Learning Analytics in Higher Education: Implications for the National University of Samoa

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Abstract

In this digital era where educational institutions are transforming in a digital environment, many have realised the significance of learning analytics to augment student learning. This enquiry primarily discourses on the benefits and challenges for Higher education and its implications for the National University of Samoa. The purpose is to consolidate all the efforts of the different sections of NUS dealing with teaching, learning, assessments and student data to enhance its consultative process with the aim of strengthening its data competence and data management processes. The enquiry proposes that relevant sections within NUS work together to introduce and adopt Learning Analytics for improved Teaching and Learning Excellence at the University.

Keywords*: Learning Analytics (LA), National University of Samoa (NUS), Digital technologies, Teaching and Learning (T&L), Stakeholders, Students, Learners, Strategy for the Development of Samoa, Strategic Plan (SP)*

Introduction

Digital technologies are fundamentally altering the dynamics of the Higher Education (HE) sector, impacting Teaching and Learning (T&L) practices, and enabling more access to data from virtual learning environments. This has been attested as judicious in augmenting the scholarship of learning (Broadbent and Poon, 2015). The fundamental shift has been on excellence in education (Lee, 2017) and to attain this goal, HEs are acclimatizing Learning Analytics (LA) to better comprehend and support learners. LA has gained impetus and will continue to advance and revolutionize rapidly (Schumacher and Ifenthaler, 2018).

According to Ferguson et al. (2016) in the *Joint Research Centre Science for Policy Report*, LA refers to the measurement, collection, analysis and reporting of data about learners. The tenacity narrates to comprehending and enhancing learning and the environments in which it emerges. LA encompasses an extensive variety of data and methods for scrutiny, for instance, statistical tests, explanatory and predictive models, and data visualization (Arroway et al., 2016). Ferguson et al. (2016) considers that LA has gigantic prospective of progressing student experiences at academia, by consenting the institute to deliver targeted and personalised support and assistance to each student. The benefits attested include, upsurging retention rates, availing enhanced feedback, capturing students' attendance data and enhancing T&L. It is further argued that LA is a dominant tactic for institutions to attain their strategic goals and that all HEIs must contemplate on hosting an apposite LA system to augment student performance. The *2020 EDUCAUSE Horizon Report*[1] *argues that the uptake of LA for student success is intensifying and this is mainly attributed to: technology, essence of facilitating students' goals and innumerable ethical and policy contemplations.* Ferguson (2012a) on the other hand, contends that LA is driven by three key factors, big data revolution, online learning and national concerns. The *2020 EDUCAUSE Horizon Report claims that as the factors impacting LA increases, this is correspondingly mirrored via augmented pressure for staff to address student outcomes in HE. Millions have been spent on LA at universities and Google Apps for Education (GAFE) is on the verge of*

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[1] *2020 EDUCAUSE Horizon Report.* Teaching and Learning Edition. EDUCAUSE, Louisville. Retrieved from: https://library.educause.edu/-/media/files/library/2020/3/2020horizonreport.pdf?la=en&hash=DE6D8A3EA38054FDEB33C8E28A5588EBB913270C

reaching 110 million users by 2020. The essence of deploying LA has been tied to early warning alerts regarding student performance and the capacity to enhance proactive outreach[2]*.*

LA is still in its premature stages in Europe (ET 2020 Working Group on Digital Skills and Competences, 2016, p. 2; Newland et al., 2015; Sclater, 2014), when paralleled to the US and Australia. This is confirmed by the first results from the SHEILA Project (Tsai and Gašević, 2017). Yanosky and Arroway (2015) discourse that there is greater attentiveness towards monitoring or evaluating student progress than forecasting learning success or propositioning intervention plans. Additionally, whilst LA remains a concern, the precedence is yet to be realised in many institutions (Arroway et al., 2016) including NUS. This was also discovered by Colvin et al. (2015) that only two (2) out of the thirty-two (32) institutions in their study reached the advanced stage of LA. Current scholarships of LA in HE unequivocally stresses its practice in HE settings (Ferguson and Clow, 2017a; Ihantola et al., 2015; Leitner et al., 2017; Nunn et al., 2016, Sin and Muthu, 2015), although corresponding research focuses on educational contexts overall (Ferguson et al., 2016; Jivet et al., 2018; Nistor et al., 2015; Peña-Ayala, 2018).

