Spring 3-19-2013

# Academic Analytics in quality assurance using organisational analytical capabilities

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**Abstract**

*The combination of increased environmental complexity and greater quantities of data presents higher education with new problems. Institutions have responded by adopting analytics-based approaches which aim to improve organisational and educational effectiveness. However, despite extensive research in academic analytics there is an identified need for further work in making analytics "actionable", a problem of 'IT in use'. Recent research in business analytics has investigated this problem using a business process orientation combined with an examination of business capabilities for analytics use. Adopting this perspective we apply it to academic analytics in the context of quality assurance, describing an outline approach to the problem of actionable academic analytics.*

**Keywords**: Academic Analytics, Learning Analytics, Higher education, Quality Assurance

## 1.0 Introduction

The combination of increased external pressures, environmental complexity and greater quantities of data presents higher education with new management problems particularly in quality assurance. Institutions have responded, following the commercial sector, adopting business intelligence and business analytics approaches modified for the education context. Business Analytics (BA) is the practice of exploring and analysing data to support decision making for improved organizational performance (Kohavi et al., 2002), (T. Davenport & Harris, 2007). In the higher education sector this practice is described as academic analytics (Goldstein, 2005), (Oblinger & Campbell, 2007). However, despite the extensive research in academic analytics over the last decade there is an identified need for further work in making analytics "actionable", a problem of 'IT in use'.

Recent research in business analytics has investigated this problem using the concept of organisational capabilities described as "analytical capabilities" which mediate analytics use and success. Adopting this perspective we apply it to academic analytics in the context of quality assurance (QA). This paper describes the problem formulation stage in a design science project addressing academic analytics in QA.

The outputs are: a conceptualization of the research problem based on existing models of analytics and a preliminary artefact design.

## 2.0 Method

This study follows a design science methodology (Hevner et al., 2004), using the action design research (ADR) method, which aims at generating prescriptive design knowledge through the creation of IT artefacts in an organizational setting (Sein et al., 2011). The work-in-progress presented in this paper describes phase one of the ADR method: Problem Formulation (figure 1).

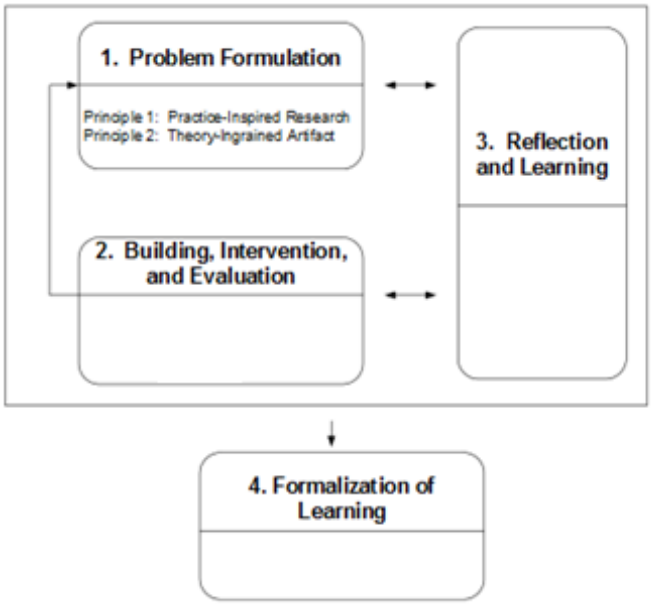


**Figure 1. ADR Method (Sein, et al., 2011)**

In accordance with this method, we carry out a literature review (section 3.0) to structure the problem and identify possibilities for an analytics design (theory-ingrained artefact). Following that we describe (section 4.0) a specific field problem: quality assurance in HE by programmatic review, which provides the research opportunity (practice-inspired research). The result is a preliminary design which is illustrated by an example.

## 3.0 Literature review

The Problem Formulation phase of ADR includes the use of prior theories to structure the problem and to identify solution possibilities (Sein, et al., 2011). In this case that involves academic analytics and the value in use.

