



# The use of Learning Analytics in STEM over 4 years

## eSTeEM Final Report

Tom Olney and Carlton Wood

STEM

2<sup>nd</sup> August 2024

Keywords: Learning Analytics, Theory of Practice

Architectures

# Contents

<b>Executive Summary</b>	<b>3</b>
<b>Aims and scope of the project</b>	<b>4</b>
<b>Activities</b>	<b>6</b>
<b>Findings</b>	<b>8</b>
<b>Impact</b>	<b>13</b>
<b>Dissemination</b>	<b>14</b>
Deliverables	14
References	14
University approval processes	15
Appendices	15

# Executive Summary

Learning analytics is a rapidly expanding area of interest for many higher education institutions. Over the last decade the focus in this field has largely been on the technical challenges associated with collecting, storing and refining data in order for it to be presented to users in actionable visualisations. Much of this work has been accompanied by an underlying assumption that once presented learning analytics will lead to improvements that are not yet clearly defined. However, the practice of educators in using learning analytics has not been well studied. This study has used the Theory of Practice Architectures (TPA) as a methodology in order to describe the situated practice of learning analytics (what it means to 'do' learning analytics), and to explore the contextual arrangements that serve to enable or constrain that practice. Based on two sets of semi-structured interviews - separated by six years - of academics and academic-related staff from STEM this study provides insights into the evolution of learning analytics practice. The findings suggest that the establishment of reliable and trustworthy data, and its presentation, is only the first step in a long and ongoing process that requires serious and substantial support at the institutional level. To illustrate this, learning analytics is discussed in terms of the actions that it prompts, the language that characterizes practice, and the time and resources that are required to embed it into meaningful practice.

# Aims and scope of the project

In 2017/2018 members of this research team completed an eSTeEM project that used a social informatics approach to explore the extent to which, and how, two learning analytics models (OU Analyse and Student Predictive Model) were being used in STEM by tutors and presentation module teams. The findings led to recommendations about the use of these tools in STEM [1].

This research study aimed to follow-up with original participating academics and curriculum managers, or new teams now associated with original participating modules, to see how their practice had evolved in the particular circumstances and contexts of their working situations. The research team employed the Theory of Practice Architectures (TPA) [2] to investigate and evaluate the particular arrangements that constrain or enable learning analytics practice in STEM. With this information the research team set out to highlight challenges and develop robust methodologies that could support both module teams as they engage, or not, with this growing field of teaching and learning and further LA implementations.

This work continued the work of previous publications broadly aligned with attempting to explain the success or not of LA implementations into educational contexts. This tradition challenges dominant views encapsulated within ‘technological determinism’ by emphasizing the consideration of eco-systems and contexts into which such implementations take place. Earlier work which has, for example, revealed the ‘invisible work’ of the user[3], and proposed the

existence of 'shadow practices'[4] that are not always reported in other studies. A different recent eSTEEem study by the lead authors used TPA as a way to draw together multiple sources of data and illuminate learning design practice in STEM over a similar timescale [5].

This study sought to address the following research questions:

**RQ1: What does it mean to 'do' learning analytics in the Faculty of STEM?**

**RQ2: What are the arrangements that enable and/or constrain the practice of learning analytics in the Faculty of STEM?**

# Activities

In 2017 the authors initiated a project supported by eSTEEem which was prompted by the introduction of a new LA implementation into an existing suite of LA dashboards and the formalisation of the use of data and analytics as a priority in the STEM Retention and Progression Plan 2017/18. One strand of the project sought to investigate the use of the new LA implementation by tutors [1], [2], [3] whilst the strand of the project in question here sought to investigate the use of LA by 26 members of thirteen module teams over the course of the 2017/18 academic year with a particular focus on the use of the new LA implementation. All the module teams had had previous support from the LDS-Learning Design team through the Analytics for Action (A4A) Framework. This project used a situated, social informatics approach to collect a wide range of evaluation data and undertake a series of reflective, semi-structured interviews designed to provide a detailed picture of LA practice that focused on context, mechanisms, and outcomes.

In 2023 the authors reviewed the collected data and re-interviewed as many of the academics and academic-related staff from the original set as possible using an instrument based on TPA. Where staff had left the institution, the current staff allocated to module teams were interviewed. In total, sixteen module team members were interviewed from nine module teams. During the six years between the projects multiple new sources of LA were now available to the teams. They were asked about their aims in using LA, their actual use, their perceptions of how their practice had changed since 2017/18, and the

arrangements that constrained or enabled their practice. Where appropriate they were reminded of their previous interview responses and asked to comment.

