

## Pigeon pecks and mouse clicks: Putting the learning back into learning analytics

**Jason Lodge**  
Griffith University

**Melinda Lewis**  
The University of Sydney

Learning in higher education can be described as a series of complex tasks and stages of development requiring a range of multifaceted behaviours and ways-of-being. Understanding what contributes to teaching for quality learning and achieving quality learning outcomes in higher education has been the topic of much debate over many decades. The current paper intends to situate and contextualise learning analytics (LA) within a broader debate on quality and student experience, outlining the affordances and constraints of this data-driven approach to quality. Firstly, we acknowledge the current use of LA within higher education and early research outcomes reported within the literature. Secondly, drawing on our combined disciplinary knowledge within experimental psychology, health informatics and health science education, as well as our current roles within quality and student experience at our respective universities, we pose some directions for enhancing and building on current approaches to understanding and using LA in the higher education context.

Keywords: learning analytics, quality, student experience

### Introduction

What is the purpose of higher education? Is it to train the next generation of professionals to be job-ready? Is it to contribute to public debate? Is it to contribute to the private good of graduates by increasing their earning potential or is it to produce morally and intellectually capable citizens with a capacity for critical thinking and solving the problems facing humanity in the 21<sup>st</sup> century? We argue that it is a mixture of all of these aims. What then are we to make of the current approaches to ensuring that, as institutions, we continue to achieve or at least aspire to these ends? In this paper, we intend to situate new approaches to understanding and tracking student development within these wider aims. Our intention in doing so is not to heap empty criticism onto learning analytics but to present for consideration a way forward in realizing the potential of analytics in the context of developing students as human beings.

Devlin, Brockett and Nichols (2009) suggest that the best way to ensure that universities are meeting their aims is to examine the quality of the learning experiences of students as they engage with their studies. Despite substantial advances in technology and methods for understanding learning in the higher education setting, there remains conjecture as to how quality learning occurs and how best to measure it (Krause, 2012). From a cognitive science and educational psychology perspective, classroom learning is an illusive and difficult to accurately operationalise phenomenon (Richardson, 1987). The approach to understanding learning in this context usually adopted by educational research, on the other hand, has been criticised for being less than rigorous (Slavin, 2008). Although there is substantial distance between the approaches and epistemology underlying these disciplines, there is general agreement that reductionist approaches to assessing quality learning are limited in their potential for explaining the value-add of higher education (e.g. Hussey & Smith, 2010). When viewed holistically therefore current evidence-based approaches to learning and teaching are lacking with neither laboratory research or classroom studies able to explain the process of learning from curriculum to neuron. Projected from the individual to the institutional level, understanding whether universities are indeed providing quality learning experiences across the gamut of disciplines becomes increasingly problematic.

The complexity associated with attempting to understand quality learning is thus problematic enough without the added complication of increased use of technology in this context. While technology introduces clear benefits and risks, the potential for tracking online engagement, integrating previously separate datasets containing information about students, is a trend that appears to be growing unabated (Seimens, 2012). The use of these approaches raises some concerns within the broader range of factors that serve as indicators of quality learning. The reductionist approach to what is a complex phenomenon is akin to behaviourist approaches used to understand learning in the 20<sup>th</sup> Century. Are we at risk of treating learning in a higher education context as being

analogous to a rat pressing a lever? Yes as we can 'measure' it, or no, as it does not make meaning out of complex notions such as learning in adulthood, learning for professional preparation, learning as research training, learning as development and growth, learning as being-in-the-world? What we are suggesting here is that current data-driven models under evidence-based approaches offer decontextualised data from a range of sources, primarily tracking data from online platforms and systems. What may this add to our understanding of the student learning journey as well as predicting student learning outcomes? Where is the personification and profiling of the individual within aggregated clumps of digitally derived data? We must take the complexity of student learning into account just as the reductionist approach to learning encapsulated in behaviourism was brought to account. The real power and potential of learning analytics is not just to save 'at risk' students but also to lead to tangible improvements in the quality of the student learning experience.