Ferguson and Clow (2017a) in their study assessed whether LA progresses learning practices in HE and it found four propositions of LA: a) they advance learning outcomes; b) they support learning and teaching; c) are deployed extensively; and d) are used virtuously. Wong's (2017) scholarship elucidates that LA helps institutions in reaching verdicts. LA expedites assessment of the usefulness of pedagogies and instructional designs for enhancement and helps to monitor meticulously students' learning and diligence, envisage students' performance, distinguish detrimental learning behaviours and emotive states, and ascertains students' at risk. This further promotes proficiency at the institutional level permitting the execution of swift interventions. This study illuminates that LA equips students with indicative data which heightens comprehensions of their learning experiences and affords a more engaging climate stimulating reflection and enhancement.

The essentials and significance of LA in HE based on the reviews indicate that it eradicates impediments to retention and student success and enables HEs to craft personalised learning environments (Baer et al., 2013; Robinson et al. 2016), as student success is dependent on retention, student diligence converts a critical institutional motive (Robinson et al., 2016). The consumption and usage of digital technologies (learning design coupled with learning analytics) has significantly and proficiently progressed student tracking and retention (Long and Siemens, 2011), stimulated superior academic performance, improved retention and graduation rates (Rienties et al., 2016; Star and Collette, 2010), enhanced student satisfaction (Rienties et al., 2016), promoted student engagement and learning practices (Worsley, 2018), plunged attrition rates and heightened motivation and belongingness of students' (Sclater et al., 2016). Scholarships further stipulate that LA benefits HEs via targeted course offerings; curriculum improvements; enhanced student learning outcomes, behaviours and processes; tailored learning; enhancements in trainer performance; post-educational engagement prospects; and augmentation of didactic scholarship (Nunn et al., 2016). Likewise, other scholarships acknowledged improved decision making capabilities and premeditated interventions as remedial measures for improved student learning and for tracking students at risk in universities (Fidalgo-Blanco et al., 2015; Karkhanis and Dumbre, 2015).

Based on the comprehensive reviews on the returns and eminence of LA, the next section discusses the Challenges of LA in HEs.

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[2] *2020 EDUCAUSE Horizon Report.* Teaching and Learning Edition. EDUCAUSE, Louisville. Retrieved from: https://library.educause.edu/-/media/files/library/2020/3/2020horizonreport.pdf?la=en&hash=DE6D8A3EA38054FDEB33C8E28A5588EBB913270C

Learning Analytics and the Challenges for Higher Education
Educational analysis discloses a number of predominant challenges in up-taking LAs at universities. These issues range from evidently setting a vision that is meticulously aligned with institutional priorities and ensuring that the development of the vision follows a consultative process, is regularly visited, and that the awareness and support of key stakeholders is rendered readily. This requires leadership, stakeholder consultation, analysis of the changes and working closely with students (Ferguson and Clow, 2017b). Criticisms indicate the abnormality of LAs where the university becomes the sole stakeholder monopolising decision-making power and conclusively draws the scope, delineation and use of scholastic data without pursuing the feedback of its other stakeholders – precisely students. (Slade and Prinsloo, 2013).

