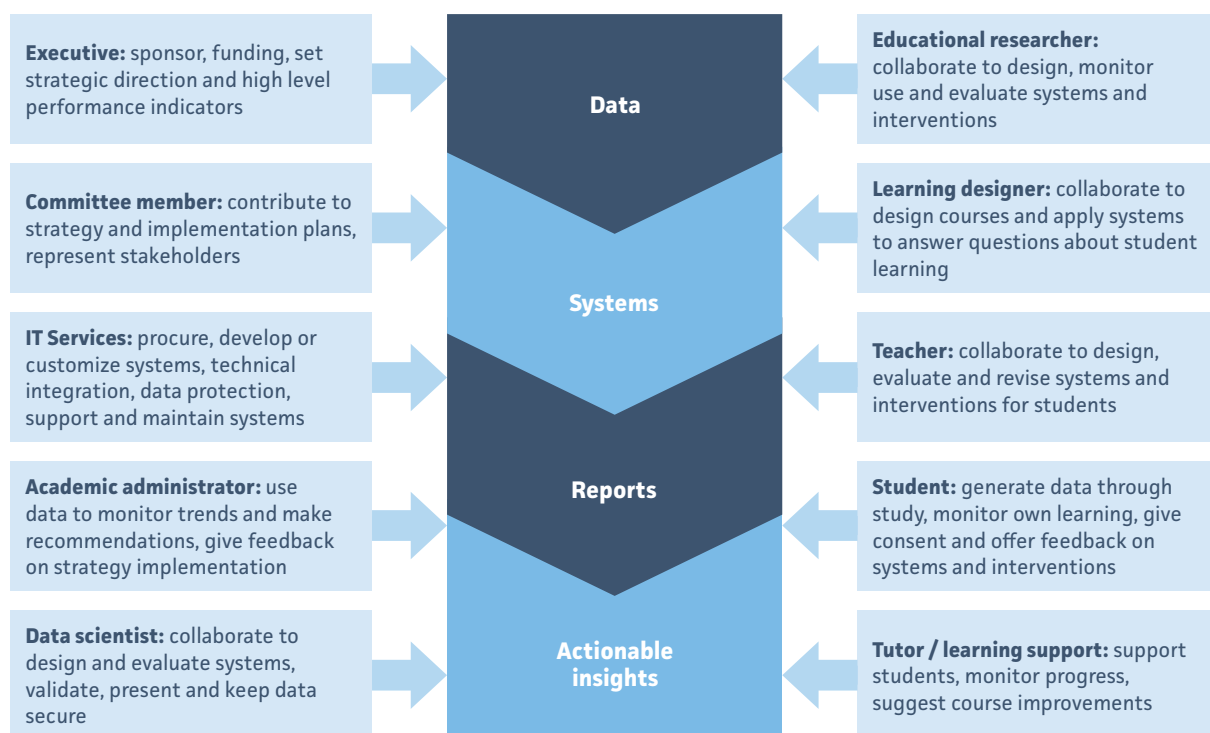
While descriptions like these are a valid way for researchers to conceptualize the emergent field of practice, they are too technical to appeal to many teachers, and therefore unlikely to encourage them to modify their practice to embrace the opportunities on offer. Furthermore, teachers are all but invisible in existing definitions, so describing learning analytics as a way that data can help teachers to answer questions about learning or address common challenges may be a more productive approach. For example, learning analytics data offers a way to close a feedback loop for teachers on their assumptions about learners and the learning design decisions they make (Kennedy et al., 2014), or to monitor student interaction with course content and activities (Sclater, Peasegood & Mullan, 2016). These are prospects most teachers would relate to and want to explore. Another useful strategy is to demonstrate how learning analytics can work with the individual and intuitive nature of teaching and learning at practice level, e.g. through teacher inquiry (Mor, Ferguson & Wasson, 2015). Focus on teaching context rather than technical aspects of learning analytics helps to bridge gaps between the discourses of learning analytics, educational research and teacher inquiry.



# Grounding research in practice

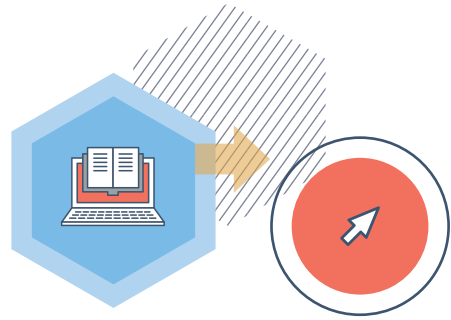
Initial investigation of local and global developments in learning analytics identified a gap between research and practice. Few initiatives involved collaboration between researchers, system developers and target users in a participatory design process. While a research focused approach may advance knowledge and produce technically clever systems, ultimately, it may have little impact on teaching and learning design practice. To promote use in practice, we used a capacity development approach. Tamas, (2008) described capacity development as a process that hinges on the identification and removal of barriers to progress in a particular area of practice. This required investigation of emergent practice within participating institutions to find the points of connection between questions teachers are asking about student learning and the roles that different stakeholders play in presenting data to provide the answers. Sclater (2017, p194) identified eleven different stakeholder groups in learning analytics projects. Figure 1 is an adapted list that reflects the local project context.

Mindful that *'policies can drive forward an agenda for change, but the real test comes at the point of use'*, (HEFCE, 2008 p5), our research explored local, grass roots learning analytics initiatives. We identified and interviewed fifteen early adopters and selected and developed six case studies to add to the data returned from the surveys. These sources combined to offer a sense of what teachers, learning designers and other stakeholders understood about the challenges, opportunities and affordances of learning analytics. Members of the research team were already working on learning design or analytics development initiatives with some of the case study leaders. The boost of external funding allowed these projects to progress further and with better resources than would otherwise have been the case. The initial findings led to development of a framework (see p12) to facilitate presentation of learning analytics concepts and practices developed through case studies to a wider audience. This framework was a key element of the dissemination plan and a professional development strategy that drew on principles of good practice for learning technology adoption initiatives (Gunn et al, 2014) as well as findings from the research into user awareness and perceptions. The project goals and activities outlined above are described more fully in the following sections, with a summary of research methods and findings.



**Figure 1: Learning analytics stakeholders and roles**

Source: Adapted from Learning analytics explained, Sclater (2017, p194)



## Goal 1:

Identify the learning analytics data currently available to teachers and learning designers through common online learning systems and tools.

### Research methods

Literature reviews, product knowledge and documentation, survey, interviews

### Findings

The range of data collected as a matter of routine by online learning systems and tools is common knowledge among elearning practitioners and is described in product information. This typically includes system records of user interactions, log ins, pages or resources visited, timestamps and downloads, as well as student generated content such as quiz answers, assignment submissions, questions and discussion posts. Student administration systems hold personal and demographic data along with records of enrolments and current and previous

achievements. There is a trend towards presenting data from different sources; for example, online learning system log data can offer teachers a more detailed profile of an individual student or a student cohort when combined with demographic or prior performance data. While most common elearning tools including the LMS capture interaction data, it is only recently that these systems have begun to present the data in readable or user-friendly format. While combining data from different sources may be useful, most institutions have a short history of being asked to do this, and the task may not be a straightforward technical one. Further details of some of the different types of data that are used for learning analytics are provided in later sections of this report, where their use and relevance to actionable insights is explained.



## Goal 2:

Develop a framework to guide educators in the selection of learning analytics data appropriate to the questions they are seeking to answer.

### Research methods

Literature reviews, case studies, survey, interviews, prototype and peer feedback

### Findings

A simple Learning Analytics – Learning Design (LA-LD) Framework with real world examples is a useful way to demonstrate data informed teaching and learning design opportunities.

Different types of learner data can be a useful input to learning design and a valuable source of feedback on teachers' assumptions about student learning and course design decisions. However, it is not always easy to access relevant data or to find practical advice on how to access and make use of the data that is available. The LA-LD framework (Figure 2) can be used to prompt teachers to focus on very specific questions at different points during the regular teaching cycle. It can also be used as an entry point to make sense of more complex learning analytics conceptual frameworks as teachers gain confidence and begin to incorporate learning analytics data into their daily practice.

Other examples include, the Learning Analytics for Learning Design Conceptual Framework (Bakharia et al., 2016) and The Framework of Characteristics for Analytics (Cooper, 2012).

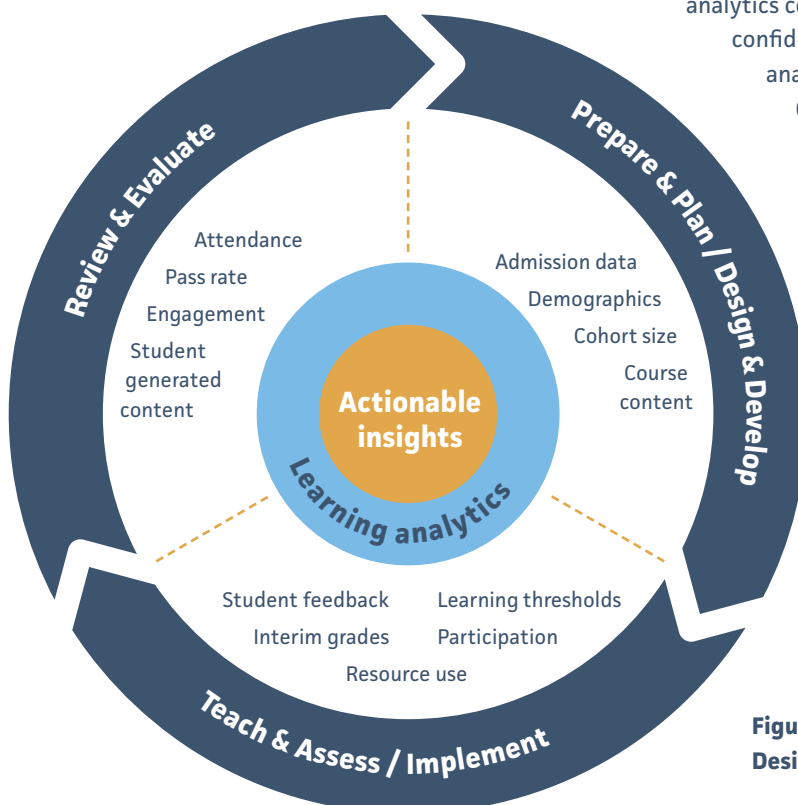


Figure 2: The Learning Analytics – Learning Design (LA-LD) Framework

## Purpose

The LA-LD framework can be used in a professional development activity to generate a personalized learning analytics action plan with a set of questions, data collection and analysis strategies, and plans for action and reflection. It was designed to help teachers widen their use of learning analytics. While learning analytics tools are becoming more user-friendly and efficient for teachers to use independently, our case studies and survey results showed that currently, for teachers to engage with learning analytics, a collaborative approach with more experienced colleagues is required. One of the most important roles for teachers working collaboratively is to be able to ask the 'right' questions.

## Evaluation

We offered presentations and facilitated workshops to promote practical application of the framework using scenarios based on our case studies. While a few technical staff and managers chose to attend these workshops, the majority of attendees were tertiary teachers from both the university and polytechnic sectors.

The LA-LD framework was introduced as part of a five-step process during the workshops:

1. Participants were asked to describe a course they taught, where they had questions about its effectiveness, and how students learned during that course.
2. Participants listed their questions or issues they had with teaching and learning in that course.
3. Participants listed all the types of student and course data they worked with before, during and after the course. This required them to clarify:
  - a. What counts as 'data', what can be measured, and what can be used ethically;
  - b. What data is available, for the course identified in (1) *before* (e.g. demographic data, admissions, cohort size, or course content), *during* (e.g. student feedback, interim grades, quiz scores, students' written work, usage of online resources, posts to discussion forums), or *after* the course (e.g. resource usage data, student evaluations, grades, pass rates, failure rates, or retention rates).

4. Participants selected a question or issue from (2), and assessed whether there was any data they had or could collect in future (i.e. set a quiz or assignment with a due date to check participation early on, or take a poll in a lecture about a threshold concept) that would help to answer that question or address that issue.
5. Participants constructed a brief scenario, which formed the basis of an action plan, for using learning analytics in their teaching. This scenario was structured as: Problem statement, Strategy (pre-, during or post course), Data sources, Evaluate and take action, Design/teaching implications.

Feedback was gathered from workshop participants on the potential usefulness of the framework and the workshop process. We also invited feedback on the framework from case study participants.

