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Short Communication

The Anthony Triangle and an Analytics Framework: Developing a Business Analytics Curriculum Conceptual Model

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Abstract

The Anthony Triangle is a long-established model for highlighting the planning and control of an organization's processes. It has aged well but should be updated for modern distribution of personnel. This paper proposes the Decision Mode Ternary, which acknowledges that most industry roles involve a mix of all three parts of the Anthony Triangle. The Decision Mode Ternary is then applied to the field of Business Analytics to develop the Analytics Framework which conceptualizes the roles around Business Analytics, Data Analytics, and Modelling. Finally, the development of a new program at the University of North Texas at Dallas is summarized, implementing the Analytics Framework.

Keywords: Business Analytics, Curriculum Design, Conceptual Model, Anthony's Triangle

1 Introduction

Business Analytics is an in-demand skillset. It is both a field of specialization within management science and it is a skillset necessary "throughout the curriculum" (AACSB, 2019). In one sense, it has been covered in many programs under the term 'Business Statistics'. Business Statistics are generally a non-calculus based, application-oriented approach to statistics, relying on mathematicians' proofs and conclusions but not delving into them pedagogically.

However, business analytics deals with larger data sets and builds stronger insights that are easier to present to stakeholders. Analytics has become a separable field, with the ability of computers to handle large datasets in more or less real time. As a result of this reliance on computerized analysis, it is often handled as an extension of Information Systems, itself a relatively new field.

However, within the broader market, jobs related to Information Systems and jobs related to Business Analytics are separate. This non-reflection in the academic realm needs to be addressed and standardized approaches need to be developed that both codify the structure of the field as well as describing and proscribing the industry (Press, 2017). This solution needs to take into account the wider variety of possible job functions, including Statistical Modeling, Data Analytics, and Business Intelligence.

2 Methods

In early 2019, there was a dearth of both doctoral and bachelor's level programs in Business Analytics. PhdStudies.com (2019) only lists a single program, and even that is an extension of Economics rather than a strict business function. At the bachelor's level, programs are just beginning to be implemented, a localized sample includes University of North Texas, University of North Texas Dallas, Texas A&M Commerce. However, industry promotion sites such as BusinessAnalytics.com (2019) only list programs at the Master's level.

As a result, Master's level programs have become comparatively common, although Zhao & Zhao (2016) conclude that only a minority of schools offered programs in Business Analytics at any level, despite consistent studies suggesting a mounting need for trained analysts. A 2013 EAB report projected a 286% growth rate in the need for Data Mining, suggested that Forecasting would be the most necessary skill for managers in the future, and predicted a 1.5 million job shortage by 2018 (EAB, 2013). This shortage of positions is interesting given the lack of a job definition by the Bureau of Labor Statistics, which lists the following types of analysts (BLS, 2018): Financial, Information Security, Management, Computer Systems, News, Market Research, Budget, Operations Research.

Forbes reported (Columbus, 2015) that finding an appropriate candidate for a job requiring data skills was difficult and that median advertised salaries were well above average. Forbes follows up with an article (Davenport, 2018) implying that a new application for business analytics was coming soon: de facto mandatory analytics for non-analytic entrepreneurs. Finally, the McKinsey Global Institute released a report (2016) that can

cleanly summarize the current state of the industry with two phrases: "most companies are capturing only a fraction of the potential value from data and analytics," and "there is a continuing shortage of analytics talent."

One subtle correction in implication: as educators, it must be necessary to believe that talent is less important than training.

3 Updating the Triangle to a Ternary

Anthony's Triangle (Anthony, 1965) is a standard framework within Management Science presented in 'Planning and Control Systems: A Framework for Analysis. It is likely only coincidental, rather than prescient, that it is a proto-Information Systems text and mentions the term 'analysis' in the title. The original framework was presented as a flowchart with Strategic Planning, Management Control, and Operational Control. Strategic Planning fed into both Management Control and Operational Control while Management Control fed into Operational Control. The standard portrayal has morphed within Information Systems to a stacked triangle, more analogous to the three-tier architecture, such as portrayed by Ho (2015).

However, this is not the original conceptualization of the model. While Anthony (1965) immediately acknowledged that his model needs a "disclaimer against implying an unwarranted degree of precision in our classifications", it is still a conceptual degradation to map the original flowchart onto the hierarchical pyramid. Instead, the conceptual structure should resemble more closely a Ternary Plot, in which there are no hierarchical implications. Rather, the recognition that absolute adherent to the poles on a Decision Mode Ternary is unlikely. CEOs still need to make operational and managerial decisions for day-to-day operations and entry-level workers are still required to make, for example, moral (strategic) decisions relating to whistleblowing or other ethical concerns.

As a result, the Decision Mode Ternary is a Ternary Plot of a three-vectored position whose sum totals a conceptual 100% of any given position. This allows for both a role-based and a position-based consideration of decision-making level. For example, an entrepreneur would operator near the middle of the triangle with approximately equal distributions of strategic, managerial, and operational breakdowns. On the other end, the process of team-based annual reviews would lean very heavily towards the managerial vertex, with a slight equivocation for operational clerical tasks and strategic alignment towards the mission of the organization as a whole. In addition, it recognizes that there is no qualitative distinction in the value of each vertex; success at a macro level depends on each role or task being completed with appropriate regard for all three kinds of decision-making.