In both cases the interviews were recorded using Skype or MS Teams and transcribed by administrative staff from within the STEM Faculty. Transcriptions were then anonymised and uploaded to NVivo analysis software. The first set of interviews were analysed using a form of Reflexive Thematic Analysis [6] to generate six themes. This report was published internally by eSTeEM along with other findings [1]. The second set of interviews were combined with the first set and analysed using TPA.

# Findings

## **RQ1: What does it mean to 'do' learning analytics in STEM?**

In 2017/18 nine of the thirteen module teams identified improved student retention, progression, pass and/or completion rates as one of their desired outcomes of using LA. None of these nine teams considered this outcome to have been realized. In general, the module teams found it difficult in their experience to associate the use of LA with student outcomes in amongst a range of different retention initiatives. As one academic commented, '...there's so many different interventions going on, you're practically tripping over!' Piloting module teams did not generally perceive the use of LA as being responsible for any improvements to retention or student outcomes.

In 2022/23 the improvement of retention continued to be the primary aim of module teams in engaging with LA. The module teams that were interviewed were asked to provide examples of their LA practice in terms of doings, sayings and relatings and twelve examples were collected. In terms of doings, the types of data that were accessed were broad. Eight of the examples referenced accessing LA for information on assessment, five for student numbers (retention/at risk/registrations), two for study intensity/pathways, two about learning design, and one on plagiarism. Eight of the twelve examples demonstrated the articulation of a clear action based on the use of LA which were split between student support (five references), learning design (two references), and no deliberate action (one reference). Four examples were



unclear about identifying any action based on LA. In terms of relatings, seven of the twelve examples referenced collection/sourcing data as an individual activity, whilst nine referenced LA being used to prompt/share/inform discussions with wider members of the module team and/or faculty colleagues. The sayings used to describe the experience of using LA were both positive and negative. Negative experiences were described as: frustrating (four references), painful, clunky, unclear in relations to systems, lack of time available (three references), and unreliable or non-timely data. Positive experiences were described using the words: confidence (two references) enjoy (two references), excited, useful, grateful, reassuring, rewarding, timely, immediate, brilliant.

The idea that LA was a 'game-changer', i.e., that it would fundamentally change their learning & teaching practice, was not expressed by any of the module teams in the 2017/18 interviews. Whilst there were positive comments focused on identifying the available LA as 'useful' and as having 'potential', interviewees were generally unable to specify actions they intended to take based on it. In 2022/23 the module teams were asked specifically about this question and eleven provided a response. Seven of these did not view LA as a 'game-changer', preferring to conclude that any current attributable impact was either too small to warrant that description, or that LA use was still offering only potential, or had only improved confidence and understanding. One suggested that it might be a game-changer for others (but not them), another thought current LA was not actionable enough, or that it just took up too much time. However, four other responses were much more confident, pointing to experiences in other educational settings as evidence, as well as the importance of LA enabling direct action. One interviewee framed their thoughts

as a question: 'What do you have without it [LA]? You have gut reaction, and you have intuition, and you have a feeling about how it goes. How can you argue the case [for an intervention] when this is all that you've got to argue it on?'

## **RQ2: What are the arrangements that enable and/or constrain the practice of learning analytics in STEM?**

In terms of material-economic arrangements the increase in the amount and quality of new LA dashboards produced by DSA was described as being an enabler of practice by at least eleven of the respondents who made comments such as, 'I'm really glad it exists. I'm really glad we have it. I think it's amazing...' and 'I'd be really upset if they took my data away'. However, themes from the 2017/18 interviews that continued to be considered constraints on practice were about trust in the LA, applicability of the LA to the specific module context in order to act, and the efficient identification and navigation of so many complex data sources. Comments included, '...you just almost can't see the wood for the trees' and '...surely the biggest barrier is that there's nothing all in one place.'