## Results

Participants found the framework generally easy to understand and intuitive:

*The framework is a fantastic summary. I like how it is quite simple and clear; it looks and feels 'manageable'.*

One teacher noted that the framework provided a useful perspective, particularly for newcomers:

*I think the framework will be very useful to teachers – particularly those who are 'new' explorers in this area.*

Another found the cyclic nature of the framework appealing as it captured:

*...the main benefits of learning analytics ... as a means to an end, being continuous improvement...*

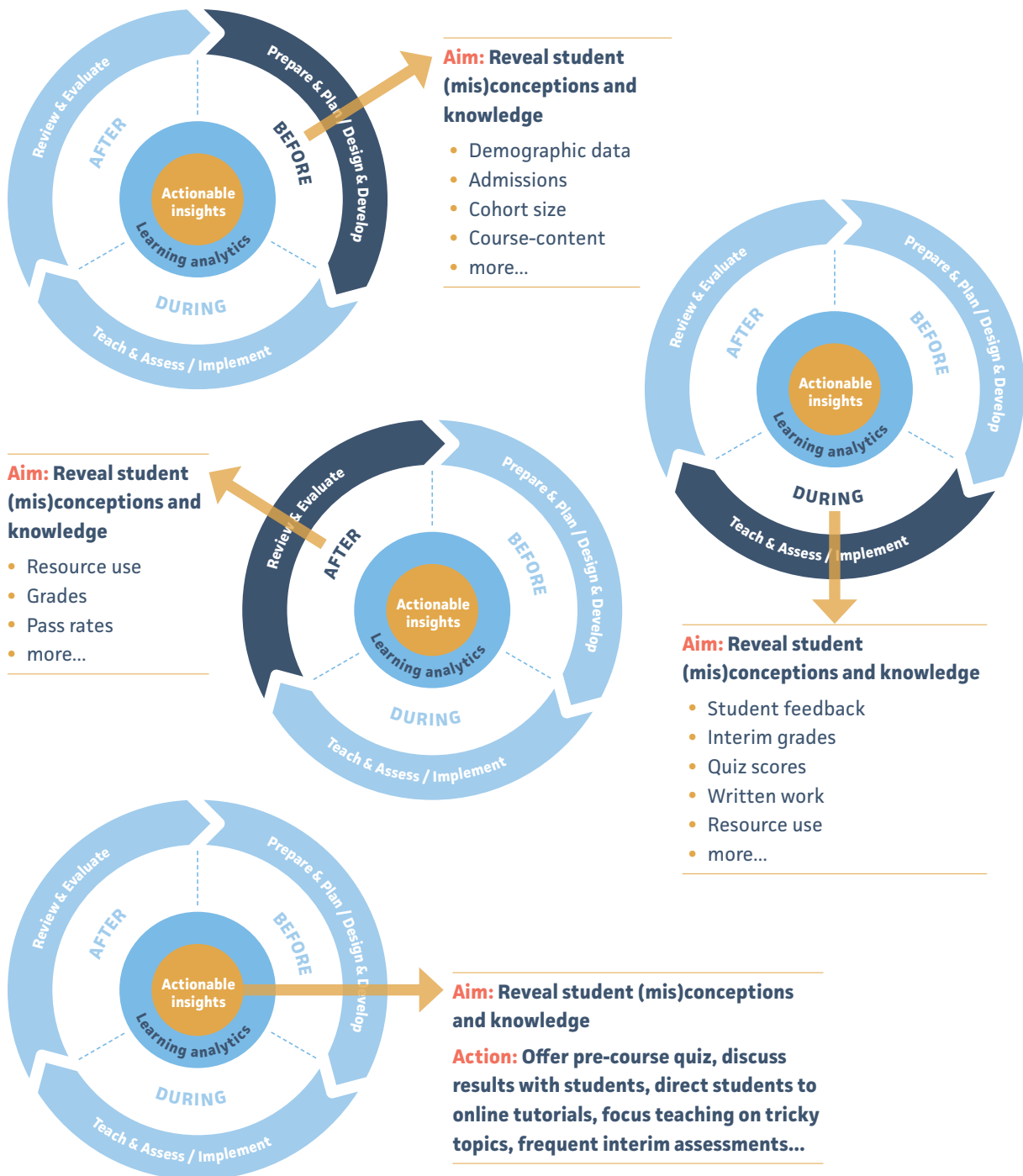
The trials also provided an opportunity to raise significant issues teachers were facing who wanted to use learning analytics. For example, obstacles to data access:

*I think the biggest barrier for most teachers (perceived or otherwise) is access to usable data (e.g. admission data, demographics, incoming GPE/A information). ... it might be worth mentioning what sort of assistance people can seek or where people can go for help in terms of making initial enquiries about accessing such data.*

It was suggested that the framework would be useful to administrators, data managers, learning designers and curriculum developers as well as teachers, and to

institutions to inform policy and strategic planning on learning analytics. Similar comments were made in response to a poster presented at an international conference for educational developers (ICED 2016, Cape Town). Suggested extensions were to provide templates, recommend starting points, and demonstrate benefits

of using learning analytics to improve courses. Further feedback on the LA-LD framework and supporting documentation will be gathered as it is incorporated into professional development sessions on learning analytics for learning design at the University of Auckland during 2017.



**Figure 3: Applying the LA-LD framework to a teaching scenario, highlighting data used before, during and after teaching to generate an actionable insight**



## Goal 3:

# Demonstrate ways that analytics data can illuminate the relationships between teaching and learning outcomes

### Research methods

Literature reviews, case studies, interviews

### Findings

A key potential benefit of learning analytics for teachers is the ability to illuminate the relationship between a) learning design, i.e. a teaching plan with intentions and assumptions about what students will learn; b) intermediate learning outcomes, i.e. the study strategies that students use, their engagement in activities and construction of new knowledge; and c) final learning outcomes, i.e. what students can demonstrate they have learned.

### Case studies

Case studies with early adopters identified through institutional networks allowed us to explore emergent learning analytics practice in the NZ tertiary context. This helped to identify questions tertiary teachers were asking about student learning and about their teaching, and practical ways to use data to help answer these types of questions. Some case studies involved collaboration between researchers, tertiary teachers and other institutional stakeholders, so the focus stayed on practice. Staff roles included academic development, student support, IT data science and administration. The case studies provided examples of how using learning analytics data as a source of primary feedback can increase teachers' understanding of student learning, and allow them to provide personalised support to students regardless of class size. Key features of the case studies are summarised in Table 1 and described in the following sections. Full details are available in a separate document, *Building an evidence base for teaching and learning design using learning analytics: Case studies*.

**Table 1: Case studies summary**

Title	Context	Questions	Approach	Findings
<b>Student engagement and retention (First Year Experience Project)</b>	College of Education. First-year, large class	Design and test intervention strategies from interdisciplinary team to support students through transition to University.	A five-point trigger for intervention was developed and evaluated. This included a combination of attendance, performance and online engagement measures.	Provision of weekly reports to teachers on triggers for intervention was effective. Important caveats for use were identified.  Strongest link was between in-person class attendance and performance.  Specialist skills required for different aspects of the project so a collaborative team approach was helpful.
<b>Student learning and engagement (Teacher perspective)</b>	Postgraduate science (1 teacher, 100 students) and engineering (1 teacher, 80 students)	Explore the relationship between teacher expectations and classroom reality in terms of LA data.	Qualitative interviews	Clear expectation that LA should help address teacher questions about student learning.  A range of practical issues and roadblocks prevented realisation of expectations.
<b>Student engagement (SRES v2) Reference</b> McDonald et al.(2016) <a href="http://bit.ly/2oq0gdp">http://bit.ly/2oq0gdp</a>	First year engineering, science and business studies. Between 860 to over 1700 students.	What steps are required to implement a LA tool designed to connect teachers with students?  Is the tool fit for purpose and can it be improved?	Pilot SRES v2 Open source software in 'live' classroom context.	Integration with university systems is critical.  Data policy and governance must support bottom up (students and teachers) data use as well as top down (business intelligence).  Benefit of multi-institution collaboration driven by teaching and learning imperatives for further development and support.
<b>Student engagement</b>	First year health science – 159 students.	Can we use LA data to promote engagement and design effective teaching strategies?	Mix of manual and automatic processes to extract data and determine interventions. Quantitative analysis.	With some caveats, LA data can promote student engagement and help them to succeed through i) improving contact between teachers and students and ii) informing elements of course design.
<b>Student engagement and retention</b>	Institution-wide ~ 30,000 online / distance students.	Illustrate how institutional student progress data can be shared with staff to assist coordination of support actions.	A bespoke reporting tool for staff with a description of use in practice.	Benefit of linking student characteristics and progress with shared record of staff contact with students.  Particular value to support first-time students.  Importance of sharing practice among tool users.  Generation of student contact notes creates a new dataset for analysis.
<b>Student learning (Analysis of written short answers) Reference</b> McDonald et al.(2017) <a href="http://doi.org/10.1111/jcal.12178">http://doi.org/10.1111/jcal.12178</a>	First year health sciences ~ 1500-2000 students per year.	Can we demonstrate empirically the theoretical link between student written short-answers and the teaching context?	Post-hoc exploratory analysis of responses to open-ended questions and relationship to course materials	Demonstrated evidence of student (mis)understandings in course materials.  Illustrated benefits of clustering student responses and comparing with teaching materials.  Noted potential for course design/teacher reflection cycles



## Case 1

### Student engagement and retention

The transition to university study, student engagement and retention were the focus for our first case study; a large, first year faculty of education class. A multi-disciplinary First Year Experience Team combined student information from institutional and faculty databases with online activity logs and performance data to monitor learners' progress. Learning milestones, or checkpoints, encompassing English language ability, physical attendance in class, assignment submission and performance and online presence were built into the course design. These checkpoints triggered contact with students who were not participating as expected. The goal was to reach out to students who may be at risk of failing before it was too late. This was achieved through an existing faculty programme where all first year students were assigned mentors to support any aspect of their studies. The aim to offer timely, individual support to students was part of a strategy to reduce a high non-completion rate in first year courses.

Key findings from this case study included:

- Monitoring learner activity throughout a course provided useful feedback to teachers on their learning design decisions;
- Although there may be other reasons for the higher pass rate and number of assignment submissions for the student cohort featured in this case study, it is likely that timely support, scaffolding student learning through formative assessment and mentoring as a form of individual support all contributed to these increases;
- The trigger with the strongest positive link to overall performance was in-person classroom attendance;
- A range of specialist skills was required to conduct this case study, emphasising the value of a multidisciplinary team approach.

## Case 2

# Scoping a learning analytics system to explore student learning and engagement

A very different approach was taken in our second case study where we conducted in-depth interviews with two teachers in different courses over an extended period. Part of the original goal for this project was to use the interview data to inform the development of custom analytics reports for an in-house course delivery tool. One teacher was responsible for a postgraduate science course with around 100 students and the other for a postgraduate engineering course with approximately 80 students. Both teachers felt that learning analytics should be able to provide:

- Coarse and fine-grained analysis of student engagement with course components and assessments, including the ability to drill down to specific individuals.
- Analysis of discussion forum participation (e.g. do a few students access the forums often, or do lots of students access the forums but seldom?) and
- Answers about possible relationships, such as correlations, between usage patterns and performance.

However, both teachers felt that analytics on interaction and access was only part of the equation. Both expressed doubt that learning analytics could provide information about the quality of an interaction. For example, a student might access information but is it the right information for that student and at the right time?

For a range of institutional and practical reasons, development of custom analytics for the course delivery tool could not proceed as planned. This

was disappointing but also part of the reality of undertaking in-house software developments within tertiary institutions (A paper describing a similar issue encountered in the next case study discusses this issue in detail).

Key findings from early prototyping and interviews for this case study included:

- Both teachers expected that learning analytics data could help address long-standing questions they had had about student learning in their courses;
- A comparison between usage and student grades done by one teacher revealed that collecting and analyzing such data was not useful if it did not reveal anything about students' learning experiences;
- There is a need for information and tracking about individual students in relation to specific learning goals. Learning analytics should help to evaluate specific teaching techniques, or course design intentions;
- In the absence of learning analytics tools, teachers are left to fall back on their own, possibly limited, skills with managing and analysing whatever data they can obtain.
- The ability to specify data captured should be built into tools for learning design. Educators, students and data specialists need to collaborate on future developments for learning analytics to inform student learning.

## Case 3

### The Student Relationship Engagement System (SRES)

A cross-institutional collaboration to develop an open-source tool to support student engagement was the focus of our third case study. Higher education providers worldwide are increasingly being measured for the effectiveness of returns on investment. This has resulted in major efforts to increase student retention and success. To achieve this, many institutions pin their hopes on learning analytics to gain insight into, and influence, student learning, performance, motivation and engagement (e.g. Clow, 2013; HEFCE, 2016). While it is well documented that students need good support, especially during their transition from high school and in the early years of tertiary study, practice-orientated approaches that are transferable into everyday teaching are in short supply.

