Understanding student experience in the age of personalised study

Conference or Workshop Item

Understanding student experience in the age of personalised study

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Abstract

Moves in higher education to provide personalised learning for students increase the importance of gaining and maintaining an understanding of the student experience. For some institutions, this increase in complexity may stretch current systems and data structures. The complexity is amplified where multiple start dates are offered to improve the personalisation of study. The Open University, OU, has over the years, continued to develop its Supported Open Learning, SOL, methods and as an institution is now prioritising Personalised Open Learning, POL. This increases the importance of accessible detailed pathway information. We describe the development of one possible approach intended to provide greater understanding of the student experience for staff interpreting progress data.

Another outcome of personalisation is the fragmentation of student cohorts, as individuals each make their own study choices while progressing towards their study goal. A relatively straightforward programme of study can lead to 64 different study routes creating a further challenge for staff in understanding the differing student experiences. We show how this can be represented in a simple data structure that allows powerful queries.

Our approach uses a multi-model database, with graphical capabilities. By creating this structure in the ArangoDB environment it was possible to readily test it with 150,000 records and query it using graphical queries in the native AQL language.

The early response from faculty colleagues is very positive. They appreciate the graphical output and the ability to straightforwardly answer their questions on whether students experience greater success on one study route rather than another. We are therefore continuing to develop this model to support a qualification review for summer 2018.

In our presentation we will describe the challenge and illustrate an approach we are taking: giving examples of the queries we are using and the kinds of data the system outputs.

Introduction

This paper is written from the perspective of a drive to improve the quality of the student experience and the effectiveness of curriculum. An understanding of the student experience is necessary to be able to make informed decisions that can have a positive impact. For our institution, and possibly for others, gaining this understanding is problematic due to the complexity of factors that now exists. And this is at least in part to attempts to increase personalisation of learning. The 2015 Innovating pedagogy report, for example, covers three pedagogies linked with personalisation: Adaptive teaching, Analytics of emotions and Stealth assessment (Sharples et al, 2015, p.7).

We consider some of these factors and the effects of moves to a greater personalisation of learning. Fitzgerald et al consider approaches to categorising personalisations and in their section on learning

analytics come close to providing the space to include the effects of personalisation on enhancement (Fitzgerald et al, 2017).

Through this paper we outline an approach that has the potential to better enable us to understand the student experience in the current and developing context.

Complexity due to tuition models

One factor leading to complexity is the choice of tuition model. Taking a very broad overview of tuition models, we can describe the simplest, most straightforward arrangement as including one tutor per student for their entire study. In this approach both the tutor and the student gain an understanding of each other, and at its best can offer an excellent learning experience. This is shown in Figure 1 as the diagram in the top left corner. A more complex arrangement is shown at the top right of Figure 1. This shows cohorts of several students studying modules sequentially – with the potential, or likelihood, that each module is taught by a different tutor. In this arrangement, each of the six students starting has essentially the same learning experience as each of the others. The final diagram in this figure is an illustration of the approach existing within the OU now. That is, a model where students have a choice of module presentation, and it shows each of the six students studying the same two modules but having a different learning experience.