Other scholars discourse on issues encompassing; dearth of leadership, absence of pedagogy based approaches, insufficient training, scarcity of scholarships empirically to authenticate the impact of LA in HE and deficiency of LA specific profiles (Arroway et al., 2016; Yanosky, 2009; Yanosky and Arroway, 2015). Additionally, lack of skills, absence of readiness amid staff and students (Arnold et al., 2014; Wasson and Hansen, 2016), students' literacy pertaining to data literacy (Wolff et al., 2016), social and cultural challenges (Siemens, 2019), ethical concerns of privacy and data protection (Ferguson et al., 2016; Gedrimiene et al. 2019; Kwong et al. 2017) and multifarious risks pertaining to privacy, equity, and control over critical infrastructure (Allen and Feehan, 2019) have been discoursed. Correspondingly, Nunn et al. (2016) identified that pursuing, assembling, appraising and scrutinising data for LA, as well as an absence of linkage to learning science, coupled with the requisites for learning environment optimization pose numerable challenges. The authors further add on issues concerning ethics and privacy (Nunn et al., 2016). The juncture of learning design and academic performance may also generate issues (Nguyen et al., 2018). Gašević *et al. (*2016) scholarship illuminates three main subjects in LA application, namely, the development of predicators and indicators for various dynamics (e.g. academic performance, student engagement, and self-regulated learning skills); the use of conceptions to explore and construe data and to prompt educative actions; and the derivation of interventions to contour the learning environment.

Methodology
This study has undertaken an exploratory review of the secondary literature sourced from the internet; mainly journals, conferences, conference proceedings, reports, books and book chapters. This enquiry primarily discourses on the benefits and challenges of LA for Higher education and its implications for the National University of Samoa. The purpose is to consolidate the efforts of all sections within NUS to engage in a consultative process with the aim of strengthening its data competence and data management processes. This enquiry is confined to NUS and the research inferences are institution specific. Given the unpredictable contexts of the institutional milieu of nations, the implications and irrefutable claims may not be relevant in another scenario. This enquiry has not embarked on any examination of human subjects thus; ethics clearance was not deemed essential.

Discussion: Implications for NUS
Against the backdrop of access to data mining technologies and the rapid advancement and impact of digital technologies, LA has taken precedence as it befits pecuniary and policy strengths for decision making. Having said that, NUS is striving towards T&L excellence which is strategically aligned to the Strategy for the Development of Samoa. The fact that its student recruitment is national as well as international, the key focus should be on its strategic positioning to entice students nationally, regionally and globally. To this end, attaining this competitive advantage in the HE sector requires NUS

to be agile and adaptive in dissecting the challenges of the 21ˢᵗ century to capitalise on the snowballing prominence of data and learning analytics for the education sector.

In order to introduce and adopt Learning Analytics for improved Teaching and Learning Excellence at NUS, institutional leadership, support and commitment has to be requisitely modelled. This should set the impetus for driving governance practices at the university and for formulating key policies, strategies, frameworks and guidelines for LA data collection, synthesis and evaluation. This is also crucial for driving an open, bottom up consultative process of stakeholder consultation and appraisal regarding LA tools, methodologies, processes etc. It will also permit NUS to draw institution-specific frameworks/models. The consultative and participatory approach will further equip NUS to draw best practices from affiliate universities, nevertheless remaining cognizant of the social-cultural and other country/institution factors in mind. Stakeholder debate is critical for increasing awareness, boosting higher standards, generating dialogue on pertinent issues and improving the application of LA at NUS. Active student engagement is a key as well. This requires student voice and representation, and of course students' consent to pave learning pathways and devise intervention strategies.

The implementation of LA tools and systems also requires infrastructural support encompassing software, hardware, standards, legal, and standardisation issues, data protection, copyright, access, privacy, etc. To draw the LA roadmap, the establishment of a task force addressing key strategic objects deems vital. The task force ought to assess the current T&L practices, systems and processes and perform a cost-benefit analysis in light of new frameworks, models and stratagems. The role would also require alignment amid pedagogy and assessment. Scaling up from a traditional approach to an automated system requires developing a plan, up skilling staff and students, raising awareness on the measures of student performance and the types of data sets to employ, understanding T&L quality indicators, aligning pedagogy and assessments, tracking poor performers and students' at risk, monitoring attrition and retention coupled with exploring student satisfaction and failure rates.

Capacity building is another area worth reflecting on. It is pertinent to assess the readiness of staff and student's engaged in the LA environment. Assessment will definitely point towards training, professional development and capacity building initiatives required at the institutional level for acclimatizing LA for improving Teaching and Learning Excellence.