Originally developed at the University of Sydney, the SRES v1 was specific to the local IT architecture, and early trials of the system were favourable. Increasing uptake at Sydney demonstrated the value of SRES in facilitating personalised communication between teachers and students, especially in large-class settings. To make SRES accessible to other tertiary institutions required redevelopment and an open-source model was agreed with the original developers. A cross-institutional collaboration between the universities of Auckland, Sydney and, in the initial stages of development Otago, resulted in the current version, SRES v2. Recently, Massey University have explored adapting SRES v2 to suit their local context.

Key findings from a pilot of SRES v2 at the University of Auckland involved three large first-year courses in engineering, science and business studies:

- The Student Relationship Engagement System (SRES) v2 supports personalized communication with students even in very large classes. It provides insight into the 'whys' and 'how' of student engagement or disengagement, and gives teachers a way to act on this information;
- Integration with university systems is critical and must be planned for in order to avoid labour intensive data handling between SRES and other institutional systems;
- Data policy and governance must support data use by teachers and students as well as supporting overarching business or institutional intelligence;
- There are significant benefits in terms of system sustainability from a cross-institutional collaboration. Conditions and resourcing can and do change in individual institutions. Cross-institutional development spreads the risk and an open-source development model ensures the rewards are sustainable and accessible to all (McDonald et al., 2016).

## Case 4

### Learning analytics to explore student engagement and inform learning design

Continuing the theme of student engagement, our fourth case study sought to determine whether learning analytics data could promote student engagement and support the design of effective teaching strategies. The project involved 159 first-year health science students and sought to identify students who may be at risk and in need of extra support at several stages throughout the course. Indicators such as low use of the LMS were used to identify students who may be at-risk and email contact was initiated to encourage them to seek support.

Key findings from this case study included:

- Personalised contact by email may encourage students to make more use of the LMS especially in earlier stages of the course;
- The overall pattern of LMS use may help the teachers to understand the effect of their teaching and make adjustments to their educational or learning design;
- Transparency around the purpose in collecting and using data is important. Tell staff and students what is happening. For example, to say that you are collecting learning analytics data is too vague and students and staff may not understand what this means.

## Case 5

### An institutional system to monitor student engagement

An institution-wide project was the subject of our fifth case study involving a bespoke learning analytics tool; the Engagement Tool from the Open Polytechnic NZ. The case demonstrates how data already collected by TEIs (Tertiary Education Institutions) to record student progress can be made available to all staff. In addition, the case illustrates how support interventions can be coordinated across academic and support functions. The Open Polytechnic is New Zealand's primary provider of open and distance education, with over 30,000 student enrolments each year. The Engagement Tool was developed as a result of a student engagement strategy confirmed in 2011. A particular challenge facing the Open Polytechnic was supporting students in open courses where students can enrol at any time. The goal of the Engagement Tool (ET) development was to provide an easy-to-use interface for summarised data already available in the Student

Management System, and to make the outcome of each staff interaction or intervention with the student available to other staff with a role in student support. It needed to handle open enrolment and allow the identification of at-risk students. As part of this case study 15 staff were interviewed on their experience of using the ET.

Key findings from this case study included:

- There is clear benefit to linking student data with a shared record of staff contact with students;
- First time students in particular appreciated the connection they made with Open Polytechnic, courtesy of the ET;
- It is important to share and develop practice among ET users;
- The generation of student contact notes creates a new dataset for analysis.

## Case 6

### Rapid analysis of student responses to short answer questions

Our final case study (McDonald, Bird, Zouaq & Moskal, 2017) sought to illuminate the relationship between student writing and the teaching context through examination of student responses to short answer questions. Student volunteers from a large first-year health sciences course answered a series of open-ended questions as part of their study for one module of the course. Student responses to these questions were examined alongside the teaching materials for the relevant course module.

Key findings from this case study included:

- Evidence of the source of student understanding or interpretation of taught concepts can often be found in course materials. Student responses may provide clues for the teacher that additional explanations or support are required. Therefore, the ability for teachers to identify and address misunderstandings evident in written work and before it is too late (i.e. before summative examinations), would be invaluable in supporting student understanding;
- Grouping or classifying student responses provides an at-a-glance picture of the class. For example, it shows how many students are on track, where students had interpreted questions in unanticipated ways and quickly identifies students who have no idea how to respond to a question (gibberish or 'I don't know' type responses);
- The potential to use existing and new computer-based tools to support text analysis makes it possible to visualise the impact of course design on student understanding over multiple cohorts and would support a cycle of teacher reflection and course development.
- An approach to text analytics for teachers and a tool to support text analytics for teachers, which have arisen directly from this case study, are described in the section on Systems and Tools.

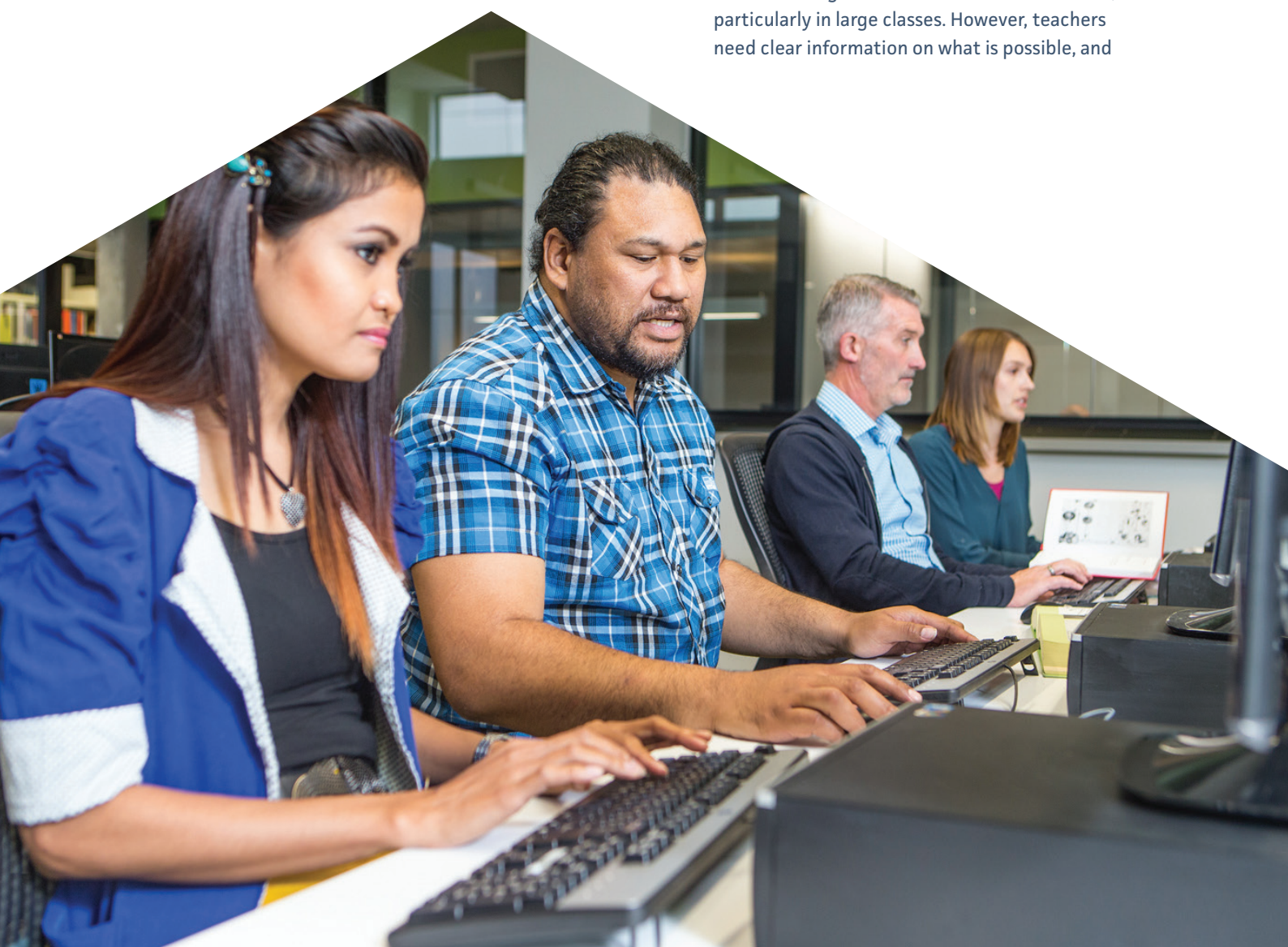
## Interviews with early adopters of learning analytics

During the scoping phase of the research, we interviewed sixteen early adopters within the lead institution to explore their experience of using learning analytics data to answer questions about teaching and learning. Fourteen interviews were with teachers, and the remaining two with staff in teaching and learning support roles. Early adopters of new technology are a good starting point to explore an emergent field of practice, particularly for an initiative that aims to promote changes to practice. Interviews with these teachers provided a sketch of what they were doing or aspiring to do with learning analytics data, the specific questions they wanted to answer about student learning, and the kinds of barriers and enablers they encountered.

The interviews also provided insights into the kinds of activities that might promote the use of data informed practice to a wider group of teachers, and what a supportive institutional context for this would look like.

Fourteen teachers from a total population of more than 2000 in one institution is a very small sample. However, institutional networks the research team members were engaged with identified a very small number of active users of learning analytics. A larger number of staff completed a survey, which explored perceptions of learning analytics among those who may be interested but not active users. In the circumstances, we accepted the view of usability expert Jakob Nielsen (1999), that if seven or eight out of ten target users raise the same issue, it is probably worth exploring. Some useful information and common themes emerged from the interview data. This helped to inform resource development, dissemination and design of professional development activities. In summary the data showed that:

- Learning analytics can increase levels of understanding between students and teachers, particularly in large classes. However, teachers need clear information on what is possible, and

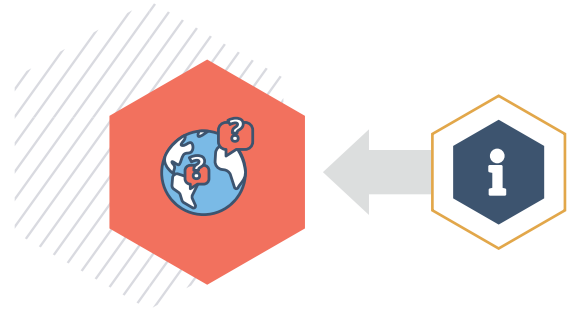


better analysis and reporting tools. A structured approach and good data visualisation tools would encourage wider use;

- Asking specific questions about learning is a critical starting point for the use of analytics data. A broad exploratory approach might produce large amounts of data without leading to any actionable insights. Asking the wrong questions can lead to a dead end, e.g. no research has found a reliable link between online presence and performance on assessments;
- Many teachers require support to formulate relevant questions to explore using learning analytics and supporting data, and to analyse and take a critical approach to interpretation of this data;
- Online presence and resource access logs are not considered to be useful indicators of learning or engagement. Monitoring log ins and resource use are basic measures that can prompt conversations with students or further exploration to answer learning related questions;
- System generated activity logs don't provide complete answers to questions about student learning. Additional (qualitative) sources are usually required. Teachers need to be aware of, and question their own assumptions when interpreting data;
- Learning analytics data captured at particular points in time can be used to inform course design. Timely access to data is important so timely responses can follow;
- Time is a limiting factor. Teachers need to be motivated to engage in data informed reflective practice and up skilled and encouraged to go beyond basic data such as reports of student log ins and grades;
- Student facing learning analytics data could reflect progress back more immediately than teacher feedback on course assessments – this is an area for further exploration.

The data also suggested that teachers define data more broadly than learning analytics researchers and developers. Definitions gleaned from the interviews included grades, usage, survey and focus group data, quiz attempts and results, course evaluations, in-class polls, pass rates, Turnitin reports and student-generated content such as assignments, discussion posts and free text responses. LMS logs were not considered particularly useful without additional qualitative data. One teacher (a statistician) noted that student discussion posts were more useful than numbers because they reflect student understanding and learning challenges. However, he also conceded that using statistics to identify students who don't meet milestones is an actionable insight.

Overall, the impression gained from this small number of interviews endorsed the need for culture change with a shift in attitudes and priorities, better data capture, analysis and reporting tools, increased awareness and ethical use guidelines, skills development for teachers and collaboration among suitably qualified staff. A summary of the interview data is included in Appendix C.



## Goal 4:

Initiate sustainable changes in teaching and learning design practice within the institutions represented by the research team, and promote similar changes in others.