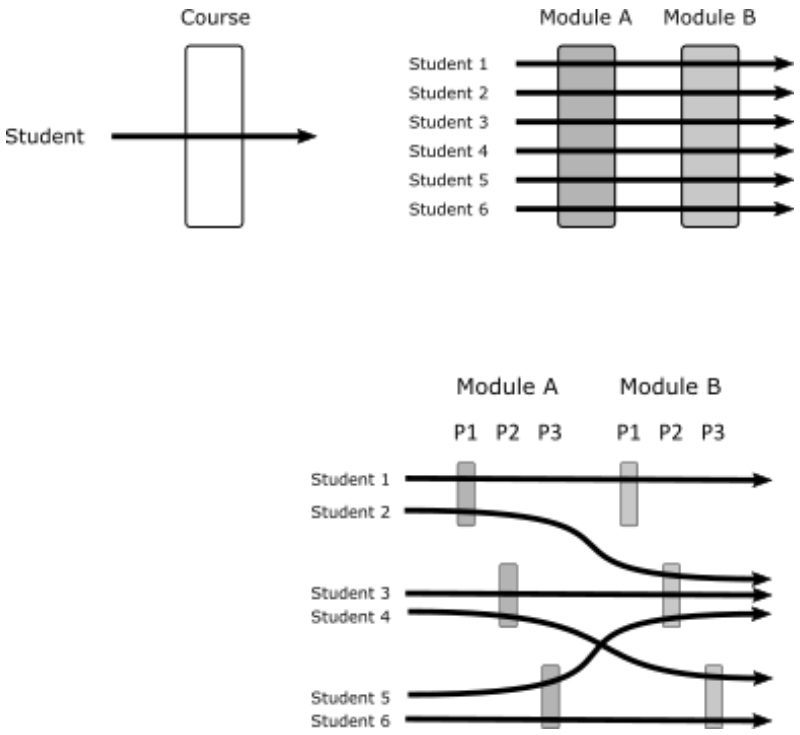

Figure 1 A broad overview of tuition models – showing student-module-tutor arrangement.

Increase in personalisation of learning

The final diagram in Figure 1 shows an approach designed to offer choice to students. The OU offers this on the majority of its programmes and there are other ways of allowing students greater flexibility in their study, through options like assessment banking and deferral. In short, all of these increase the personalisation of learning. However, increasing choice, flexibility and overall personalisation of learning for students also leads to greater complexity in the data relating to learning through the fragmentation of cohorts. It means that no tutor really knows about each

student's experience and makes the need to find new ways to understand student experience and effectiveness of curriculum more urgent.

Whilst it is conceivable we could move to more complex tuition models, and this is currently being considered, we have already shown the need to consider students' individual pathway choices. Therefore, the main difference with any further increase of complexity would likely be increased fragmentation of cohorts.

Complexity due to curriculum design

In addition to the choice in how students study, we can also increase complexity by designing choice into the curriculum. Figure 2 shows a network representation of the OU's Psychology degree. In the diagram the red arrows indicate a set of paths we decided to focus on in trying to get a sense of the overall student experience. At each level (roughly 'year' in most universities) there is an initial choice which is then followed by a compulsory module to complete study at that level. By the OU's standards this is a compact and well constrained programme of study, and it was a surprise to us when we thought about just how may potential routes to qualification there really are.

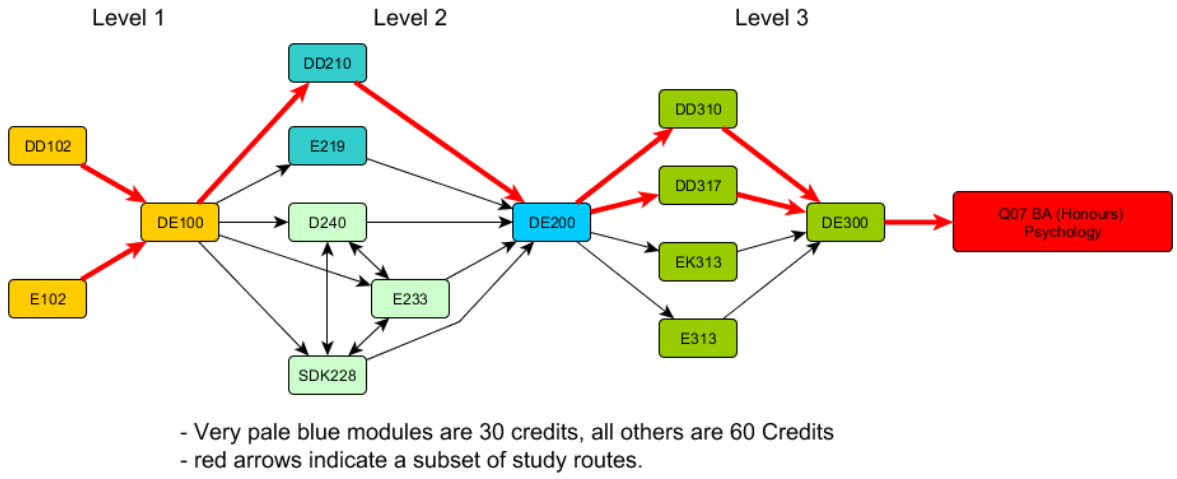

Figure 2 A network diagram of the OU's Psychology degree

When one draws a branching diagram, showing the actual pathways open to students as they make each of their study choices, as in Figure 3, it is clear that this particularly programme supports 64 different study routes to qualification. The University has therefore designed fragmentation of cohorts within its curriculum.