4 Analytics Framework

Using the Decision Mode Ternary as a base, this allows for a more robust breakdown of the field of Analytics. A brief overview of available and filled positions can broadly class the positions into three types. On the abstract, strategic end is Business Analytics which focuses on presentation of results, interpretation of meaning, and general interface with non-analytic functions. The managerial position is typically filled by a Modelling role, which is concerned with developing new mathematical modelling, establishing procedure, and researching best practices. Finally, Data Analytics type roles are at the operational vertex, focusing on implementation of the model and engaging in the day to day operations of an analytics function.

Removing the reliance on the Decision Mode Ternary or the Anthony Triangle suggests that the roles are simply separate functions that can be evaluated atomically, to a certain extent. However, considering this Analytics Framework in light of the previous, established models elucidates some of the information flow. Business Analytics roles will determine need on both the Modelling and the Data Analytics side. The Modelling role, will in turn, establish functional processes for the Data Analytics roles.

Further, following Gorry and Morton's (1971) correlation between Anthony's Triangle and Simon's (1960) separation based on Programmatic and Non-Programmatic tasks allows for a triangulation that unifies the framework in an industry-reflective manner. The Business Analytics role is largely Unstructured (Non-Programmatic) decision making tasks associated with communication, interpretation, and other soft skills per Robles (2012). The Data Analytics role is largely Structured (Programmatic) decision making tasks associated with data entry, following process, and implementing policy. The non-Simon addition of Semi-Structured tasks is most closely associated with the Modelling role, as it is tied heavily into creative thought that is constrained by established mathematics and the structure of the organization.

5 Business Analytics Curriculum

The need for a framework, the need for trained data workers, and the lack of accessible undergraduate programs led the faculty at the University of North Texas Dallas to develop a new undergraduate Business Analytics curriculum that derives from this analysis (Friesen, Larson, 2018). Following the framework that the field of Analytics can be divided into the three roles, the program was designed to heavily center on the Business Analytics role of the Analytics framework. The rationale for this was as a result of the already heavy emphasis on qualitative roles at the university. There was already expertise at the training of presentation and interpretation tasks, which allowed for overlap with the new curriculum.

However, centering the framework on the Decision Mode Ternary highlighted the need for all Data Analytics workers to have a baseline capacity in all the model vertices. The nature of the model implies that strictly single-vertex roles will not be the norm. To establish a training paradigm centered around this model, it was decided to establish singular skillsets that corresponded with each of the vertices. Thus, Business Analytics was centered around Data Visualization, Data Analytics was centered around Tools, and Modelling was based around Statistics.

As a training paradigm for new entrants into the Analytics field, this allows for the routine measure of trained skills. This orientation around skillsets also allows for a straightforward understanding of the nature of a program. A higher number of hours taught in specific skillsets implies that there is a higher intention to orient the program around a given role.

At University of North Texas Dallas, the breakdown turned out to be 27 hours of major courses: 3 hours in statistics beyond those required of all business students, 6 hours in current tools, 9 hours in visualization and presentation topics including the capstone, and 9 hours in program electives. However, breaking these numbers down further, the majority can be taught from a Business Analytics perspective: the statistics hours are in case studies critiquing both the mathematical analysis as well as from a more strategic level and the hours in tools are oriented around databases which will necessitate an implementation focus. Further, the elective hours will be recommended to be management science, a theory of visualization, and an internship, all of which re-center on the Business Analytics role.

The next steps are anticipated to involve the development of a Data Analytics minor to complement complementary programs such as Accounting, Logistics and Supply Chain Management, and Communications and Technology. Long-term, the development of a Modelling certificate to

complement either the Business Analytics major or the Mathematics major will be explored for interest and competitiveness.

As a result, Master's level programs have become comparatively common, although Zhao & Zhao (2016) conclude that only a minority of schools offered programs in Business Analytics at any level, despite consistent studies suggesting a mounting need for trained analysts. A 2013 EAB report projected a 286% growth rate in the need for Data Mining, suggested that Forecasting would be the most necessary skill for managers in the future, and predicted a 1.5 million job shortage by 2018 (EAB, 2013). This shortage of positions is interesting given the lack of a job definition by the Bureau of Labor Statistics, which lists the following types of analysts (BLS, 2018): Financial, Information Security, Management, Computer Systems, News, Market Research, Budget, Operations Research.

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6 Results

So, the conceptual model that should be more widely discussed and implemented as a standard derives from the industry-oriented Analytics Framework, which derives from the Decision Mode Ternary, which in turn derives from the established Anthony Triangle. This model emphasizes training in three explicit areas: Models, Visualization, and Tools. These areas should be shifted in priority based on the emphasis of the program itself to target a particular mix within the Analytics Framework of Business Analytics, Data Analytics, and Modelling.

Conflict of Interest: none declared.

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