### Research methods

Literature reviews, survey of target users

### Findings

An important starting point for any change initiative is to understand the target audience: i.e. what do they currently know, how do they perceive the prospects, and how receptive or otherwise are they to the proposed change? This understanding is also critical in planning for dissemination of research findings and related professional development initiatives. An initial step in understanding the broad target audience for our learning analytics initiative was an exploratory survey circulated through institutional networks in the three universities represented by the research team. The following sections present key findings from the survey. Survey questions, response rates and a descriptive analysis are provided in Appendix D. Interview data outlined in the previous section is referred to where it adds depth to survey findings and additional insights related to the project aim to promote sustainable change to teaching and learning design practice.

### Survey – who are the target users and what elearning tools do they use?

A request to participate in the survey was distributed through internal networks at participating institutions with consent from a Deputy Vice Chancellor or equivalent. The survey returned 351 responses. The maximum number of responses to any individual question was 327. We anticipated that our distribution method may not reach all staff and note the following limitations:

- The views of all staff in the three participating institutions are not represented by the data;
- Based on the annual report figures for staff employed at each institution during 2015, the overall response rate to our survey from the sample of staff who might have received an invitation to participate is likely to be rather less than 5%. Given this high margin of error, inferential statistical tests are not appropriate and our analysis is descriptive only;
- The potential for bias (e.g. respondents having an interest in learning analytics) is high therefore the confidence level is likely to be low.



While teachers and learning designers are the main target users for learning analytics practice, IT staff, institutional managers and policy makers are also interested parties. Asked to indicate whether teaching was part of their role, 262 out of 326 respondents (80%) responded in the affirmative. The number of responses to each question varied; presumably to reflect the relevance of the question to the respondent's role.

Respondents were asked to identify the level at which they were employed. Of the 327 respondents to this question, 18 were Professors (5%) and 18 Associate Professors (5%). The largest group was 122 lecturers or senior lecturers (37%). 67 respondents identified their primary role as Tutors, Teaching Assistants or Teaching/Professional Practice Fellows (21%). The remaining 67 (21%) were in general or professional staff roles. In response to a question that sought clarification of the primary role within respondents' current position, only 4 respondents selected IT or Data services. This may have been a result of the academic networks used to circulate the survey, though clearly there is scope to further investigate the perceptions of people in these key roles.

A majority of respondents involved in teaching (216 or 83%) had more than 5 years experience and used some form of technology in teaching. Unsurprisingly, the most common educational technology used was the LMS, although this was seldom used in isolation; a range of online learning tools were used with the LMS by a majority of teachers (183 or 80% of those who responded to this question).

The most common use of technology was 'posting learning materials and resources' (210 responses or 89%) followed by 'assessment tasks and feedback' (151 or 64%), learning focused interactions between teacher and students (118 or 50%), and learning focused interactions between students (80 or 34%). These functions were most commonly used in combination. This pattern of technology use (i.e. top combinations and relative proportions) was similar for two of the three universities. The third institution was slightly different where the predominant combination was 'Posting learning materials and resources' together with 'Assessment tasks and feedback'.

This sketch of elearning use suggested that the way to promote the use of learning analytics to the largest number of users would be by demonstrating ways that insights can be gained from the activity reports produced by the LMS and other common tools. This

would include the increasingly common use of data reports to identify and support students who may be struggling with courses and at risk of drop out or failure. It would also help to answer questions about what resources students actually use, and how their learning progresses throughout a course. More specialized uses such as the analysis of student writing (e.g. short answers, essays or discussion posts) to understand learning might appeal to users who engaged with a wider than average range of online learning tools.

## What do target users already know about learning analytics?

Turning to the focus of the research, the survey returned 149 negative responses out of a total of 286 (53%) to the question "Are you aware of the emerging field of learning (rather than business) analytics?" Only 14% were "very aware", and 33% "somewhat aware". The number of respondents already aware of the kinds of data recorded by online learning systems either within or outside the LMS was 39%, while 34% were not sure and 27% were unaware. This result is shown in Figure 4.

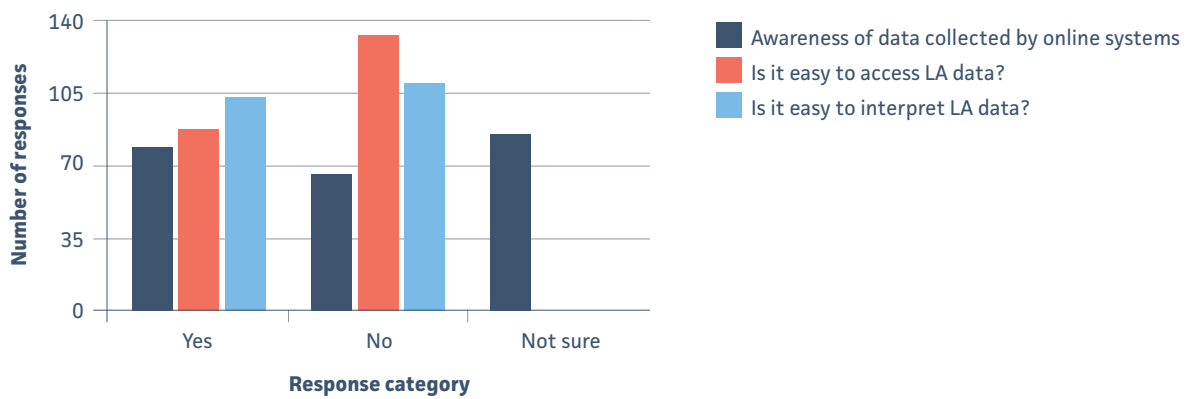
Overall, we did not anticipate major differences between institutions but while the level of at least some awareness of learning analytics was similar at two universities (44% and 48%), awareness at the third was only (30%). Awareness was lowest across all institutions among those in traditional academic roles (37%). These results should be interpreted with caution given the small number of respondents and possible bias. However, if there are differences in awareness between institutions and between academic, teaching and non-teaching staff, this could be confirmed through further investigation. It would be worth reviewing institutional approaches to learning analytics to see how they impact on staff in different roles. In particular, if learning analytics is to be promoted as a useful tool for teachers, then raising awareness among teaching staff would be an obvious area to focus on.

Further probing showed the most common perceived uses of learning analytics data to be for students to monitor their own progress, or for teachers to monitor student progress. Checking student use of course materials, research or evaluation of teaching and learning, course design and identifying and supporting students at risk of failure were familiar to

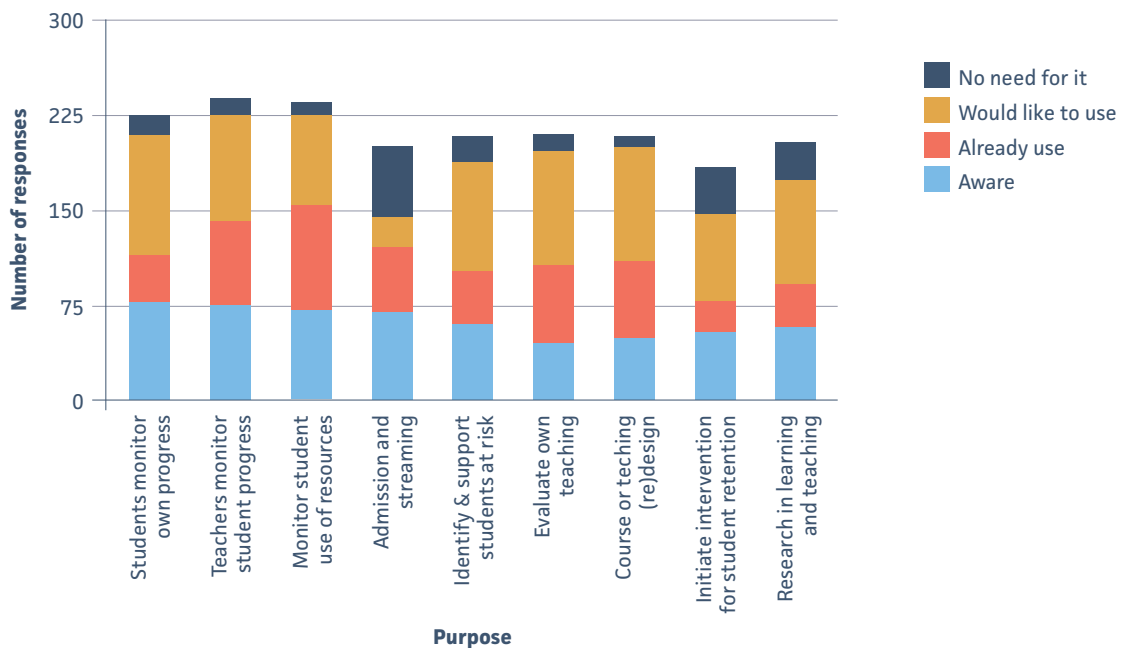
fewer respondents, though some did say they would like to use data for these purposes. Responses to questions about ease of access and ability to interpret data pointed to an area for immediate action, as 60% said data was not easy to access.

Common free-text responses to questions about data use and interpretation were that data was not reliable or in usable format. Many respondents did not feel they had the right skills to convert it. More than half said it was not easy for them to interpret data, and some commented that they had never seen the data in question so had not tried to interpret it. For the 42% who said they did not believe the data could 'provide relevant and useful indicators of student

learning', there may have been little incentive to try. Figures 4 and 5 show responses from staff with teaching as part of their role. Many were either not aware or not sure what student data is recorded by online learning systems. Many who were aware did not find it easy to access or interpret the data ('Not sure' was not an option for these questions). Figure 5 shows varying levels of awareness and interest in using data for various purposes. Participant perceptions are that learning analytics data is less useful for admission and streaming purposes ("no need for it") whereas the majority would like to use data to monitor student progress, for risk identification, to inform learning design and for their own evaluative practice.



**Figure 4: Teachers' awareness, ease of access and interpretation of data captured by online systems**



**Figure 5: Teachers' awareness and use of learning analytics for specific purposes (respondents could select multiple options)**

## Ethical issues

Many respondents shared the widespread concern about ethical issues related to the use of learning analytics data (39% had concerns, a further 42% were unsure while 19% had no concerns). The ability to use student data in such extensive ways is relatively new so existing policy frameworks do not adequately cover all the available options. This is something institutions would do well to address through the development or adoption of policies and acceptable use guidelines. The *Code of Practice for Learning Analytics*<sup>5</sup> developed by JISC is a useful example. The establishment of boundaries around this often-contentious issue will provide useful signals for users who are unsure, and build confidence around what is considered acceptable use. The most commonly expressed concerns were with students' right to privacy and confidentiality, their ability to give informed consent, about action based on incomplete data or inappropriate interpretation, and protection of data from unauthorised access and sharing. While our research did touch on ethical issues, particularly around the benefits that can arise if teachers have wider access to student data than many currently do, the responsibility for defining ethical frameworks and policies lies with their institutions.

## Is it my role to use learning analytics?

It was encouraging that more than half the respondents (56%) did see using learning analytics as part of their role. However, 28% were unsure and 16% stated that it was not. Some insightful comments were offered, showing the diversity of perspectives within the target user groups:

*Possibly, but again I would want clarity about the purpose, ethics and processes involving students.*

*The systematic collection should be done by ITS, I should collect those required for teaching evaluation on an ad hoc basis.*

*I don't necessarily think it should be compulsory for individual teachers; it's one tool in the toolbox.*

*Having heard from other colleagues who are experts in analytics in higher education, I would find this*

*knowledge useful for teaching, researching, and supervising in higher education.*

The number of respondents whose role involved teaching who did not believe or were unsure if using learning analytics was part of their role, and the number who did not respond to this question (136 or 52%) suggests that many potential users are either unaware of the potential, or not in a position or willing to begin to explore the field. Interestingly, the question whether learning analytics data can provide relevant and useful indicators of student learning attracted an almost binary answer, with 58% of respondents answering 'yes' and 42% 'no'. Reasons for answering 'no' included not knowing enough about the field of learning analytics, questioning the type of data collected by online systems as proxies or evidence of student learning, and a general "not sure about it" indicating a real need for professional development in this area. Asked about their interest in professional development for learning analytics, 78% stated that they would be. This endorsed the plan for a professional development roadshow as part of the dissemination strategy.

## Promoting a shared discourse for teachers and researchers

Experience gained through the research activities outlined in this report, and through engagement in Australasian and international learning analytics conferences and networking events created the impression that researchers and teachers were using different language and having different conversations on the topic. Literature reviews had already failed to identify a high level of interaction between these groups, despite industry best practice of involving target users in a process of participatory or co-design. Discussions at a JISC Learning Analytics Network meeting in the UK after a member of the research team presented the project's interim findings seemed to endorse this point. Members of the JISC network agreed to complete a short survey designed to explore perceptions and the language this group of experienced practitioners used to talk about learning analytics.