The funding model needs identification and the transformation needs to be planned systematically and phased out keeping in mind the bottlenecks. Integrating the silos and integrating across the sections of data would be quite challenging and needs proper project planning and management. LA would be beneficial for institutional research, academic development, enhanced planning and quality assurance and for increasing student success at the university.

NUS must enhance its data capability and data management policy and on this note collaboration with other affiliate universities should set the foundation for a robust progress of LA methods and tools at the institutional level.

Quality assurance (QA) teams also play a predominant role and at NUS, while the Academic Quality Unit is charged with ensuring the QA of NUS programs, AQU, faculties and Senate plays a vital role in the assessment and assurance for validating/scrutinising the robustness of the tools, stratagems, methods etc which would be implemented. It would also pinpoint towards the validity and reliability of LA.

It is understood that as the Education sector accumulates a wealth of data, NUS also generates and consumes massive volumes of data daily. Nonetheless, NUS has not yet leveraged LA to capitalise on the gigantic prospects offered via the data revolution. It is lagging behind other universities in this

area. It is judicious for NUS and the university staff to be equipped with the resources and capacity to manage data well. Otherwise, it would lag behind and students' would be inept, and would slip out on many promising learning and support benefits.

   NUS also needs to be prepared for the mounting mandates for more prompt data in the coming years, from the government, the HE sector and the community, and thus the university needs to embrace the virtuous data management approaches of LA.

   At the national level, it is imperative to improve assessment checklists for LA, utilising the models and frameworks and appraising quality indicators for LA at the institutional level. This also calls for more research driving scholarships on LA, its tools and methodologies, approaches, and frameworks and models. The research culture needs to boost studies on LA adoption, usage, and effective practice.

Conclusion

The National Vision for education in Samoa is, "for every Samoan to enjoy an improved quality of life premised on improved education and strengthened cultural and traditional values"[3]. This is the impetus leading the establishment of the NUS Strategic Plan in which T&L enhancement mandates an institutional priority, dictating committed strategies and structures (Ibid). NUS currently has a TEL policy and we need to fully implement it to realise the full benefits of TEL for NUS students.

   Digitalisation has transformed the educational milieu and digital learning is manifested in multi-fold ways at universities. Now, the call is for universities to strategically deploy it. It is of great prominence that NUS embraces learning analytics under vibrant guidelines that are grounded in its socio-cultural, economic, political/legal and international settings specific for its context and this must precisely be founded on current best practices for LA. As is already stipulated in its Strategic Plan, Clause 2.1.3, p. 12 (Ibid), one of the Key Performance Indicator for T&L Enhancement is increasing access to Technology Enabled Learning (TEL) methods and tools and measuring the impact of TEL on students' learning, research and teaching (Ibid). LA in this regard ties in with the KPI.

   This paper is merely advocating for NUS to consider LA, its benefits and relevance for T&L enhancements and for institutional progress and maps its way forward through internal dialogue with key stakeholders within the University and with think-tanks to achieve a sustainable model of LA. Of course in driving this forward, it will encounter a few bottlenecks along the way; however, these will need to be managed.

   This paper is a preliminary attempt to add value to the way NUS collects and uses data on students' learning to enhance not only the learning but increase completion rates. It intends to pave the way for NUS to consider LA as a means of enhancing its Teaching & Learning programmes and to provide some discussion points for internal consultations. Once the concept of LA and its benefits is made known to all relevant sections of NUS, a way forward for LA will certainly be made clear.

   This paper aims to engage NUS in an internal consultative process with the aim of enhancing its data competence and data management processes.

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[3] NUS CORPORATE PLAN 2017/18 – 2020/21. Retrieved from https://www.nus.edu.ws/s/files/NUS-SP-CP-FY2017-2020_V2_4_2019UPDATED.pdf

References

Allen, N., and Feehan, P. 2019. "*Risk Mitigation and Data Analytics: Privacy, Equity, Infrastructure. Poster Session*." EDUCAUSE Annual Conference, October 14–17, 2019 McCormick Place West, Chicago, IL. Retrieved from https://events.educause.edu/annual-conference/2019

Arnold, K.E., Lynch, G., Huston, D., Wong, L., Jorn, L., and Olsen, C.W. 2014. "Building Institutional Capacities and Competencies for Systemic Learning Analytics Initiatives." Proceedings of the Fourth International Conference on Learning Analytics and Knowledge, New York, USA, 257–260.