### 3.1 Academic Analytics and Value

One of the open research questions in analytics is the problem of maximising the organisational impact and value, a problem of "IT in use" (Lönnqvist & Pirttimäki, 2006), (LaValle et al., 2010). This problem is particularly difficult in public sector analytics where measures of value are more complex (Levine, 2012). Academic analytics is focussed at the institutional level where value and action are problematic but most of the research is case-based and practitioner oriented (Arnold, 2010), resulting in a lack of generalisable process models and key factors for further research in use and value. This gap has been identified within academic analytics with a call for a move to "action" analytics (Norris et al., 2008). In contrast, recent research in business analytics has examined the value proposition for analytics from a variety of perspectives.

### 3.2 Business Analytics and Value

The importance of generating value from business analytics has been extensively discussed (Kohavi, et al., 2002), (T. H. Davenport, 2006), (LaValle, et al., 2010) but much of the discussion has focussed at a strategic, organisational level (Hostmann et al., 2009), (T. Davenport & Harris, 2007) and has been case-based and descriptive, rather than explanatory (T. Davenport & Harris, 2007), (Eckerson, 2008). However, recent research work has provided a more explanatory approach, looking at the factors explaining how analytics can maximise value and success. Several empirical studies of analytics success (Popovič et al., 2012), (Cosic et al., 2012) have attempted to measure analytical value using the concept of analytical decision making capabilities which enable business analytics to generate value. Similarly recent conceptual models of business analytics success have included analytical capabilities (an organisational ability) as a mediating factor in the use of analytics technology to generate insight and make decisions (Sharma et al., 2010), (Seddon et al., 2013). Analytical capabilities are variously described as: evidence-based decision-making practices (Cosic, et al., 2012) (Seddon, et al., 2013); information management routines (Trkman et al., 2010); or the use of information in decision-making processes (Popovič, et al., 2012). These can be summarised using already accepted categories of business analytics (Delen & Demirkan, 2012).

| | → Analytical Complexity → | | |
|---|---|---|---|
| **Analytics categories** (Lustig et al., 2010) | **Descriptive Analytics** | **Predictive Analytics** | **Prescriptive Analytics** |
| **Analytics Tools** | Reports, Dashboards | Forecasting, Data mining | Simulation, mathematical models |
| **Key Question** (Delen & Demirkan, 2012) | What happened? | Why did it happen? | What could happen? |
| **Analytical Capability** | Measure/monitor performance | Project, Analyse relationships | Model decisions, Optimise |

**Table 1. Analytics capabilities**

Based on this perspective, we suggest that the descriptive literature on analytical capabilities just described provides a basis for a prescriptive approach to applying academic analytics. Based on an existing process analytical capabilities can be identified for each of the three levels of analytical complexity described above. Following the ADR approach, this suggestion can be refined by reference to the field problem: quality assurance.

## 3.0 Field problem: Theory-Ingrained Artefact

While the literature review can serve to refine the research problem and assist with solution designs, further evidence for the problem and design can be obtained from within the organisational context (Sein, et al., 2011). In this case field knowledge is provided by three sources: regulatory documents prescribing the central process, institutional documents recording instances of the process, and finally researcher professional experience within the process.

Quality Assurance (QA) has become a critical process in HE while at the same time criticised for encouraging excessive bureaucracy (Srikanthan & Dalrymple, 2003). One solution is to provide tools to support QA management, particularly tools designed for the HE environment (Cullen et al., 2003). In Ireland this process is regulated by the Higher Education and Training Awards Council (HETAC, 2010), in accordance with European QA norms for higher education (ESG, 2009). An important element in QA is programmatic review, the process of reviewing a current programme of education, typically carried out as part of a self-review process on a periodic basis (HETAC, 2011). The goals of and process for programmatic review are prescribed by HETAC (HETAC, 2010), (HETAC, 2010b). Space constraints for this paper restrict

our description to one particular element of the process; which we use to illustrate the general approach. The assessment strategy is a central part of good programme design. Programmatic review requires an evaluation of the programme and module assessment strategies (section 3.4, p.15 HETAC, 2010) in accordance with agreed standards (HETAC, 2009).