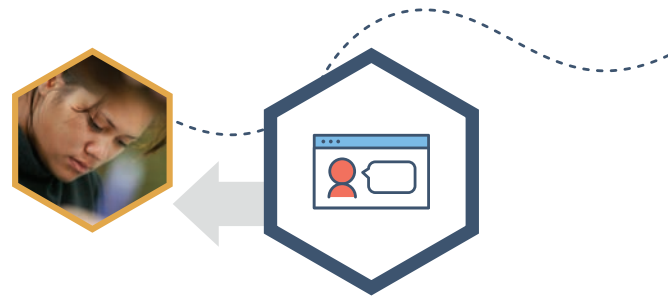
This survey returned a total of 69 responses, including 62% (43) from people in IT, management or administration and 35% (24) in teaching, research or learning support roles. In the first survey, which

5 ... <https://www.jisc.ac.uk/guides/code-of-practice-for-learning-analytics>

received 351 responses, 80% (262) were from staff involved in teaching. While the two surveys asked different questions and targeted different networks, both aimed to explore perceptions of learning analytics among stakeholder groups. The different percentage of responses from staff involved in teaching was notable, even although the surveys involved small samples that did not represent the national higher education sector in either case. The question remains, would more representative surveys have reflected a similar split of stakeholder roles, or is the proportion of teachers engaged in learning analytics actually different in the apparently better-resourced UK context? The results of this survey raised more questions than they provided answers, and further research is required. However, in a rough comparison of responses to the question 'Is learning analytics part of your role?' from those involved in teaching from the first survey (N=223), 56.5% said it was, 29% were unsure and 14% said it was not. In response to the question 'Will teachers make use of learning analytics' from the second survey (N=39),

90% said yes and 10% said no. While more extensive research would be required to draw any conclusions, this does seem to align with other evidence suggesting different perceptions of learning analytics among those involved in research, development and teaching. If, as our surveys suggested, practitioners and target users have no shared understanding of the scope and purpose of learning analytics or common language to describe it this may slow progress with adoption. If practitioners are developing systems and tools for users, but not working collaboratively with them on the process, there is a risk of products not being fit for purpose. The Systems and Tools section of this report describes a practice-focused, participatory design approach recommended by the project.





## Goal 5:

# Promote the principle that data is an objective and context specific form of evidence about learner behaviour and a necessary input to learning design

### Research methods

Literature reviews, interviews

### Findings

One of the project's key aims was to put learning analytics data into the hands of teachers and learning designers who were interested in ways to make use of the data generated by the online learning tools they use with students. The main method used to achieve this aim was a dissemination strategy based on all the evidence collected from different sources, and drawing on the research team's considerable experience of leadership, facilitating professional development and practice in the field of learning technology. The survey results suggested we would have a captive audience. The case studies, interviews and feedback from conference presentations all pointed to issues a dissemination strategy would need to address, e.g. the kinds of questions about learning that data can help to answer, practical ways to use the tools and analysis techniques involved, and how to build milestones into courses to monitor progress and provide targeted and timely feedback to students.

The term 'translation' describes what we believed would be required, as many teachers found raw data too hard to manage. Survey and interview data was backed up by the literature and discussions within professional networks that revealed differences in the use of language around learning analytics. A second survey sent to a UK learning analytics network

confirmed the observation that definitions of data and perceptions of the purpose of learning analytics varied widely, so inclusive discussions to clarify meaning would be important.

We were aware of a gap between research and development on the one hand, and participatory design and professional development for teachers on the other (Gunn et al., 2016). Our concern was that this would lead to another instance of the high expectations – low adoption cycle that is common in learning technology circles (Zemsky & Massy, 2004). Being conscious of this gap, we were mindful to try and address it.

Our core dissemination strategy involved a series of seminars, workshops and panel discussions facilitated by project team members and hosted by tertiary institutions around New Zealand (the Roadshow). The joint hosting arrangement created an opportunity for external facilitators to lead discussions to reveal the different perspectives on learning analytics held by local stakeholders. Panel membership and the focus of the discussion varied at each location. A common format included a brief introduction to learning analytics from each panel member's perspective, followed by a discussion of teaching, learning, research, technical, institutional and general issues and questions from the floor. The discussions ranged from headline issues from mainstream media (surveillance, ethics and privacy), what ethical use of data means within the institutional context, and deeper questions about student learning and

institutional change. Members of the project team joined local participants on the panel at each site to offer a researcher / practitioner perspective, and to be 'the devil's advocate' where collegial relationships may have suppressed questions on thorny issues. Our aim was to create the opportunity for discussions with various stakeholders at host institutions to continue after the event.

These discussions gave the project team a clearer sense of perspectives and levels of experience among different stakeholders and potential users of learning analytics. The lively exchanges endorsed the survey finding that definitions and expectations of learning analytics not only vary across and within institutional roles but also that they remain contested. There were some enlightening moments. For example, it was useful to hear a data scientist say there were no technical barriers to providing the combined data sets including student demographics, previous results and grades across courses that some teachers were keen to access. Political barriers are another matter. An IT staff member commented on the rare opportunity to engage with teachers on an area of common interest. Clearly there are many gaps to cover.

To raise awareness of the possibilities, and encourage teachers to use available data to inform their practice, we presented seminars and workshops featuring case studies and tools. Some of our case studies used generic data reports from the learning management system (LMS) to good effect. We described the cases in detail to illustrate how data can promote deeper understanding of student learning resulting from teachers' learning design decisions, or prompt further investigation based on the objective feedback that learning analytics provides. Examples from the case studies also allowed us to show that system generated data alone may not be particularly useful if it is not framed by a specific question or line of inquiry, and illuminated by additional data of a different type. For example, if students have not logged in to a course or accessed resources by a critical point in time, finding out why should precede taking any remedial action. Similarly, if quiz results show student knowledge is not as far advanced as anticipated at a point in time, it is important to explore the matter further (e.g. by reviewing teaching material, timing, priority etc.) before coming to a conclusion about the cause.

We also introduced more advanced tools which were works in progress to demonstrate how using text analysis tools can help to increase teachers'

understanding of student learning (McDonald et al., 2017), and how data informed relationship management using a purpose built tool, the Student Engagement Relationship System (SRES v2), could increase communication and have a positive impact on student retention, particularly in large classes (McDonald et al., 2016). While there are many tools designed for a similar purpose to the SRES, the ease of use for teachers, work in progress to integrate it with student administration and LMS data and the availability of open source code are considered important differences. For those interested in further exploration, we offered hands on engagement in workshops using text analysis tools, the SRES and the learning analytics-LD framework with examples of which types of data might be useful at different points in the learning design and teaching cycle (Donald et al., 2016). Short scenarios based on the case studies prompted participants to think about ways they might use learning analytics data in their own practice. The scenarios described common challenges faced by teachers, and presented simple solutions that could be adapted to any technical environment and teaching context, including real examples of ways to:

- Identify and support students who struggle with the transition from school to university;
- Monitor progress and maintain communication with students in large classes;
- Find out what students know, or think they know, at the start of a course to set them on the right track to successful study;
- Use an enterprise system to personalize student support and improve retention;
- Analyze student and teacher discourse to explore sources and growth of disciplinary knowledge;
- Use frequent formative assessment and online dialogue to support student learning.

A further aim was to invite interested parties to use, comment on, or adapt the open source learning analytics tools and creative commons workshop resources developed during the project for their own professional practice context. Doing this while the work was still in progress would help to reduce the risk of finished products not quite meeting user needs and being unsuitable for customisation. As is often the way (Goodyear, 2013), user feedback suggested additional uses for these resources that we, as developers, had not anticipated.

The design of our dissemination strategy and events drew, as far as possible, on current models of academic development for learning technology (Creanor, 2014). Professional development through action learning and sustained engagement is often recommended. While our Roadshow could not provide sustained engagement, we made all tools and resources available to local staff for their use or adaptation. We promoted action learning by asking participants to consider how the tools, resources and processes might work in their own practice, and designed workshop tasks to engage with this question. Participants were invited to bring their own data or case studies to the workshops, although few took up the offer. As the funded phase of the research came to an end, we were implementing plans for learning analytics professional development for teachers and learning designers within our own institutions. Research on the complex process of operationalizing elearning innovations within tertiary institutions is also relevant to dissemination

initiatives (Gunn 2010; McDonald et al., 2016). The implications of these broader issues for adoption of learning analytics practice by teachers will be kept in mind, along with practical issues such as lowering barriers to entry through easy to use tools and accessible, relevant and readable data reports.



# Reflections on development of learning analytics systems and tools

The majority of the elearning tools used by teachers and described in this report are off-the-shelf products supported by IT departments within tertiary institutions. LMS, including Moodle, Blackboard or Canvas are the most common examples. More specialised tools with specific functions such as e-Portfolios (e.g. Mahara), conferencing software (e.g. Zoom or Bb Collaborate), discussion (e.g. Piazza), and assessment tools (e.g. Peerwise) are also common and integrate, to a greater or lesser extent, with institutional IT systems. Two software tools, the SRES and the Text Analysis Tool are bespoke systems, which were further developed during the project in collaboration with developers from other tertiary institutions and target users. The Open Polytechnic's ET Tool was custom built for the local institutional environment to meet the needs of the specific target group of distance learners. This reflects the diversity that currently exists in the emergent area of learning analytics, for which no dominant products have yet emerged. Whichever model is followed, tool integration is important to learning analytics for at least two reasons. First, data captured by such systems needs to be related back to courses, groups of students and individuals so teachers can gain insight from these combined datasets. Second, data from these elearning systems needs to be exchanged with other institutional systems as required. Ideally, course enrolment data would not be duplicated between the Student Management System (SMS) and the LMS; the LMS should typically populate its courses with data from the SMS. Failure to do this in an efficient way results in demand for time, effort and considerable expertise to resolve duplicate information and errors when teachers seek to answer questions using the data. Specific examples of this type of issue featured in our survey results, interviews and case studies.

However, elearning tool interoperability with institutional systems is improving. Most modern LMS are standards-aware and many educational web applications, even quite specialised tools, conform to authentication standards (authentication occurs, for example, when you login to your institutional LMS, which then 'knows' who you are, what you are

doing and what you can access). Increasing numbers of tools conform to standards such as Learning Tools Interoperability (LTI), which is used to connect external web applications with an LMS in order to share basic information. Newer and more ambitious standards have been designed to support the exchange of information about specific learning activities between a range of different systems (e.g. xAPI or Tin Can) and between LMS and other systems (e.g. Caliper).

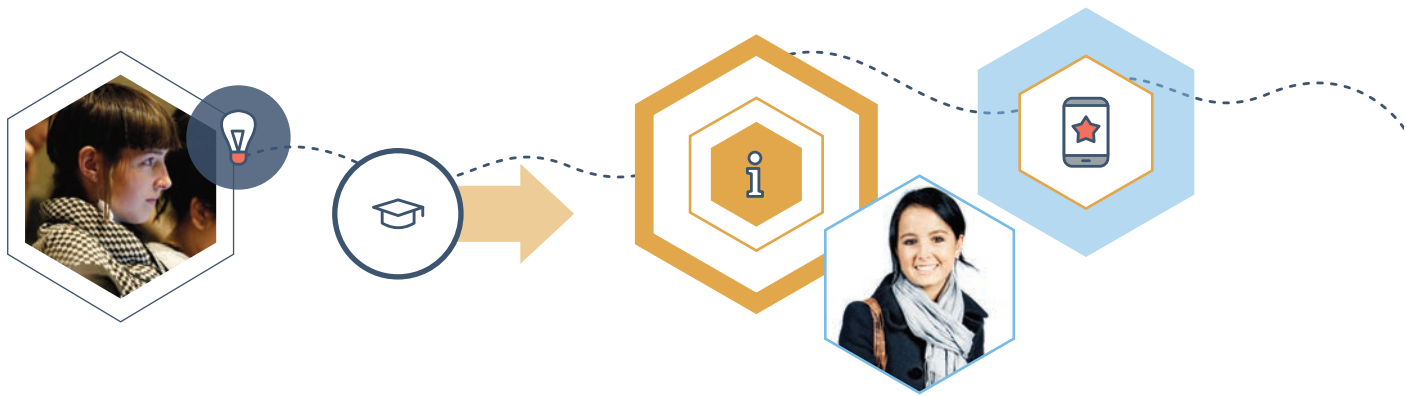
From a teacher perspective, the array of evolving standards can quickly become baffling. The only thing a teacher may understand is that the data or tools they find useful may or may not be easy to access, interpret and use. The emphasis on the need for multidisciplinary teams highlighted in several of our case studies is in no small part due to issues around interoperability with institutional systems.