Arroway, P., Morgan, G., O'Keefe, M. and Yanosky, R. 2016. *Learning Analytics in Higher Education*. EDUCAUSE. Retrieved from https://library.educause.edu/~/media/files/library/2016/2/ers1504la.pdf

Baer, L.L., Duin, A.H., Norris, D., and Brodnick, R. 2013. "*Crafting Transformative Strategies for Personalized Learning/Analytics*." Proceedings of the Third International Conference on Learning Analytics and Knowledge, New York, USA, 275–277.

Broadbent, J., and Poon, W. 2015. "Self-regulated Learning Strategies and Academic Achievement in Online Higher Education Learning Environments: A Systematic Review", *The Internet and Higher Education*, 27, 1-15.

Brown, M., McCormack, M., Reeves, J., Brooks, C. D., Grajek, S., Alexander, B., Bali, M., Bulger, S., Dark, S., Engelbert, N., Gannon, K., Gauthier, A., Gibson, D., Gibson, R., Lundin, B., Veletsianos, G., and Weber, N. 2020. *2020 EDUCAUSE Horizon Report*, Teaching and Learning Edition, EDUCAUSE, Louisville.

Colvin, C., Rogers, T., Wade, A., Dawson, S., Gasevic, D., Shum, S.B., Nelson, K., Alexander, S., Lockyer, L., Kennedy, G., Corrin, L., and Fisher, J. 2015. *Student Retention and Learning Analytics:* A *Snapshot of Australian Practices and a Framework for Advancement*. The Australian Government Office for Learning and Teaching.

Education and Training 2020 Working Group on Digital Skills and Competences. 2016. Learning Analytics. Key Messages. Retrieved from https://ec.europa.eu/education/sites/education/files/2016-pla-learning-analytics_en.pdf

Ferguson, R. 2012a. Learning Analytics: Drivers, Developments and Challenges. *International Journal of Technology Enhanced Learning* 4 (5/6): 304-317.

Ferguson, R. 2012b. *The State of Learning Analytics in 2012: A Review and Future Challenges.* Technical Report KMI-12-01, Knowledge Media Institute, The Open University, Milton Keynes, UK.

Ferguson, R., and Clow, D. 2017a. Where is the Evidence? A Call to Action for Learning Analytics. In: *LAK 17 Proceedings of the Seventh International Learning Analytics & Knowledge Conference*, ACM International Conference Proceeding Series, ACM, New York, USA, pp. 56–65.

Ferguson, R., and Clow, D. 2017b. Learning Analytics: Avoiding Failure. *EDUCAUSE* Review. Retrieved from https://er.educause.edu/articles/2017/7/learning-analytics-avoiding-failure

Ferguson, R; Hoel, T., Scheffel, M., and Drachsler, H. (Eds.) 2016. *Journal of Learning Analytics, 3 (1). Special Section on Ethics and Privacy in Learning Analytics.* UTS ePress, Sydney, Australia.

Ferguson, R., Brasher, A., Clow, D., Cooper, A., Hillaire, G., Mittelmeier, J., Rienties, B., Ullmann, T., Vuorikari, R. 2016. Research Evidence on the Use of Learning Analytics - Implications for Education Policy. R. Vuorikari, J. Castaño Muñoz (Eds.). Joint Research Centre Science for Policy Report; EUR 28294 EN; doi: 10.2791/955210.

Fidalgo-Blanco, Á., Sein-Echaluce, M.L., García-Peñalvo, F.J. and Conde, M.Á. 2015. "Using Learning Analytics to Improve Teamwork Assessment." *Computers in Human Behavior*, 47, 149-156.