## **Learning analytics: tracking for quality or quantity?**

While the use of learning analytics to track and predict student success in higher education is rapidly becoming mainstream practice in higher education institutions, it is predominantly being used to predict and prevent student attrition. For example, Macfadyen and Dawson (2010) report on an 'early warning system' that utilises a tool for tracking interaction with a learning management system (LMS) to determine which students are not engaging with online material and with each other within the virtual learning space (VLS). Macfadyen and Dawson present a study conducted at the University of British Columbia (UBC) where student interactions within the BlackBoard Vista LMS were tracked and modelled. Student interaction is tracked on a number of dimensions including time online, number of mail messages sent and received, files viewed and visits to the gradebook etc. Within the context of LA, although this kind of tracking is not new, the authors argue that using this data to model/analyse online relationships is new and allows for a more complete picture of student engagement. Macfadyen and Dawson further claim that the resulting model is a powerful predictive tool able to explain 30% of variance in overall grade and can identify with 81% accuracy students who will fail (2011, p 588).

Although there is some face validity to the claims being made by Macfadyen and Dawson (2010) and the model proposed in their paper looks to be useful in assisting students through early intervention, there are a number of issues with the approach. The tools themselves have evolved from analytics used in management and marketing (Baepler & Murdoch, 2010). Common uses of analytics in the commercial world are to predict consumer behaviour and decision-making in order to virtually influence purchasing behaviour, a behaviour less complex than those associated with student learning and attrition from university (e.g. Yorke & Longden, 2004). In rationalising the use of marketing tools in education, Macfadyen and Dawson concede the argument made by Goldstein (2005) that the usefulness of LA in learning and teaching practice has received little attention but there is no suggestion as to why. They argue instead that the increasingly diverse mix of students and underutilisation of these tools justify the presented research. However, a critique of their justification alludes to reasons why LA has not been more broadly embraced. This justification is supposedly based on social constructivism as the theoretical foundation for the research. They suggest that their approach can accurately gauge the engagement of students in a 'learning community' and that this places the framework within the social constructivist literature.

The research on learning communities and student engagement both suggest a complex interaction of factors including the physical, virtual and practical contribute to student success (Zhao & Kuh, 2004). Laird and Kuh (2005) have conducted extensive research based on the National Survey of Student Engagement (Kuh, 2001) and found that tracking student interaction with information technology adds little to existing measures of student engagement. Holley and Oliver (2010) also suggest that even the best designed and most well intentioned e-learning environment cannot effectively address the diverse issues students have as they attempt to progress through university. By the same logic, it is not possible to use a measure of interaction with these environments as an all-encompassing way to predict which students are likely to have problems and which students are effectively engaged with their studies.

In addition to the broader issues around student engagement, LA is limited in terms of the capacity to capture the important distinction between deep and surface learning (Buckingham Shum & Deakin, 2012). Although more time on the learning management system may correlate with higher grades, this may reflect a strategic rather than a deep, lasting engagement with the content and body of knowledge and that is reliant on the contested idea that learning can be categorised cleanly into one of three categories: deep, surface or strategic. Regardless of whether these categories are useful in understanding student behaviour or not, Biggs (1999) argues, in what has become all but a cliché, that the focus for higher education should be on what the student does rather than what the teacher does. Although it is evident that LA is indeed assessing what the student does

online, these tools are simply too blunt to be able to separate those students taking an approach that will maximise their chances in the assessment, from those who genuinely engage with the material in a deep and critical way. Although the distinction between surface and deep learning is itself limited for understanding student approaches to learning and that the sum of student learning experiences are far more complex, there is sufficient evidence that deeper approaches to learning lead to better student outcomes (Prosser & Trigwell, 1999). LA is unable to elucidate the student approach to learning, relationships between apparent levels of engagement online and overall student experiences, and is therefore limited as a measure of the process and pathways students may undertake to complete their learning, let alone for higher cognitive processes or ways of being.

The approach currently being adopted in the implementation of LA, with some notable exceptions (e.g. Leece, 2012) is more akin to a behavioural theory of learning than any within the social constructivist realm. Bates and Poole (2003) suggest that, although there is some use for a behavioural approach to learning and much was clearly gained through the work of Skinner (e.g. 1948) and other behaviourists, these approaches to learning do not provide a complete account of what happens in higher education and through technology-mediated, networked learning environments. Laurillard (2002) also points out that a constructivist approach relies on understanding how students interact with the world and with knowledge. The emphasis here is on 'how' and not 'how much' as appears to be the nature of the data collected using LA.

One notable observation from LA is that the amount of interaction on a learning management system does not necessarily lead to higher grades for all students. Other researchers who advocate the use of academic analytics have also raised this issue. For example, Beer, Clark and Jones (2010) admit that, despite their substantial accumulation of data from their learning management system, there is a large amount of variation between individuals. This variability highlights the major flaw in the argument for academic analytics: not all students interact with information in the same way. The amount of time students spend on the LMS is not an indication of deep or surface learning.