The benefits of cross-institutional collaboration come to the fore in bespoke application development, as demonstrated in two of our case studies: the SRES v2 and the Engagement Tool (ET). SRES v2 was designed to meet local needs but with an awareness of the variety of institutional contexts where the tool may be used. Even so, considerable integration work was required in order to run in-class pilot studies at Auckland University and similar work is currently underway at Massey University. The advantage of such collaboration is in building a community of users and developers in order to support ongoing development as time and resource permits. The Engagement Tool (ET) by contrast, was built specifically for one institution. While the ideas and concept are transferable, the software, at the time of writing, was not. The ET was also likely to be superseded by a new Student Management System (SMS) and enhancements to the Open Polytechnic online study platform iQualify. However, the proof of concept was strong and could help determine priorities moving to a new technology environment.

Finally, the case study involving analysis of written short answers also proved a concept and by doing so, laid the ground for development of a new text analytics tool for teachers. What began as a simple process for analysing student responses, first mocked up in a Jupyter Notebook, has evolved into a fully-fledged open-source web application. While beyond the scope of the current project, the intention is to pilot the text analytics tool in three NZ tertiary institutions later in 2017.

Links to open-source software, code and resources developed for the project are listed in Appendix A.





## Discussion

A global perspective on developments in learning analytics shows an emergent field of practice with all the usual stakeholders involved in learning technology initiatives active in the usual ways. Software and LMS vendors are quick to respond to the growing demand for useful data in readable format that represents students' digital footprints. Popular LMS products now offer dashboards and data reports to fill the basic and general needs of tertiary teachers and institutions. These basic system components serve a useful purpose in allowing teachers to interact with high level data showing student log ins, resource use and various forms of submissions. However, the limitations of these tools are soon encountered, either when the capability limits of a 'one size fits all' solution are reached, or the questions teachers are asking cannot be answered by high level information such as clicks and log ins. It is at this point that researchers and learning analytics system developers enter the frame. Research and development in learning analytics has advanced rapidly over the past five or so years. Some very sophisticated analytics systems and tools have been developed, and trials in use have produced promising results as well as pointing to future development opportunities. However, the level of teacher engagement in learning analytics practice is lagging behind developments. One reason for this may be the low level of involvement of target users in participatory design and tools development.

The project described in this report was a collective effort to address some of the gaps between research, development and practice, by making learning analytics accessible and understandable to teachers as target users. This required the translation of complex technical concepts, terminology and systems into

language and processes that are already familiar to teachers. We focused our efforts on what was happening at grass roots level, the kinds of questions teachers were asking about student learning and the ways that learning analytics data might be collected, analyzed and presented to help answer those questions. We then devised ways to promote the potential benefits we had identified, and to disseminate the results of ours and others' research to a wide audience of target users. We followed a collaborative pathway throughout the project, engaging in conversations, working alongside and seizing every opportunity to offer reusable resources to teachers and other interested parties. While it is fair to claim a level of success in realizing the objectives we set out with, it is also honest to say that we still have a long way to go before some of those objectives are fully met. Promoting sustainable change in something as well established as higher education teaching practice, and organizations as large and complex as tertiary institutions will always take more than the lifespan of a two-year project. However, we believe we have made an important contribution to an emergent field of practice, and done what few other researchers in this space have attempted to do, that is, to build learning analytics practice from the ground up in partnership with target users.

Initiatives similar to the New Zealand research and case studies are becoming more common, though levels of investment by institutions and national funding agencies vary widely across countries. Some representative examples include:

- The University of Michigan <https://campustechnology.com/articles/2015/03/02/michigan-invests-1.4-million-in-innovative-instructional-technologies.aspx> where one institution has invested \$1.4M over three years;
- JISC has national funding to run a UK-wide programme <https://www.jisc.ac.uk/rd/projects/>

effective-learning-analytics that currently involves 85 participating institutions rolling out a learning analytics strategy;

- OLT in Australia funded various collaborative projects with focus on learning analytics; <https://utscic.edu.au/projects/olt-projects/learning-analytics-in-australian-higher-education/>

These are just a few examples of the expertise and resources that are being directed into learning analytics initiatives worldwide.

The gap we identified between practice and research is also echoed globally. A recent report from Australia, by Kennedy, Corrin & de Barba (2017) talks about this:

*However, the seduction of access to [...] large data sets can distract educators from the realities and complexities of creating meaning and actionable understanding from these data sets. While the potential of "big data" is well recognized, fundamental challenges for institutions remain in finding ways in which data can be captured, analyzed and reported so they can usefully inform educational practice. p.67.*

A position paper from Gašević, Dawson, & Siemens (2015) reminds us: Let's not forget: Learning analytics are about learning.

Research isolated from practice is problematic in the context of learning analytics. Finding common ground is a matter of the highest priority. The LA-LD framework presented in this report, supported by appropriate academic development opportunities, the introduction of accessible data reporting tools and access to expertise relevant to a project's scope are all critical factors going forward. Another important step is for institutions to provide a clear policy framework, acceptable use guidelines and an actively supportive environment.





## Conclusion

Changing teaching practice through technology is never a simple task. Generally speaking, the tools need to be intuitive to the extent that they are almost invisible to users, and the practical benefits to teachers and learners have to be visible, compelling and tangible. Institutions have to demonstrate commitment and active support in equally tangible ways, by developing acceptable use guidelines and supportive policies, and offering effective development and support opportunities for staff.

Learning analytics is an emergent field of practice that will flourish if the benefits are real, or recede as other technology innovations have done if the benefits prove to be hypothetical or too difficult or costly to achieve.

A growing body of evidence, including the case studies outlined in this report, shows benefits that are accessible and real. However, it is beyond the scope of educational research or emergent data informed teaching practice to determine if they are scalable or cost effective to implement. These are issues that only the kind of collaboration recommended in this report can decide.

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## Appendix A:

# Links to workshop resources, software tools and open-source code

All the following project materials are/will be available online at:

<https://akoaootearoa.ac.nz/using-learning-analytics>

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### Workshop and seminar resources

#### Introductory seminar

Slides

#### Learning analytics-LD framework

Workshop handout and slides

#### Student Relationship Engagement System (SRES) v2

Workshop handout and slides

#### Text analytics for teachers

Workshop handout and slides

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### Learning analytics case study reports

Text analytics: revealing student conceptions in a large class setting. A case study in disciplinary literacy

The Open Polytechnic Engagement Tool

Setting students up to pass: A first year experience initiative

Early alerts to encourage students to use Moodle

The Student Relationship Engagement System (SRES)

Two postgraduate taught courses in science and engineering

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### Learning analytics professional development scenarios

Example professional development scenarios drawn from interviews and case studies

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### Short videos introducing the project and case studies

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### Open source software, either developed through this project or consequent to needs identified during this project, are available online at:

Demonstration - SRES v2 system:

<http://144.6.229.141/sres/>

Source code and the current SRES project wiki is available at:

<https://github.com/atomsheep/sres>

Demonstration – analyse student responses in context:

<http://www.quantext.org>

Source code

<https://github.com/quantext/quantext>

Please note: We strongly recommend you use demonstration sites for evaluation purposes only. We do not recommend uploading any sensitive data or data where students may be identified.

## Appendix B:

# Publications arising from the project to date

### In press or under review

Blumenstein, M., Liu, D.Y.T., Richards, D., Leichtweis, S. & Stephens, J. (in press). Data-informed nudges for student engagement and success. In J. Lodge, L. Corrin & J. Cooney Horvath (Eds.), *Learning analytics in the classroom: Translating research for teachers*. Routledge.

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Gunn, C., Donald, C. & McDonald, J. (under review) Learning analytics and learning design: Promoting a conversation among equals.

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### 2017

Blumenstein, M., Leichtweis, S. & McDonald, J. (2017, May). *Learning analytics in practice: Nudging students towards success*. Poster presented at The Higher Education Technology Agenda (THETA), Auckland, New Zealand.

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### 2016

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## 2015

Gunn, C. & Donald, C. (2015). *Mapping analytics data to the learning design cycle to promote evidence-informed teaching practice*. Poster presented at Australasian Learning Analytics Summer Institute (ALASI 2015), 26-27 November. Sydney.

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## 2014

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# Appendix C:

## Learning analytics interview data summary

***Semi-structured interviews invited acknowledged early adopters of learning analytics practice to share their experience with the researchers. A total of 16 interviews were conducted, 14 with teachers and 2 with teaching support staff.***

### **Q1. Which elearning systems and tools do you use for teaching?**

All 14 teachers used the LMS, and 6 used CourseBuilder (an in house rich text editor to create interactive course websites) to deliver content; 5 used Piazza for questions, answers and interaction; 4 used Turnitin for feedback; 3 used QuestionMark to check learner understanding and Peerwise for students to write and receive peer feedback on multi-choice questions, and 2 used MCQ Results to give feedback to students. A number of other tools were mentioned by individual teachers, including lecture recording, MOOC platforms, subject specific software, social media, SPSS, Excel, Google Poll and Dropbox.

### **Q2. What types of activities do your students do in these elearning environments?**

Teachers used the tools to provide access to resources, for students to participate in discussions, pose and answer questions, complete tests, upload assignments, interact with peers, teachers and online tutorials, and for teachers to provide and students to receive feedback. Individual teachers used subject-specific tools for students to learn content and gain relevant experience, critique articles and watch subject-related videos.

### **Q3. Do teachers develop their own activities, collaborate with others or use third party software?**

Five teachers used either in-house or third party tools to develop or adapt activities for students, and found Peerwise, Turnitin and CourseBuilder particularly useful to facilitate teaching and learning, and to administer

and evaluate courses. Most teachers sought advice or assistance to develop these activities.

### **Q4. What do teachers know about learning analytics or system log data?**

A common view was that the LMS was capable of reporting on student log ins and resource access, but that this basic data was presented in raw format, only available on request and in need of careful interpretation. CourseBuilder also produces useful data but not in user-friendly format. Turnitin is good to detect plagiarism and provide timely feedback. Individual cases included:

- Mastering Biology (a third party tool) provides useful, fine-grained data on time, attempts, use of feedback etc. This can be combined with LMS data to explore engagement and achievement;
- Dropbox shows who submitted work and lecture recordings shows time of viewing;
- Piazza offers good analytics for performance management, and useful graphical representations;
- Code Avengers records basic data on engagement and time on task;
- Peerwise provides data on student generated questions and peer ratings, one response noted a correlation between use and grades, while another noted transparent engagement and access times;
- MCQ Results facilitates more timely and better quality feedback to students, as well as staff viewing of use statistics and results summaries;
- Oasis (an in house Q&A tool for engineering and physics) provides a limited amount of raw data that is hard to access;
- Student discussion posts in a MOOC show activity, reveal learning issues and provide opportunities for peer and teacher feedback;
- Learning Space allows teachers to see what students find difficult.

A general comment was that learning analytics could facilitate ongoing assessment of student learning rather than waiting until the end of a semester. One respondent believed that learning analytics data reflects a correlation between resource use and grades, while another believed the opposite.

#### **Q5. Do teachers make use of learning analytics data and if so, for what purposes?**

Responses reflected the individual nature of teaching and the different uses of elearning tools and learning analytics data in these contexts. A common theme noted by 7 of the teachers was using learning analytics data to monitor access, resource use, student contributions to course activities and quiz performance; 4 used data to monitor performance and to address learning issues, while 3 also used this data to inform their teaching; 3 stated a preference for the data capture and presentation functions of third party systems over the institutional LMS, as they found the finer granularity offered more helpful. One teacher used data to identify students who may be at risk, and 2 sought qualitative data to illuminate the data from system logs. 2 commented separately on the limitations of current systems, and the possibilities if tools were better and more teachers could be made aware.

#### **Q6. Is it easy for you to understand what the data means?**

Most teachers (12) found basic system log data easy to understand, though of limited value for understanding student learning. The basic data provided by the LMS and CourseBuilder was not considered detailed enough to be informative, or to be presented in usable format. One teacher commented that system log data is a source of macro information, which needs cautious interpretation, particularly in looking for correlations. Deep analysis and additional data would be required to produce meaning insights. The need for qualitative data to compliment numbers was reiterated, along with the need to start with specific questions and experience of data analysis.

#### **Q7. Have teachers worked alone, or with others to access and understand data?**

Most teachers talked to colleagues or students to develop an understanding of system data. Consultation with elearning system developers or

administrators and experienced data analysts was a common theme.