Gašević, D., Dawson, S. and Pardo, A. 2016. "How Do We Start? State and Directions of Learning Analytics Adoption." *International Council for Open and Distance Education*, Retrieved from https://icde.memberclicks.net/assets/RESOURCES/dragan_la_report%20cc%20licence.pdf

Gedrimiene, E., Silvola, A., Pursiainen, J., Rusanen, J., Muukkonen, H. 2019. "Learning Analytics in Education: Literature Review and Case Examples from Vocational Education*." Scandinavian Journal of Educational Research*, doi: 10.1080/00313831.2019.1649718

Ihantola, P., Vihavainen, A., Ahadi, A., Butler, M., Borstler, J., Edwards, E. H, Isohanni, A; Korhonen, A; Petersen, A; Rivers, K., Rubio, M. A., Sheard, J., Skupas, B., Spacco, J., Szabo, C., and Toll, D. 2015. *Educational Data Mining and Learning Analytics in Programming: Literature Review and Case Studies. Proceedings of the 20th Annual Conference on Innovation and Technology in Computer Science Education (ITiCSE 2015)*, Association for Computing Machinery (ACM), New York, USA.

Jones, K.M.L. 2019. "Learning Analytics and Higher Education: A Proposed Model for Establishing Informed Consent Mechanisms to Promote Student Privacy and Autonomy." *International Journal of Educational Technology in Higher Education,* 16, 24. Retrieved from https://doi.org/10.1186/s41239-019-0155-0

Jivet, I., Scheffel, M., Specht, M., Drachsler, H. 2018. "*License to Evaluate: Preparing Learning Analytics Dashboards for Educational Practice.*" Proceedings of the 8th International Conference on Learning Analytics & Knowledge, ACM, pp. 31-40.

Karkhanis, P.S., and Dumbre, S.S. 2015. "A Study of Application of Data Mining and Analytics in Education Domain." *International Journal of Computer Applications,* 120 (22): 23-29.

Kwong, T., Eva, W., and Yue, K 2017. "Bringing Abstract Academic Integrity and Ethical Concepts into Real-life Situations." *Technology Knowledge and Learning* 22 (3): 353-368.

Lee, K. 2017. "Rethinking the accessibility of online higher education: A historical overview." *The Internet and Higher Education*, 33, 15-23.

Leitner, P., Khallil, M., Ebner, M. 2017*. "Learning Analytics in Higher Education – A Literature Review. In Peña-Ayala, A."* (Ed.) 2017. Learning Analytics: Fundaments, Applications, and Trends: A View of the Current Stat of the Art to Enhance e-Learning, Springer, Chum, pp. 1-23

Long, P., and Siemens, G. 2011. "Penetrating the Fog: Analytics in Learning and Education." *EDUCAUSE Review 46* (5): 31-40.

Newland, B., Martin, L., and Ringan, N. 2015. *Learning Analytics in UK HE 2015: A HeLF Survey Report*.

Nguyen, Q., Huptych, M., and Rienties, B. 2018. "*Linking Students' Timing of Engagement to Learning Design and Academic Performance.*" In Proceedings of the 8th International Conference on Learning Analytics and Knowledge, ACM, New York, pp. 141–150.

Nistor, N., Derntl, M., and Klamma, R. 2015. *"Learning Analytics: Trends and Issues of the Empirical Research of the Years 2011–2014."* In G. Conole, T. Klobučar, C. Rensing, J. Konert, & E. Lavoué (Eds.), Design for Teaching and Learning in a Networked World. Lecture Notes in Computer Science, Vol. 9307 (pp 453-459). Cham, CH: Springer International.

Nunn, S., Avella, J.T., Kanai, T., and Kebritchi, M. 2016. "Learning Analytics Methods, Benefits, and Challenges in Higher Education: A Systematic Literature Review." *Online Learning*, 20 (2): 1-17. Retrieved from https://olj.onlinelearningconsortium.org/index.php/olj/article/view/790

Peña-Ayala, A. 2018. "Learning analytics: A glance of evolution, status, and trends according to a proposed taxonomy." *Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery*. Retrieved from https://doi.org/10.1002/widm.1243

Rienties, B., Boroowa, A., Cross, S., Kubiak, C., Mayles, K., and Murphy, S. 2016. Analytics4action "Evaluation Framework: A Review of Evidence-based Learning Analytics Interventions at the Open University UK." *Journal of Interactive Media in Education*, 1 (2): 1-13.