Whilst these constraints were very much evident in the interviews, the most common and consistent constraint was around the lack of time available to module team members to spend developing and exploring their LA practice. It is evident from these comments that the module team members that were interviewed did not perceive the use of LA in the site of practice investigated here as an easy or straightforward task where the work had mostly been done for them by the designers of the LA dashboards. Rather that it took a substantial

commitment from them in terms of time and activity which may have been better spent, in the opinions of some at least, ‘...trying to forge good relationships with my students rather than looking at who has clicked on the web page this week’. For these reasons, the interviews demonstrated a powerlessness to respond to the demands of keeping up to date with LA developments and a forced reliance on the LA tools or sources they were most familiar with.

Analysis of the cultural-discursive arrangements revealed some interesting findings about the language that was used around LA and how it could be seen as both an enabler and constraint on practice. For example, one respondent shared an anecdote about how they had changed the language they used when they had discovered a set of predictive data supported what they already perceived based on their experience, about a set of students likely to struggle in the next intake on a particular module. Rather than share the information with colleagues using data terms (loaded as that was likely to be with language such as ‘algorithms’ and ‘machine learning’), the staff member preferred to present the information relying on their experience as evidence and believed that was more effective. Conversely, three interviews referenced examples of knowledge gained from the use of LA dashboards being used to debunk ‘myths’ which had become widely accepted in colleagues thinking about student behaviour. Referring to LA dashboards, tools and sources by the incorrect names was also persistent. On the whole, the interviewees tended to refer to specific LA sources by either the department of the University that had developed them, the model that underpinned the data, the person that had first demonstrated it to them, or the generic platform/software which hosted the information. Opinion was divided amongst the interviewees about the extent to

which this was a problem or not, but repeated clarification and the presence of visual cues were required during the interviews to ensure that all parties were referring to the same things. Nevertheless, confusion was present.

# Impact

In November 2023, the findings from this project were presented at the ICERI Educational Conference in Seville by Carlton and I (see deliverable). As a result of this presentation, we have also been invited to join a TPA Research group at the University of Wollongong and we will be presenting there in September. Due to the focus on practice in this study I will co-chairing the practitioner strand of the Learning Analytics and Knowledge (LAK) Conference in Dublin in 2025.

The approach taken in this project will inform the evaluation of the Student Performance Tracker (SPT) LA implementation pilot during 2024/25. I have already started supporting Jenny Worthington from Data & Student Analytics who is leading the pilot and implementation.

# Dissemination

## Deliverables

Olney, T., & Wood, C. (2023). The evolution of learning analytics practice over six years at the Open University, UK: what are the arrangements that enable or constrain this practice? ICERI2023 Proceedings, Seville. pp 449–455.

<https://doi.org/10.21125/iceri.2023.0173>.

## References

[1] Olney, Walker, Wood & Clarke (2019) *Piloting OUA and SPM on 12 STEM modules – eSTEEeM executive summary*

<https://www.open.ac.uk/about/teaching-and-learning/esteem/sites/www.open.ac.uk/about/teaching-and-learning/esteem/files/files/2019-08-Carlton-Woo-Steve-Walker-Piloting%20OUA-final-report-executive-summary.pdf>

[2] Mahon, Kemmis, Francisco & Lloyd (2017) Introduction: Practice Theory and the Theory of Practice Architectures. In *Exploring education and professional practice*, pp 1–30. Springer, Singapore

[3] Walker S, Olney T, Wood C, Clarke A, Dunworth M (2019) How do tutors use data to support their students? *Open Learning*, Volume 34, Issue 1, pp 118–133.

<https://doi.org/10.1080/02680513.2018.1554476>

[4] Olney, T., Walker, S., Wood, C., & Clarke, A. (2021) Are We Living In LA (P)LA Land? Reporting on the Practice of 30 STEM Tutors in their Use of a Learning Analytics Implementation at the Open University. *Journal of Learning Analytics*, 1–15. <https://doi.org/10.18608/jla.2021.7261>

[5] <https://www.open.ac.uk/about/teaching-and-learning/esteem/sites/www.open.ac.uk/about/teaching-and-learning/esteem/files/files/2022-03-Tom-Olney-Learning-design-approaches-final-report.pdf>

[6] Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative research in sport, exercise, and health*, 11(4), 589–597. <https://doi.org/10.1080/2159676X.2019.1628806>

## **University approval processes**

This research project has been reviewed by, and received a favourable opinion, from The Open University Human Research Ethics Committee – HREC/4224/Olney.

## **Appendices**

Olney\_Appendix\_A\_metrics

Olney\_Appendix\_C\_TPA LA practice\_iCERI23\_Conference\_Proceedings