#### **Q8. Do you have additional questions you would like to be able to answer using learning analytics data?**

A common response to this question was an expression of the wish to better understand the potential to explore data beyond basic measures such as access logs. Some teachers wanted demographics data linked to access logs, and the ability to ask students to comment on which pages or activities they found useful, which tasks were challenging and why, and what motivated their interest in a particular subject. An ideal situation would be one where teachers are able to track the specific resources and activities that help students to learn and to understand how their knowledge develops. However, this was considered unrealistic and beyond the capabilities of learning analytics systems. Ways to present analytics data back to students would also be of interest.

#### **Q9. How familiar are you with learning analytics literature or practice?**

More than half the teachers said they were not familiar with the learning analytics literature and focused more on practice. While they may have some knowledge of relevant aspects of research, only one was actively engaged with the learning analytics literature, as this was an aspect of study for a higher degree.

#### **Q10. How widely is learning analytics data used by teachers in higher education?**

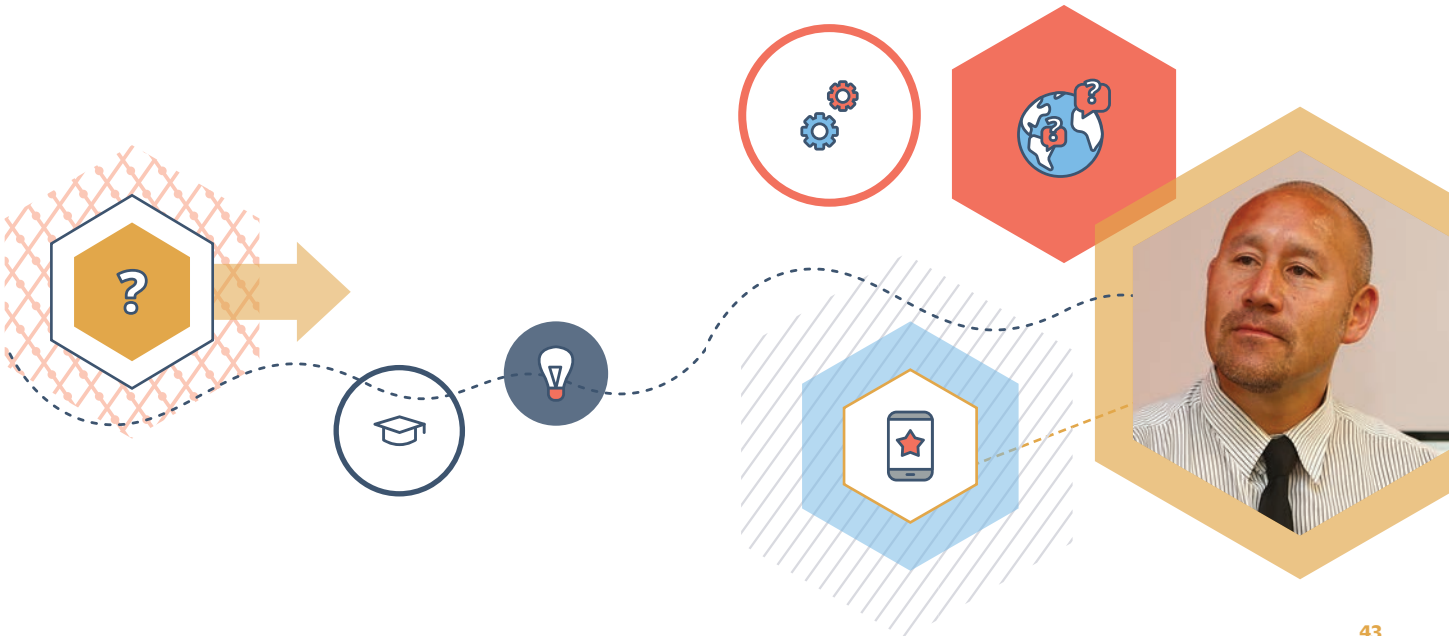
Six teachers thought learning analytics was not widely used, and cited different reasons for this, including, lack of time, interest or awareness, difficulty in accessing data and the tendency to default to familiar practices. Three believed that basic level use was widespread, though greater granularity and ease of access would be required to encourage wider use and deeper forms of analysis. A further three believed there were differences in levels of use based on faculty and course content. Two teachers believed that the tools were improving and the number of users was growing. One teacher was concerned about inappropriate use and interpretation of basic data.

**Q11. Do you see potential for teachers to make greater use of learning analytics data?**

Most teachers believed there is great potential for further use of learning analytics if the challenges of time, skills and incentives and data access can be addressed in appropriate ways. One teacher commented that course reviews were a good incentive for this kind of analysis. Another noted the need for a change of attitude among teachers on the use of learning analytics as part of teaching improvement, and for the development of relevant data analysis and interpretation skills. Collaboration between IT and teaching staff was considered important.

**Q12. Do you have additional comments on teachers' access to or use of learning analytics data?**

Comments offered in response to earlier questions were reiterated here, including the lack of time and relevant skills, the difficulty of accessing data, and the very basic nature of current data reporting capabilities. Additional comments introduced the need for professional and ethical data handling and use, the potential for use of course evaluation analytics and the balanced perspective that data is just a 'snapshot' that doesn't represent the person.



# Appendix D:

## Learning analytics survey report

354 respondents accessed the survey.

### Consent (Q1)

Of the 354 respondents who accessed the survey, 351 gave consent by responding to Q1, two explicitly declined consent and one did not respond to Q1. Survey N = 351

This exploratory survey was designed to gain a sense of perceptions of learning analytics within potential target user groups across the NZ tertiary sector and to guide further investigation. The survey was distributed through staff networks at participating institutions with consent from a Deputy Vice Chancellor or equivalent. This distribution method was not expected to reach all staff in the participating institutions however, and it is important to note the following limitations:

- Based on the annual report figures for staff employed at each institution during 2015, the overall response rate to our survey from the sample of staff who might have received an invitation to participate is likely to be rather less than 5%. Therefore, the margin of error for this survey is both uncertain and likely to be too high to include meaningful inferential statistical tests.
- The data may not be a representative sample of NZ tertiary staff and this is likely to be exacerbated by the low response rate. This increases the likelihood of bias (e.g. respondents with an interest in learning analytics may have been more likely to respond) and the confidence level of this survey is therefore likely to be low.
- The following analysis provides descriptive statistics only.

### Q2-Q7 relate to attributes of survey respondents – commentary is provided below for each question

#### Q2. What is your primary role in your current position? (Select one option) n = 326

From the total, 138 (42%) respondents selected 'teaching & research' as their primary role. 72 (22%)

selected 'Teaching students', 33 (10%) selected 'Management/administration', 32 (9.8%) selected 'Learning & teaching support for staff', 26 (8%) selected 'Other<sup>6</sup>', 21 (6.4%) selected 'Learning support for students' and 4 (1.2%) selected 'IT/data services'. 25 respondents did not answer this question.

#### Q3. Which institution are you affiliated with? (Select one option) n=327

The three largest institutions provided 61 (19% - Massey), 88 (27% - Otago) and 173 (53% - Auckland) responses. 1 response was received from staff at another NZ tertiary institution and there were 4 responses from respondents outside the NZ tertiary sector (1%). 24 respondents did not answer this question.

#### Q4. At what level are you employed? (Select one option) n=327

The largest group of respondents (122) were lecturers/senior lecturers (37%). These were followed by professional (or general) staff (67 or 21%), professional teaching fellows or professional practice fellows (45 or 14%) and tutors or senior tutors (22 or 7%). 18 (5%) of respondents were associate professors and 18 (5%) were professors. 35 respondents fell into 'other' categories (11%). 24 respondents did not answer this question.

#### Q5. For how many years have you worked in the education sector? (Select one option) n=326

Responses to this survey were dominated by staff with considerable experience in the sector. 132 respondents had more than 15 years experience (40%), 56 had 10 to 15 years (17%), 73 had 5-10 years (22%). Only 65 respondents had less than 5 years experience (20%) and of those only 10 had less than 1 year's experience. 25 respondents did not answer this question.

#### Q6. Is teaching part of your role? (Select one option) n=326

262 respondents indicated that teaching was part of their role (80%), 64 respondents indicated that it was not (20%). 25 respondents did not answer this question. A breakdown of responses to this question by institution is provided in Table 1.

<sup>6</sup>... 'Other' included research only, library staff, doctoral supervision, nurse, staff and student support, PhD student and clinical teacher

**Table 1: Respondent role by institution**

Institution	Teaching part of role	Total responses	% responses from teachers
Auckland	137	173	79%
Otago	71	88	80%
Massey	52	60	85%
Other	2	5	40%
Total	262	326	

**Q7. In what modes do you teach? (Select one option) n=235**

This question was answered by only 235 respondents. Nevertheless, we would only expect those who had indicated that teaching was part of their role (a maximum of 262 respondents from Q6) to respond. This was in fact the case and only respondents who had indicated that teaching was part of their role answered this question. 64 (27%) respondents were only involved in face to face teaching. 3 respondents were involved exclusively in online or distance teaching (1%). The majority of respondents used a combination of modes: 74 respondents used online material to supplement face to face teaching (32%) and 91 (39%) respondents were involved in both online or distance teaching as well as face to face teaching. 3 (1%) respondents indicated other teaching modes which included: i) online supervision and ii) flipped mode with contact provided on-demand and content provided online. 116 respondents did not answer this question.

**Q8 – Q20 relate to experiences, understandings and expectations of LA, data and/or technology.****Question analysis method**

An overall analysis for each question is provided including, where appropriate, a breakdown by institution and teaching role. Where it seems sensible to do so, teaching role is broken down further to see whether there are differences depending on whether staff are in traditional academic roles (i.e. combined teaching-research roles: lecturer/sl/ap/prof) or professional and ad hoc teaching roles. Free text responses are not considered in this analysis except where this helps to illuminate results. Finally, where appropriate, consistency across responses is analysed.

**Q8. For what purposes do you use online or learning technologies to support your teaching?(Select all that apply)****n=235**

Overall, the most common use of technology was 'posting learning materials and resources' (210 responses or 89%) followed by 'assessment tasks and feedback' (151 or 64%), learning focused interactions between myself and my students (118 or 50%) and learning focused interactions between students (80 or 34%). This pattern was reflected at each institution. The most common combinations of technology use are detailed in Table 2.

**Table 2: Most common combinations of technology use**

Technology use	Number of respondents who selected these option combinations
<ul style="list-style-type: none"> <li>Posting learning materials and resources,</li> <li>Assessment tasks and feedback,</li> <li>Learning focused interactions between myself and students,</li> <li>Learning focused interactions between students</li> </ul>	57 (24%)
<ul style="list-style-type: none"> <li>Posting learning materials and resources,</li> <li>Assessment tasks and feedback</li> </ul>	50 (21%)
<ul style="list-style-type: none"> <li>Posting learning materials and resources,</li> <li>Assessment tasks and feedback,</li> <li>Learning focused interactions between myself and students</li> </ul>	23 (10%)
<ul style="list-style-type: none"> <li>Posting learning materials and resources,</li> <li>Learning focused interactions between myself and students</li> </ul>	13 (6%)

This pattern of technology use (i.e. top combinations and relative proportions) was similar for both Massey and the University of Auckland. The pattern at Otago was slightly different where the predominant combination was 'Posting learning materials and resources' together with 'Assessment tasks and feedback' (20 or 28%) followed by 'Posting learning materials and resources' together with 'Assessment

tasks and feedback' and 'Learning focused interactions between myself and students' (13 or 18%)

There was little difference in the pattern of use (i.e. top combinations and relative proportions) between staff in traditional academic roles (n = 158) and other teaching staff (n = 77). Both were similar to Table 1.

#### **Q9. Which online learning tools do you use regularly in your teaching? (Select all that apply) n=230**

Overall, learning management systems - CECIL (97), Moodle (Stream) (76), Canvas (51) and Blackboard (45) - dominated the online learning tools regularly used in teaching followed by lecture recordings (87). Online tutorials (44), Course Builder (33) and Social Media apps (28) were the next most frequently used tools. While LMS use certainly dominates, it is seldom used in isolation. In other words, a range of online learning tools are used in combination with LMSs by the majority of teachers (183 or 80% of those who responded to this question).