Robinson, C., Yeomans, M., Reich, J., Hulleman, C., and Gehlbach, H. 2016. "Forecasting Student Achievement in MOOCs with Natural Language Processing." *The 6th International*

Sin, K., and Muthu, L., 2015. "Application of Big Data in Educational Data Mining and Learning Analytics – A Literature Review" *ICTAC Journal of Soft Computing* 5 (4):1035-1049.

Szabo, C., and Toll, D. 2015. "Educational Data Mining and Learning Analytics in Programming: Literature Review and Case Studies." In Proceedings of the 2015 ITICSE on Working Group Reports, ITICSE-WGR '15, pp. 41–63, New York, NY, USA.

Conference on Learning Analytics and Knowledge, Edinburgh, pp. 383-387.

Sclater, N. 2014. *Learning Analytics: The Current State of Play in UK Higher and Further Education*. Jisc.

Sclater, N., Peasgood, A., and Mullan, J. 2016. *Learning Analytics in Higher Education: A Review of UK and International Practice*. Retrieved from www.jisc.ac.uk/reports/learning-analytics-in-highereducation

Schumacher, C., and Ifenthaler, D. 2018. "Features Students Really Expect from Learning Analytics." *Computers in Human Behavior* 7: 397-407.

Siemens, G. 2019. "Learning Analytics and Open, Flexible, and Distance Learning", *Distance Education 40* (3): 414-418. Retrieved from 10.1080/01587919.2019.1656153

Slade, S., and Prinsloo, P. 2013. "Learning Analytics: Ethical Issues and Dilemmas." *American Behavioral Scientist*, 57 (10): 1509–1528. Retrieved from http://oro.open.ac.uk/36594/

Star, M., and Collette, L. 2010. "GPS: Shaping Student Success One Conversation at a Time." *EDUCAUSE*, Retrieved from http://er.educause.edu/articles/2010/12/gps-shaping-student-successone-conversation-at-a-time

Tsai, Y.S., and Gašević, D. 2017. *The State of Learning Analytics in Europe – Executive Summary. SEILA Project*. Retrieved from http://sheilaproject.eu/wp-content/uploads/2017/04/The-state-of-learning-analytics-in-Europe.pdf

Vuorikari, J., and Castaño, M. (Eds.). 2016. *Research Evidence on the Use of Learning Analytics - Implications for Education Policy. Science for Policy report by the Joint Research Centre (JRC) and the European Commission*. Publications Office of the European Union, Luxembourg. Retrieved from
https://publications.jrc.ec.europa.eu/repository/bitstream/JRC104031/lfna28294enn.pdf

Wasson, B., and Hansen, C. 2016 In Cecilie. 2016. "*Data Literacy and Use for Teaching*." In Reimann, P., Bull, S., Kickmeier-Rust, M. D., Vatrapu, R., and Wasson, B. (Eds). Measuring and Visualizing Learning in the Information-Rich Classroom, Chapter: 5, Routledge. pp. 56–73.

Wolff, A., Moore, J., Zdrahal, Z., Hlosta, M., and Kuzilek, J. 2016. *Data Literacy for Learning Analytics*. Proceedings of the Sixth International Conference on Learning Analytics & Knowledge, New York, USA, 500–501.

Wong, B. T.M. 2017. "Learning Analytics in Higher Education: An Analysis of Case Studies." *Asian Association of Open Universities Journal*, 12 (1): 21-40. Retrieved from
https://doi.org/10.1108/AAOUJ-01-2017-0009

Worsley, M. 2018. *(Dis) engagement Matters: Identifying Efficacious Learning Practices with Multimodal Learning Analytics*. Proceedings of the 8th International Conference on Learning Analytics and Knowledge, ACM, 365-369

Yanosky, R. 2009. *Institutional Data Management in Higher Education*. ECAR.

Yanosky, R., and Arroway, P. 2015. *The Analytics Landscape in Higher Education*. ECAR.