

# **Designing Big Data Analytics Undergraduate and Postgraduate Programmes for Employability**

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## **Abstract**

There is a widely forecast skills gap developing between the numbers of BDA graduates and the predicted jobs market. Many universities are developing innovative programmes to increase the numbers of BDA graduates and postgraduates. The University of Derby has recently developed two new programmes which aim to be unique and to offer the applicants highly attractive and career enhancing programmes of study. One programme is an undergraduate Joint Honours programme which pairs Analytics with a range of alternative subject areas; the other is a Masters programme which has specific emphasis on Governance and Ethics. A critical aspect of both programmes is the synthesis of a Personal Development Planning Framework that aids the students to evaluate their current status, identify the steps needed to develop towards their career goals and to also to provide a means of recording their achievements with evidence that can then be used in job applications.

## **Keywords**

Big Data Analytics, Governance, Ethics, Trust, Skill, Education Programme, Employability, SFIA

## **Introduction**

There is a severe shortage of “Analytics” skilled and literate graduates. Employers are stating that they need staff with “analytics smarts”, by which they mean that they want staff who understand both the subject domain and also are numerate and understand the critical skills of Analytics, which include many of the softer skills of leadership, team work and communication. In many instances, they do not want the traditional computer science “programmer type” of graduates.

This is a challenge to traditional Computer Science departments, who tend to concentrate on the technologies, the hardware and software and the algorithms. There are a few University departments which have developed strong undergraduate and post graduate programmes.

The University of Derby has recently developed two different programmes which address the predicted shortages in two different ways. The first approach is an undergraduate programme which is part of the University of Derby’s Joint Honours programme, where students study two different subject areas. The second approach is in a new MSc programme in which the topics of Ethics, Trust and Governance play a key part in preparing the graduates for roles such as Data Steward.

This paper will outline the rationale, aim and objectives for each of the programmes and their structure.

## **BSc Joint Honours Analytics Programme**

### **Programme Rationale**

Employers like joint honours degrees - for the obvious reason that graduates come out with a range of skills from the different subjects they have studied. Unusually, joint honours awards allow students to study a subject with vocational relevance, such as Information Technology, alongside elements of a traditional degree such as History, English or Sociology. In this way joint honours Information Technology can give students a degree which is both relevant to the world of employment and yet combines a traditional academic degree.

As identified by Hodgson [1], in contradiction to the view that joint honours might be perceived as a soft option, students hope that taking a joint course will enhance their employment prospects. Students believe that studying joint honours will demonstrate their determination, hard work and individualism: “You’re slightly different and you’ve dared to combine the two [subjects].” Other students believe that studying joint honours means they are attractively flexible in terms of subject competence.

This pathway is, therefore, aimed at students who are of a technical bent and interested in data analysis, particularly in relation to their other joint programme, such as Business, Geography, Accounting, Sociology, etc. The modules are chosen to provide a strong foundation of analytics, programming and databases together with an understanding of the provision and governance of Information and Information Services in business. Successful students will have the opportunity to sit the Base SAS Certification exam, which will enhance their employment prospects and the starting salary by some £10K.

### **Programme Structure**

The University of Derby Joint Honours programme requires students to take three modules per year for each of their two subject areas. The following diagram illustrates the way that subject combinations can be developed, Analytics has been placed in Zone 3, which enables Analytics to be paired with a range of significant subjects, such as Geography, Maths, History, Accounting, Business Management, Media Studies and Sociology .

Timetable Zones (Derby)			
ZONE 1	ZONE 2	ZONE 3	ZONE 4
Educational Studies	American Studies	Architectural Design	Accounting
Film and TV Studies	Applied Criminology	English	Early Childhood Studies
Geography	Biology	Geology	Environmental Hazards
Marketing	Business Management	Human Resources Management	History
Mathematics	Creative Writing	Law	International Relations & Global Development
Psychology	Dance & Movement Studies	Popular Music Production	Journalism Writing
	Media Studies	Third World Development	Preparatory Development
	Zoology		Sociology
			Sports & Exercise Studies
			Theatre Studies

### **Modular Structure**

#### Year 1

- Introduction Data Analysis (SAS JMP and Visual Studio)
- The IT Design Studio
- Programming Principles (including Base SAS)

#### Year 2

- IT Services Management
- Databases (including SQL and SAS)

- Data Management and Business Intelligence (with SAS Visual Analytics, Base SAS and SAS Studio)

**Year 3**

- Advanced Analytics (with advanced components of SAS)
- Sustainable Information and Corporate Governance (Research module)
- Enterprise Systems (Capstone, research module)

As can be seen, the module diet is comprehensive, provides both analytics, SAS and more general Informatics topics, including Governance.