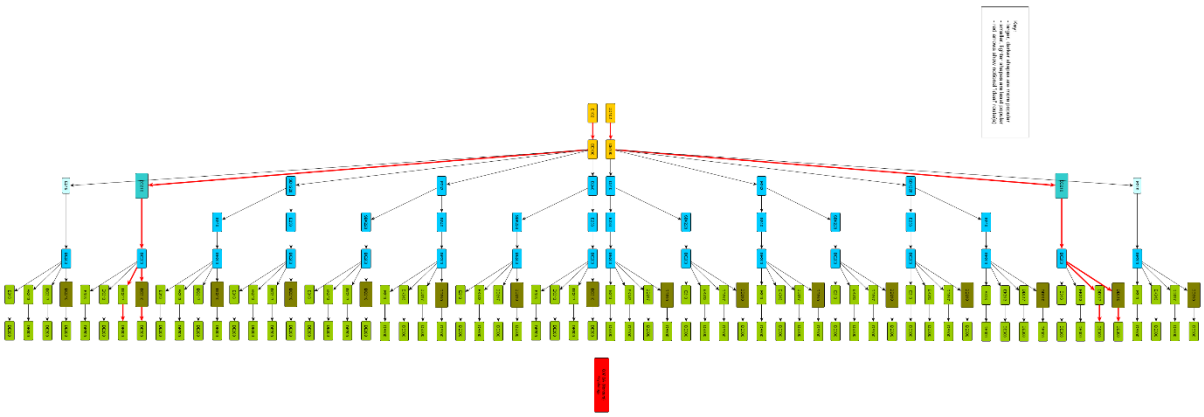

Figure 3 A branching diagram of the OU's Psychology degree – on its side to fit here. A fully scalable version is available on Figshare (Edwards, 2018)

A problem with data structure?

Colleagues at our institution have built ways to analyse path and have produced some great Sankey diagrams and other infographics. It is clear, however, that these take considerable effort to produce, and because of this they cannot readily be produced to answer a slightly modified question. In some ways these helpful visualisations may hide a fundamental issue. It is possible that the way we structure and organise our data makes this problematic**.** The roots of our institutional approach were set much earlir in the University's history. So, although the patterns are there they may be hard to see with our current data structures. This is not to say the data structures are poor, they have, and continue to serve the Institution very well and enable it to function effectively. It is interesting to ask however, that if we could restructure data now, how would we do it?

This is a question two of us (Mark Gaved and I) set ourselves recently. We had in mind that:

- our primary use for the data is to **enhance the student experience**, or to put it another way;
- to make our **curriculum as effective as possible**.

These are essentially the main goals within our roles as data wranglers.

Alongside this definition of purpose, we also set down that the data needs to give insight into the curriculum in as close to real-time as possible. Although data on the effectiveness of individual module presentations is made available soon after their end, this very quickly becomes an issue when we try to consider the effectiveness of qualifications. For an institution where the norm is for a degree to take six years and up to sixteen, waiting until students complete their study before a reflection on the effectiveness of the pathway to qualification they chose is not viable as the primary mode of qualification enhancement, simply because the student's early study is, in most cases too distant to hold any meaning in today's context.

An underlying aspect of the data is what we choose to be the fundamental unit – the element around which other data is accrued. The normal approach within our structures is to set this element as the individual student. If, however, we want to build an understanding of experience over time we could change to an approach that sets a hybrid element of student, module and module presentation as the fundamental unit around which study experience data accrues. In other words, we are saying that currently within our institution study experience relates to student attempts at studying individual modules.