**3.1 Existing Analytical Capabilities**

Programmatic Review is carried out primarily by existing educators on the programme but is reviewed by an external review group. The review of assessment strategy involves inter alia, documentation describing the weight for continuous versus final assessment for each of the constituent modules on the programme, plus a timeline for assessments. Analysis involved exhibits a number of characteristics: a reliance on text rather than numerical data; provision of data in pre-defined reports which cannot be reconfigured for different analyses; a reliance on professional knowledge of reviewers with little or no decision support tools. Based on the analytics capabilities framework (table 1), the capabilities exhibited are basic: the ability to monitor performance (analytical capability), to see what has happened on the programme (key question), by reference to predefined reports (analytical tool). An example result from this type of analysis is the conclusion that 'Year 1 of the programme is over assessed as compared to other years' (from an unpublished programmatic review report). Using the analytics capabilities framework (table 1) we suggest a more advanced analytics capability set.

**3.2. Suggested Analytical capabilities:**

1. Capability to summarise and take an overview of programme assessment activity

   A single programme might include seventy to one hundred assessment events (over a typical three year cycle). This quantity of master data is difficult to assimilate in a narrative discussion supported by paper documents in which numerical assessment data is integrate with other textual data. An example analytics tool would be a programme schedule report displaying all assessment events over the life of the programme.

2. Capability to examine relationships within the overall assessment strategy

   There is a general assumption of a causal and temporal relationship within chains of events consisting of continuous assessments, terminal assessments and final grades. Reviewers should be able to select and examine event chains. An

appropriate analytics tool with query and correlational tools would assist in the examination and testing of these assumptions.

3. Capability to analyse historical data in depth and make predictions and forecasts
   In addition to the master data described in 1, there is further data on individual learner outcomes in every assessment which can be summarised in statistical models. These models could be manipulated by users to identify (for example) the modules whose grades have no effect on final learner award for the programme.

Summarising these capabilities within the framework provides a suggested set of analytics capabilities for assessment strategy evaluation.

| | → Analytical Complexity → | | |
|---|---|---|---|
| **Analytics categories** | **Descriptive Analytics** | **Predictive Analytics** | **Prescriptive Analytics** |
| **Generic Analytical Capability** | Measure/monitor performance | Project, Analyse relationships | Model decisions, Optimise |
| **Instance: Assessment Strategy Review** | Overview of assessment activity across entire programme | Examination of relationship between assessment events | Determine modules that have most and least effect on programme award |
| **Analytics Tool (e.g.)** | Programme schedule report | Correlation and regression analysis tools | Statistical modelling tools enabling user modification of parameters |

**Table 2. Analytics capabilities for assessment strategy evaluation**

The examples provided allows us to extend the original framework presented in table 1 to provide a suggested design solution for analytics capabilities within one part of a quality assurance process in higher education. This is illustrated in table 2.

## 4.0 Discussion and Conclusions

A key objective in academic analytics is to achieve actionable analytics: the problem of the value of the analytics in use. Applying an action design research process we describe a tentative model that extends existing academic analytics research. Our work shows three levels of complexity of analytics which impact on the various capabilities. The model was instantiated for the case of programmatic review in an education environment. It shows the usefulness of our approach; however, further work is required to expand the illustrative case and also to extend the work along the design science framework presented in section 2.0. At a more conceptual level, further

work is also required to delineate and define the concept of organisational analytical capability which is related to but distinct from other capability models such as CMMI (Chrissis et al., 2003) and IT-CMF (Donnellan & Helfert, 2010). As these related works show, a focus on capabilities provides a way to evaluate and potentially improve the value of academic analytics ‘in use’.

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