The programme will be starting in September 2014, with a predicted intake of about 20 to 40 students

**MSc Big Data Analytics**

**Programme Rationale**

Big data is all around us. Every day, 2.5 quintillion (2,500 followed by 15 zeros) bytes of data are created, and 90% of the data in the world today has been generated in the last two years (and is of unknown reliability [2]). As a consequence, the ability to identify and obtain intelligence from big data requires a set of skills which is increasingly in demand.

“The demand for Big Data professionals continues to grow as companies further expand their strategies, harnessing the power of Big Data into all areas of their business operations” (Harnham Salary guide 2014, page 10).

The MSc in Big Data Analytics provides students with the opportunity to gain in-depth knowledge and critical understanding of a range of issues and concepts in Big Data Analytics. A central theme of the programme is the extraction, analysis and management of information from big data using a variety of scientific techniques and software tools. A unique aspect of the programme is the theme of Ethics, Trust and Governance which provides a unifying focus across the modules.

This programme is designed for graduates from relevant technological subject (such as Science, Technology, Engineering and Mathematics, or STEM degrees, as well as subjects areas where statistical analysis is a core subject), who wish to explore and gain knowledge pertaining to Big Data Analytics. It provides a robust grounding in the key principles and tools, together with a strong focus on industrial applications. Thus, it provides a foundation for either further research, or a career applying leading edge software analytics technology to industry.

The School also has close links with SAS, who are global leaders in data analytics and a variety of existing modules include this software alongside other tools that are relevant to the area, both at undergraduate and postgraduate level.

**Programme Structure**

The programme is composed of 10 modules, of which 6 are required. Students have to choose one option from the remaining 4 modules.

Module Code	Module Title	Credits	Status
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7CS094	Studying at Masters Level & Research Methods	20	Core
7MAxxxx	Statistical Techniques	20	Core
7CS512	Business Analytics with SAS	20	Core
7CSxxxx	Processing Big Data	20	Core
7CSxxxx	Information Visualisation	20	Core
7CSxxxx	Analytics: Ethics, Trust and Governance	20	Option
7CSxxxx	Natural Language Processing	20	Option
7MAxxxx	Optimisation	20	Option
7CSxxxx	Comparative Analytics Tools	20	Option
7CS997	Independent Scholarship	60	Core

Initially, it is intended that only the Analytics: Ethics, Trust and Governance module will be offered as the sole optional module as the numbers of students in the first year are predicted to be too small to justify offering all four option modules. The Studying at Masters level module provides some of the group and communications skills that employers are demanding.

### **Common Theme - Employability, Skills and Evidence**

Whilst the above outlines address the technicalities of the BDA agenda for the two programmes, this is not all that employers are demanding that universities deliver to their students. They want us to also deliver employable students who have communication skills, can work in teams, have leadership potential and a range of soft skills. In addition, they want potential employees who can effectively sell themselves. This latter aspect requires that graduates have an objective framework to use for self reflection and to guide the development and collection of evidence of their skills for use during the job application process.

In the UK, we have two sources of skills frameworks which can be synthesised to provide a self-assessment matrix for the students to use as their Personal Development Planning (PDP) toolkit. These are the Skills Framework for the Information Age (SFIA-Plus) framework [3] developed by the SFIA Foundation and the Higher Education Academy developed Student Employability Profiles [4].

Whilst it is often difficult to get students to engage with the PDP process [5, 6, 7], the approach being developed in these two programmes is based on the fact that the SFIA is used by many employers in the IT world as the basis for both Job adverts and also for staff assessment processes. In addition, part of the approach in the Department of Computing and Maths is to demonstrate very early on the students' career the benefits to them of active engagement in using such a framework in order to evaluate their current status, identify the steps needed to develop towards their career goals and also to provide a means of recording their achievements with evidence that can then be used in job applications. One of the advantages of the SFIA framework is that it evaluates skills over a range of 7 levels which

range from “follow” through to “Set Strategy”. One of our objectives is to ensure that both undergraduates and postgraduates have opportunities to achieve levels of output and achievement at the “Set Strategy” levels. This objective is being achieved in some current modules and students are now recognising their achievements as a result of using this approach, when, in the past, they failed to realise what they were achieving.

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