Figure 4 The proposed fundamental element to accrue study experience data

Whilst, at some future point we might be able to revise this, it would make no sense in our current context. We clearly cannot divide the individual student any further, and each student will study individual modules. Each module has multiple presentations and many factors can change between one presentation and the next. It is not uncommon for students to have multiple attempts at the same module and this would be recognised within this model: assessment banking and deferrals have already been mentioned above but we can also add resits, and withdrawals to this list of reasons for multiple attempts at study of a module.

Demographics, assessment scores, attendance at tutorials, timeliness of handing in work, any other variable that might impact on a student's experience could be linked to each student-module-presentation element.

It is important to note that the student is fundamental to this hybrid element, and whilst the University can attempt to enhance factors relating to module and presentation, each student is intrinsically contributing to their study experience. This is something that can be forgotten, particularly if higher education is seen as a market place.

Rethinking the database environment

Since the University established its database structures, multi-model databases have emerged and have been continuously developed to become highly functional, with some offering graphical queries that would readily support the kind of questions we regularly try to answer. During 2017 we selected ArangoDB to trial to implement the proposed data model.

The language of this database is slightly different to that of a relational database. ArangoDB has collections rather than tables and has two kinds of collection:

- Node collection of documents, like records
- Edge collection of documents, like join tables

Having selected ArangoDB it has so far proved to be a good choice. It is readily set up and managed, and provides the functionality and scale the University would need.

With decisions about data environment made, it was possible to set down an hypothesis. The hypothesis was that four data entities would be sufficient to manage the review of the effectiveness of curriculum. These are illustrated in Figure 5. Study and Modules are document collections and Path and Qualifications are the edge collections that hold relationship information.

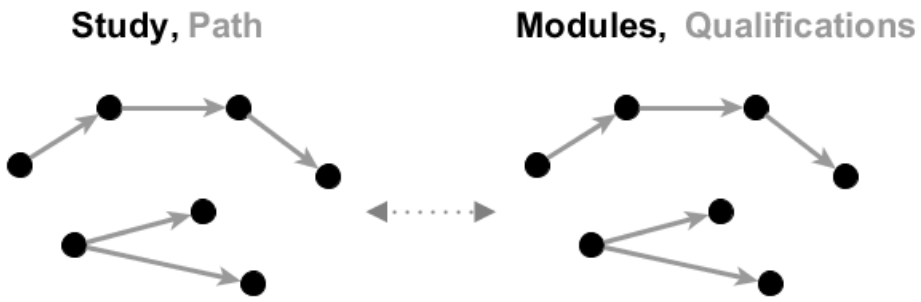

Figure 5 The proposed data structure with four data entities: Study, Path, Modules and Qualifications

Using Arango

Arango's built-in query language, AQL, allows graphical queries that traverse the data. The example below selects just the modules in the Psychology programme and plots the Psychology degree structure. The plot generated from this query is shown in Figure 6.

```
FOR v, e, p in 1..10 OUTBOUND 'Modules/Start' Qualifications
       OPTIONS {uniqueEdge: 'path'}
       FILTER e.`Qual` == "Q07"
       RETURN DISTINCT e
```