We anticipated differences between institutions because of differences in both LMS and institutionally supported systems. For LMS use, Blackboard and Moodle dominated at Otago, while CECIL and Canvas dominated at the University of Auckland and Moodle dominated at Massey. Lecture recordings featured across all three institutions as did online tutorials. Coursebuilder and Peerwise featured among the most commonly used tools at Auckland and these are both tools developed at Auckland. Nevertheless, there was one mention of Peerwise from an Otago respondent which supports our impression of wider Peerwise adoption among NZ tertiary institutions. Otherwise, the only specific tools mentioned (Piazza, Aropa and Peermark) were mentioned only by University of Auckland respondents. The overall response rates for social media apps (12%) and mobile apps (6% - 14 responses in total) were reflected at each institution.

There was little difference in technology use between those in traditional academic roles (158) and those in other teaching roles (72). LMS use predominated and the majority used one or more online learning tools in addition to the LMS.

#### **Q10. Are you aware of the emerging field of learning (rather than business) analytics? (Select one option) n=286**

This question was answered by those in all roles. Overall, the number of respondents who had never heard of learning analytics was 73 (26%). 76

respondents were not aware but had heard the term (27%), the number who were somewhat aware was 96 (33%) and 41 respondents felt they were very aware of learning analytics (14%). In other words, approximately 47% of respondents indicated that they had at least some familiarity with learning analytics. 65 respondents did not answer this question.

The majority of respondents to this question included teaching in their role (235). Of this group, only 26 indicated that they were very aware of learning analytics (11%). A slightly lower proportion than the respondents to this question as a whole had at least some awareness of learning analytics (104 responses or 44% of those who teach). This suggests, an awareness of learning analytics may be lower among tertiary staff who teach than those who do not. Among those in traditional academic roles (142 respondents) 52 (37%) had at least some awareness of learning analytics. In comparison, 52 out of 93 (56%) of respondents who were in teaching but not in traditional academic roles had at least some awareness. Given the small sample size of our survey and the potential for self-selection bias, it is important to treat these results with caution. However, this general pattern in awareness between university staff roles was consistent across the three universities.

Overall, we did not anticipate major differences between institutions but while the level of at least some awareness of learning analytics at Massey (44%) and Auckland (48%) was similar and reflected the overall picture of around 48%, awareness at Otago was only (30%). Again, this result should be interpreted with caution given the relatively small number of survey respondents and possible bias. (Note that the relative proportion of respondents to this question who teach, from each institution, was similar to the overall response from those who teach at each institution ~ 80% at Auckland and Otago and 85% at Massey).

Nevertheless, if there are in fact differences in awareness between institutions and between academic, teaching and non-teaching staff, and this would need to be confirmed through further investigation, it may be worth looking at institutional approaches to learning analytics to see how these impact on staff in different roles. In particular, if learning analytics has potential as a tool for teachers then raising awareness specifically among teaching and academic staff may need to be addressed.

**Q11. Are you aware of the kinds of student data recorded by online learning systems, either within or outside your Learning Management System, for the use of learning analytics? (Select one option) n=283**

Overall, 111 respondents indicated they were aware of the kinds of data recorded (39%), 96 were unsure (34%) and 76 were not aware (27%). 68 respondents did not answer this question.

232 respondents who had indicated that part of their role involved teaching answered this question. Among this group, 79 indicated awareness (34%), 86 were unsure (37%), and 67 had no awareness (29%). For teachers in traditional academic positions, 41 out of the 140 respondents (29%) were aware of the kinds of data recorded, 53 were unsure (39%) and 46 were unaware (33%). This pattern is similar to that observed in Q10 and the same caveats apply.

Across institutions, the greatest number of staff with an awareness of data recorded came from Massey University - 57% indicated they were aware of the kinds of data recorded by online systems. Only 12% of Massey staff felt they were unaware. Otago and Auckland staff were broadly similar to the overall

distribution although more Otago staff expressed no awareness (36%). Again, the response rates by institution to this question reflected the overall rate of responses from each institution.

**Q12. What purposes are you aware of, or do you use learning analytics for? Please select all responses per row that apply.**

Ten possible learning analytics use were specified for this question. The number of responses to each of the ten rows varied and are summarised in Table 3. For each learning analytics use (row) respondents could select any or all of the following: i) Already use it, ii) Would like to use it, iii) No need for it, and iv) Aware of it. 258 respondents answered at least one part of this question and 93 respondents did not answer any part of this question.

For comparison, Table 4 summarises the total selection tally for each option per question part by teaching role. We chose to focus on responses from those in a teaching role since the majority of respondents to this question (from Table 3 - around 80% across all parts of Question 12) indicated they are in a teaching role.

**Table 3: University teachers' stated uses of learning analytics**

Question 12 row #	Total responses	Teaching role responses	Non-teaching role responses	Auckland responses	Otago responses	Massey responses	Other responses
1. Students to monitor own progress	245	200	45	133	66	42	4
2. Teachers to monitor student progress	258	209	49	140	68	47	3
3. Monitor student usage of course materials/resources	258	209	49	140	69	46	3
4. Student admission and streaming	224	181	43	124	57	40	3
5. Identification of students at risk	238	192	46	133	59	43	3
6. Evaluation of own teaching practice	239	195	44	135	60	41	3
7. Course-(re) design/teaching improvements	236	191	45	130	63	40	3
8. Initiate interventions for student retention	221	173	48	124	52	42	3
9. Researching learning and teaching	231	185	46	127	60	41	3
10. Other applications	9	6	3	5	3	1	0

Key features from Table 4 are summarised as follows.

Overall, around 24% of all teachers who responded to Q12 were already using learning analytics while around 46% indicated they would like to use it. There was little variability between in these responses between different applications of learning analytics. By contrast, there was more variability in teachers' assessment of the need for learning analytics for specific uses (4% - 28%. Note that the rate for part 10 is ignored since the response rate for this open option was very low.)

The specific learning analytics application already used by most teachers who responded to Q12 was to monitor student usage of course materials/resources (36%). The application most teachers indicated there was no need for was for student admission and streaming (28%) followed by initiating interventions for student retention (21%). In addition, only 12% of respondents indicated that they would like to use learning analytics for admission and streaming whereas 38% indicated that they would like to use learning analytics to initiate interventions for student retention.

An additional question we felt was worth exploring was to see whether those teachers who indicated that they already use learning analytics were the same respondents who indicated an awareness of learning analytics (Q10) and an awareness of data recorded by online systems (Q11).

For rows 1-3, 5, 8 and 9 between 60-77% of selections for 'Already use it' came from teachers who had expressed at least some awareness of learning analytics (this includes respondents who expressed a high awareness). Only 38% of responses to row 4 – student admission and streaming – came from those who expressed an awareness of learning analytics while 56% of the responses to part 6 – evaluation of own teaching practice and part 7 – course (re) design/teaching improvements came from those who expressed an awareness of learning analytics. An almost identical pattern of selections for 'Already use it' came from teachers who answered "Yes" to Q11 – about whether they had an awareness of data recorded by online systems.

It is a moot point whether these differences suggest that the more institutional uses of learning analytics are rather more used in practice by those with an awareness of learning analytics than those which directly impact on teaching in the classroom. Even so, it is encouraging that almost half of all teachers who responded would like to use learning analytics for evaluation of their own practice and teaching improvements. This area could be a fruitful avenue for further investigation.

**Table 4: Tally of selection from all responses to each row of Q12 by those in a teaching role.**

Q 12 row #	Already use it			Would like to use it			No need for it			Aware of it		
	Total	#	%	Total	#	%	Total	#	%	Total	#	%
1	44	33	16%	100	93	46%	27	16	8%	103	70	35%
2	76	56	27%	91	84	40%	19	11	5%	104	65	31%
3	98	75	36%	74	69	33%	20	9	4%	95	62	30%
4	60	49	27%	27	21	12%	69	50	28%	88	65	36%
5	55	39	20%	94	85	44%	30	19	10%	81	54	28%
6	64	56	29%	96	89	46%	35	13	7%	61	39	20%
7	66	53	28%	98	89	46%	19	9	5%	71	43	22%
8	34	22	16%	79	66	38%	45	37	21%	82	51	29%
9	40	28	15%	92	79	43%	39	29	16%	83	52	28%
10	1	1	16%	2	2	33%	6	3	50%	0	0	0%

Total = Tally of selection from all responses to this part of Q12  
 # = Tally of selection from those in a teaching role who answered this question  
 % = % of those in a teaching role who selected this option. Note that % total for each row may exceed 100% since some respondents selected more than one option e.g. Already use it, Aware of it.



**Q13. Is it easy for you to access the learning analytics data generated by the system(s) you use? (Select one option) n=273**

Overall, 108 respondents found data easy to access (40%) whereas 165 did not (60%). 78 respondents did not answer this question. This relative proportion was retained irrespective of whether respondents were in a teaching role or not.

Across the three universities there were some differences that may or may not reflect the capabilities of the specific LMS and online learning tools that are in common use. At two universities, only 34% of all respondents found data easy to access compared to 54% at the third. Because of the survey sample size and potential bias this difference may or may not be meaningful but it may provide an incentive for further investigation by the individual institutions. Even so, that 60% of respondents overall find data hard to access is no cause for complacency.

We were interested to see whether those who indicated in Q12 that they actually used learning analytics data for any of the purposes listed found access easier. In other words, does access become easier with experience in data use? The answer to this question appears to be yes. Between 55 -73% of those who indicated that they actually use learning analytics data (across the different applications presented in Q12) found access to learning analytics data easy. While again, this should not be taken as a definitive finding it does lend support to the idea that training and/or support for tertiary staff in data use and handling in particular contexts will likely be important in order to capitalise on any benefits promised by proponents of learning analytics.

**Q14. Is it easy for you to interpret the learning analytics data? (Select one option) n=263**

Overall, 126 respondents found data easy to interpret (48%) whereas 137 did not (52%). 88 respondents did not answer this question. Like Q13, this relative proportion was retained irrespective of whether respondents were in a teaching role or not and across the three universities.

Again, we felt it would be interesting to see if actual use of learning analytics data was associated with respondents reporting that it was easier to interpret. Like Q13, the answer is again, yes. Between 62 - 81% of those who indicated that they actually use learning analytics data (across the different applications presented in Q12) found learning analytics data easy

to interpret. It is possible that those who did not use learning analytics data were not in a position to comment on ease of interpretation.

This provides additional support for the idea that training and/or support for tertiary staff in data use and handling will likely be important in order to capitalise on any benefits promised by proponents of learning analytics.

**Q15. Do you think learning analytics data provide relevant and useful indicators of student learning? (Select one option) n=263**

Overall, 153 respondents felt that learning analytics data provide useful and relevant indicators of student learning (58%) whereas 110 did not (42%). 88 respondents did not answer this question. The relative proportions did change a little among respondents who had teaching as part of their role – 55% felt that learning analytics data provide useful and relevant indicators of student learning compared to 45% who did not. Across the three universities there was some variation. 62% of Auckland University respondents felt that learning analytics data provide useful and relevant indicators of student learning compared to 53% at Massey and only 46% at Otago. This is another area where further investigation would be useful to explore the drivers and context of these perceptions.

This analysis supports the view that there is an essentially binary response to this question and the free text comments assist in elucidating the reasons for this. Whatever they are, a key question surely is that if 50% of tertiary staff do not believe learning analytics provide relevant and useful indicators of student learning what exactly are learning analytics for?

*Note: The final four questions are not reported by teaching role or institution either because there was little difference in the overall results or because there were a large proportion of 'unsure' responses. Free text responses to each of these questions and the final Q20, 'Any other comments' are reported, where relevant, in the body of the final report.*

**Q16. Are there any data reporting functions or capabilities that you currently cannot access but would like to have access to? (Write in the space provided) n=88**

This question related to whether there were additional reporting capabilities or functions in systems that respondents used that they would like which are not currently there.

**Q17. Do you believe there are ethical issues arising from the recording and use of learning analytics data? (Select one option plus text) n=277**

Overall, 109 respondents believed there are ethical issues arising from the recording and use of learning analytics data (39%) whereas 116 were unsure (42%) and 52 did not believe there are ethical issues (19%). 74 respondents did not answer this question.

**Q18. Do you see it as part of your role to access and use learning analytics data? (Select one option plus text) n=274**

Overall, 154 respondents believed that it is part of their role to access and use learning analytics data (56%) whereas 77 were unsure (28%) and 43 did not believe it is part of their role (16%). 77 respondents did not answer this question. Of those who teach 126 (48%) felt that it is part of their role, 97 (37%) felt it was not or were unsure and 39 (15%) did not respond to this question.

**Q19. Would you be interested in attending events, workshops, seminars etc. on learning analytics? (Select one option) n=276**

Overall, 215 respondents expressed an interest in attending learning analytics events (78%) whereas 61 did not wish to attend learning analytics events (22%). 75 respondents did not answer this question.





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