



The Learning Analytics Architectural Lifecycle
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ENGLISH SUMMARY

The Learning Analytics Architectural Lifecycle.

Less than a decade old, Learning Analytics is a new field in which research and practice are fragmented, new data sources are becoming widely available, whose value to education has yet to be thoroughly researched, and there is much duplication and fragmentation of the field's effort. To provide a safe path for implementing scaled LA services based on novel data sources, I defined a lifecycle with validated stepping stones. The lifecycle is split into three interconnected parts: i) strengthening and monitoring the current infrastructure, ii) understanding the context of new services, and iii) inclusive community practices. I highlighted the need for inclusive practices, and showed that there are many future research directions possible, and argued for an emphasis on community practice with the inclusion of all stakeholders. Through these means, we decrease the risks associated with deploying comprehensive services.

The outcomes included an international discussion on curation processes around capturing digital traces and associated software artefacts to support standardisation. An experimental open Synthetic Data Generator that has tested the stability of national experimental LA infrastructure and discovered bugs and performance issues. Validation of a novel data source, 3 million job advertisements for their predictive value in explaining longitudinal gender segregation within the UK job market. The application of job adverts as a source of recommendations within Eportfolios to improve the usability for lifelong learners and their teachers/mentors. The peer review and publication of design patterns that when enacted will enable the large-scale deployment of LA services that support the lifelong learner. The development of community-driven risk mitigation strategies that in turn is in the process of generating and interpreting evidence so that the broader community avoids the most common risks during its deployment of LA services. The organisation of many International hackathon events which caused much discussion and helped focus a comprehensive set of further research questions. The connection of hackathon events to amplify focus helping to avoid fragmentation and duplication of effort.

In detail, I explored the safe path through the lifecycle by researching five problems.

Current Infrastructure: Problem one: *How do we Standardise learner's digital traces?* Before adding a new data source, we need to make sure we can add it to current infrastructures in a standard way. If we cannot do this, then it becomes difficult to compare data across organisations. We enhanced and provided practices for curating the xAPI standard for capturing the digital traces of learners (Berg, Scheffel, Drachsler, Ternier, & Specht, 2016 a; 2016 b).

Problem two: *How do we validate the whole infrastructure?* If we add a new service to a sophisticated infrastructure, then we run a significant risk of decreasing the stability or accidentally disclosing personal information during development. We can monitor impact and decrease risks through a Synthetic Data Generator (SDG). I defined the requirements through a literature review for an open source approach to generating synthetic xAPI statements and validated by building a prototype. The SDG tested an experimental national infrastructure and discovered issues which the systems developers then addressed (Berg, Mol, Kismihók & Sclater, 2016 a; 2016b).

Context: Problem three: *How do we support the requirements of the lifelong learner within the context of LA?* I answered this problem in two phases. Firstly, I analysed a novel data source of 3 million job advertisements exploring its potential for tracking populations in the job market. Secondly, I developed a service design pattern incorporating the JISC national infrastructure with the original data source to support Eportfolios and provide authentic task recommendations for students and mentors/teachers in context to the job market (Berg, Branka, & Kismihók, 2018).

Inclusive Community Practices: Problem 4: *How do we organise inclusive community processes?* To address community practices, I research the concept of an interlinked set of two-day events known as hackathons that are used to review with many stakeholders emerging research questions (Berg et al., 2018; Berg, 2018; Berg & Kismihók, 2018).

Problem 5: *How do we transfer knowledge within the community (about risk)?* In this study, I suggest a new practice where we globally collect risks and their mitigations from deployment of LA services, verified during hackathons and publicising through a top ten list (Berg, Kismihók & Lynch, 2018).

Studying the five problems, I validated a lifecycle for adding inclusive new services based on novel data sources, community practices, standardisation and monitoring. Through these means I designed a new service which supports the lifelong learner.