Despite the clear problems with using a behavioural measure for understanding complex social and cognitive processes, LA is clearly not without value. Macfadyen and Dawson (2010) conclude by arguing that the real significance of their study is in the predictive power of LA. Given the current federal government's agenda of 40% of 25-34 year old with at least a bachelor degree by 2025 (Australian Government, 2009), there is some use for LA in identifying students who are not engaging or are engaging very little with the learning management system because more 'non-traditional' students will be entering higher education over the next decade. Based on the observation that this is a simple behavioural measure, it is of concern to see this being touted as a measure of student engagement and success beyond being a blunt indicator. With an increasing emphasis on teaching and learning quality in higher education, this measure is not suitable for assessing quality because it fails to capture a myriad of factors that contribute to student success (see Tinto, 2012). Although there may be benefits in using these tools to identify students who are at risk of attrition, they are currently of little use in ensuring quality and should not be promoted as being able to.

## **A future for learning analytics**

Ultimately, there is a clear need for tracking student engagement as class sizes increase and demands on student and faculty time and attention become more pressing. This argument has been reflected many times in the literature (for instance, James, Krause & Jennings, 2010). LA does provide a tool for assessing a level of interaction and therefore have merit as a broad indicator of students who might be struggling. Despite this, it is evident that LA contributes as much to the understanding of student engagement as did Skinner's (1948) pigeons to human learning in general. Strict behavioural data such as this lacks the power to contribute to the understanding of student learning in a complex social context such as higher education.

What then is the future of LA in this context of complexity and the need for ensuring quality? We argue that, as with any indicator such as surveys of student satisfaction, LA could become more useful than for managing attrition if it is understood within context. When contextualised within a broader set of indicators, the predictive and diagnostic affordances of LA do indeed provide some ability for understanding student behaviour. As we progress further into the 21<sup>st</sup> century, it will become less difficult to objectively assess student thinking in ways that are currently prohibitively expensive or unimaginable. The idea of quality learning is going to shift markedly and will necessitate radical revision of the models and learning theories underpinning higher education. We argue that the learning sciences and informatics, in particular, will be at the forefront of these revisions. Our aim with this paper was not to debunk LA as a valid approach to understanding and enhancing the student learning experience, nor was it our intention to single out Macfadyen and Dawson (2010) for

particular criticism, we could have just as easily chosen from dozens of other studies on LA. Our hope with this critique is that LA will grow from its current foundation to become part of a larger suite of indicators of quality student learning built on multidisciplinary collaboration, much like that evident in the health sciences. The mining of datasets will continue to provide interesting and useful information about patterns in student behaviour, the future challenge is to better understand patterns in student being, thinking and metacognition, factors that lie at the core of the purpose of a 'higher education'.