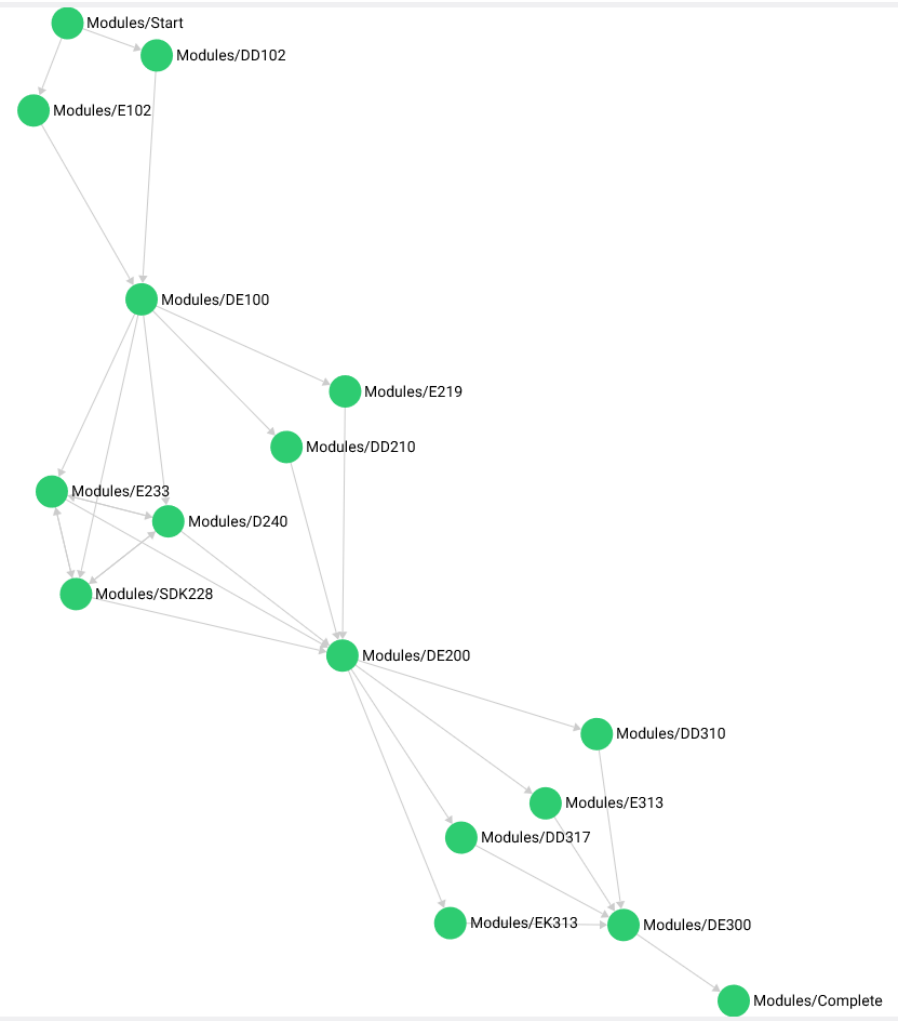

Figure 6 The plot of the Psychology degree produced from a simple graphical query in AQL

We can also use AQL to query the student data. The following query selects all the records for students passing Module2 **directly** after Module1.

```
FOR doc IN Study
   FILTER doc.`Module` == “Module1" && doc.`Outcome` == "Pass"
   FOR itm in OUTBOUND doc.`_id` Path
     FILTER itm.`Module` == “Module2" && itm.`Outcome` == "Pass"
     RETURN DISTINCT itm
```

Alternatively, we could filter for sometime (rather than directly) after:

```
FOR doc IN Study
   FILTER doc.`Module` == “Module1" && doc.`Outcome` == "Pass"
   FOR itm in 1..10 OUTBOUND doc.`_id` Path
     FILTER itm.`Module` == “Module2" && itm.`Outcome` == "Pass"
     RETURN DISTINCT itm
```

Conclusion

As an institution, we have always found it a challenge to review the effectiveness of the curriculum within a qualification. Some of the main reasons for this include the choice designed into qualifications that leads to multiple pathways and fragmentation of cohorts; the choice offered to students as to when to study a module which also leads to fragmentation; the structure of data associated with study which makes any query non-trivial and resource heavy. The current drive to offer increased personalisation of learning will naturally further increase choice and flexibility for students and therefore also will increase the complexity within the data and the need to find improved ways to understand the student experience.

Over recent months we have taken a fresh look at how we structure our data and the data base environment that we use to manage it. Our initial findings, from using the multi-model ArangoDB and a four collection structure are extremely positive and show that data can be readily selected for further analysis using very straightforward queries which closely model the kinds of questions we need to ask. This is not suggested as any kind of replacement for OU systems but rather as a way of augmenting the range of tools at our disposal. ArangoDB also has a highly flexible structure that can be adapted as required in response to development in teaching and learning

We will continue to develop this approach through producing a working system for review of the Psychology qualifications in 2018 in support the Faculty of Arts and Social Science (FASS).

Acknowledgements

Mark Gaved is the other half of the data wrangling team supporting FASS. And although I prepared and gave this webinar, we are working together, and will work on a joint publication.

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