## References

- Australian Government (2009). *Transforming Australia's Higher Education System*. Canberra: Commonwealth of Australia.
- Baepler, P. & Murdoch, C. J. (2010). Academic analytics and data mining in higher education. *International Journal for the Scholarship of Teaching and Learning*, 4, 1-9.
- Bates, A. W., & Poole, G. (2003). Introductory remarks on knowledge, learning and teaching. In A. W. Bates & G. Poole (eds.) *Effective teaching with technology in higher education*. San Francisco: Jossey-Bass.
- Beer, C., Clarke, K., & Jones, D. (2010). *Indicators of engagement*. Proceedings ascilite Sydney 2010. Retrieved on May 31, 2012 from <http://ascilite.org.au/conferences/sydney10/procs/Beer-full.pdf>
- Biggs, J. (1999) *Teaching for quality learning at university*. Buckingham: Society for Research into Higher Education and Open University Press.
- Buckingham Shum, Simon and Deakin Crick, Ruth (2012). Learning dispositions and transferable competencies: pedagogy, modelling and learning analytics. In: *2nd International Conference on Learning Analytics & Knowledge*, 29 Apr - 02 May 2012, Vancouver, British Columbia, Canada
- Campbell, J. & Oblinger, D. (2007). *Academic analytics*. Washington DC: EDUCAUSE Centre for Applied Research.
- Devlin, M., Brockett, J. & Nichols, S. (2009). Focusing on university student engagement at the institutional level. *Journal of Higher Education Policy and Management*, 31 (2), 109-119. DOI: 10.1080/13600800902825827
- Goldstein, P. J. (2005). *Academic analytics: The uses of management information and technology in higher education*. Washington, DC: EDUCAUSE Center for Applied Research.
- Holley, D. & Oliver, M. (2010). Student engagement and blended learning: Portraits of risk. *Computers & Education*, 54, 693-700. <https://doi.org/10.1016/j.compedu.2009.08.035>
- Hussey, T. & Smith, P. (2010). *The trouble with higher education: A critical examination of our universities*. New York: Routledge.
- James, R. Krause, K-L. & Jennings, C. (2010). *The first year experience in Australian universities: Findings from 1994 to 2009*. Melbourne: Centre for the Study of Higher Education.
- Krause, K.-L. (2012). Addressing the wicked problem of quality in higher education: theoretical approaches and implications. *Higher Education Research and Development*, 31(3), 285–297. doi:10.1080/07294360.2011.634381
- Kuh, G. D. (2001). Assessing What Really Matters to Student Learning: Inside the National Survey of Student Engagement. *Change*, 33 (3), 10-17. <https://doi.org/10.1080/00091380109601795>
- Laird, T. F. N. & Kuh, G. D. (2005). Student experiences with information technology and their relationship to other aspects of student engagement. *Research in Higher Education*, 46, 211-233.
- Laurillard, D. (2002). *Rethinking university teaching: A framework for the effective use of learning technologies* (2<sup>nd</sup> ed.). London: Routledge. <https://doi.org/10.4324/9780203160329-13>
- Leece, R. (2012). Using technological solutions to create a sense of community for the distributed learner in higher education: implications for student-institutional engagement and retention. Paper presented at *15<sup>th</sup> International First Year in Higher Education Conference*, 26 – 29 June 2012, Brisbane, Queensland, Australia.
- Macfadyen, L. P. & Dawson, S. (2010). Mining LMS data to develop an “early warning system” for educators: A proof of concept. *Computers & Education*, 54, 588-599.
- Prosser, M. & Trigwell, K. (1999). *Understanding learning and teaching: The experience in higher education*. Buckingham: Society for Research into Higher Education and Open University Press.
- Richardson, J. T. E. (1987). Research in education and cognitive psychology. In J. T. E. Richardson, M. W. Eysenck, & D. W. Piper (eds.). *Student learning: Research in education and cognitive psychology*. Milton Keynes, UK: Open University Press.
- Siemens, G. (2012). Learning analytics: Envisioning a research discipline and a domain of practice. In: *2nd International Conference on Learning Analytics & Knowledge*, 29 Apr - 02 May 2012, Vancouver, British Columbia, Canada. <https://doi.org/10.1145/2330601.2330605>
- Skinner, B. F. (1948). Superstition in the pigeon. *Journal of Experimental Psychology*, 38, 168-172. <https://doi.org/10.1037/h0055873>

- Slavin, R. E. (2008). Perspectives on evidence-based research in education: What works? *Educational Researcher*, 37 (1), 5-14. DOI: 10.3102/0012189X08314117
- Tinto, V. (2012). *Completing college: Rethinking institutional action*. Chicago: The University of Chicago Press. <https://doi.org/10.7208/chicago/9780226804545.001.0001>
- Zhao, C. M. & Kuh, G. D. (2004). Adding value: Learning communities and student engagement. *Research in Higher Education*, 45, 115-138. <https://doi.org/10.1023/B:RIHE.0000015692.88534.de>

**Author contact details:**

Jason Lodge, [j.lodge@griffith.edu.au](mailto:j.lodge@griffith.edu.au)  
Melinda Lewis, [Melinda.Lewis@sydney.edu.au](mailto:Melinda.Lewis@sydney.edu.au)

**Please cite as:** Lodge, J. & Lewis, M. (2012). Pigeon pecks and mouse clicks: Putting the learning back into learning analytics. In M. Brown, M. Hartnett & T. Stewart (Eds.), *Future challenges, sustainable futures*. Proceedings ascilite Wellington 2012. (pp.560-564).

<https://doi.org/>

Copyright © 2012 Jason Lodge and Melinda Lewis.

The author(s) assign to the ascilite and educational non-profit institutions, a non-exclusive licence to use this document for personal use and in courses of instruction, provided that the article is used in full and this copyright statement is reproduced. The author(s) also grant a non-exclusive licence to ascilite to publish this document on the ascilite website and in other formats for the Proceedings ascilite 2012. Any other use is prohibited without the express permission of the author(s).