Assessing Undergraduate and Postgraduate Hard and Soft Skills in Analytics and Data Science Courses
Richard J Self

Big Data Evangelist and Research Fellow – Big Data Lab, Dept of Computing and Maths, University of Derby

Department Learning, Teaching and Assessment Advisor, leading the development of analytics based academic programs at Derby, keynote speaker at industry conferences and developer of innovative pedagogy for STEM subjects that leads to outstanding levels of achievement

Co-owner of Big Data Analytics Educational Resources Website [http://computing.derby.ac.uk/bigdatares/](http://computing.derby.ac.uk/bigdatares/) with Kathy Maitland
What Employers Want

From joint research by e-skills UK and SAS

What we often Traditionally Deliver

- Technical Expertise
- Theoretical knowledge
- Language, syntax and grammar
- Ability to produce required artefacts

Assessed using

- Tightly defined problems
- Artefact demonstrations
- Code walk-through
- Written Examinations and/or CBT

Result

- Employer dissatisfaction with HE graduates
- Geeks
- Disengaged students
Thus, for any nondeterministic Turing machine $M$ that runs in some polynomial time $p(n)$, we can devise an algorithm that takes an input $w$ of length $n$ and produces $\hat{F}_M$. The running time is $O(p(n))$ on a multitape deterministic Turing machine and...

WTF, man. I just wanted to learn how to program video games.

SIPSER CH 7

$N = (A \cup B_m) \wedge (A \wedge B_n) \wedge \ldots$

$N = \ldots \wedge \ldots$
The Big Question

- How can we develop and assess the Soft Skills?

- Curiosity
- Creativity
- Problem Solving
- Collaboration
- Communication
- Story Telling
Leaky Buckets?

- “Education is not filling (leaky) buckets but lighting fires (of enthusiasm)”
  
  Plutarch (amended)

- Imagination is more important than knowledge. Knowledge is limited; imagination is infinite

  Albert Einstein

- I have no special talent. I am only passionately curious.

  Albert Einstein
Pedagogic Philosophy

- Academic as
  - “Learning-to-learn expert”
    - not
  - “Domain expert”

- Schedule Contact hours are too valuable to waste on “teaching”, should be devoted to inspiring, challenging, guiding and mentoring
  - Small groups
  - Individuals
Our Approach to Engagement and Excellence

- Guide students to teach themselves the “language(s)”
- They learn by guided Research
- Set very broad topic areas for “negotiated” projects
- Find their own data (defined minimum size)
- Gain “Insights”
- Present “Critical Assessment” of their projects
Three Case Study modules

- Introduction to Data Analysis (1\textsuperscript{st} year – SAS)
- Emerging IT Product Developments (Final year – IBM Watson Analytics and Bluemix)
- Business Analytics with SAS (MSc)
Learning Outcomes
Introduction to Data Analysis (1st year – SAS)

On successful completion of the module, students will be able to

- Understand and apply basic statistical and data analysis techniques.
- Effectively design and implement simple systems for performing basic data analysis and reporting.
- Use data analysis tools to communicate results effectively to others.
Emerging IT Product Developments (Final year – IBM Watson Analytics and Bluemix)

On successful completion of the module, students will be able to:

- Be conversant and demonstrate higher analytical skills and critical understanding about developments in emerging technologies, and demonstrate the ability to make objective, rational decisions towards their adoption in the real world.

- Be able to identify and apply emerging technologies tools towards the development of an advanced IT product as well as justify and evaluate their developmental decisions.
Business Analytics with SAS (MSc)

- On successful completion of the module, students will be able to:
  - Identify and critically evaluate the key requirements for effective data management, analysis and presentation to meet users’ needs
  - Develop a small management information reporting system that meets the users’ needs using a prototyping / Agile approach in the SAS programming environment
Teach or Mentor Learning?

Learning and Teaching Strategy
No (or very little) Technical “Teaching”!

- Students
  - Guided to learn SAS and Watson Analytics
  - Guided to find supporting solutions to their problems, e.g.
    » http://robslink.com/SAS/Home.htm
    » http://computing.derby.ac.uk/bigdatares/
  - Given broad challenge for the module as core to applied learning
  - Guided to research approaches and techniques
  - Mentored in soft skills development, e.g.
    » https://www.youtube.com/watch?v=8EMW7io4rSI by Cole Nussbaumer Knaflic (Google)
Introduction to Data Analysis

- Use SAS 20 Chapters to learn
- Research how to use elements of SAS (in pairs)
  - Importing data into SAS
  - Data Cleansing (ETL)
  - ODS System
  - New SG graphics
  - Creating Reports
- Develop small system using at least two sources > 2000 rows (data of interest to them)
Emerging IT Product Developments

- Explore IBM Bluemix and Watson Analytics
- You will need to select a suitable source (or sources) of Open Data that you will input to one or more Bluemix products.
- You will identify an interesting problem that can be found within the data and which suitable analytics will enable you to gain valuable insights into the problem.
- You will then develop a suitable requirements specification, which will also justify the choice of data and the problem that you want to gain insights about.
- You will then use the functionality of the Bluemix products that you have chosen in order to perform some relevant analytics from which you can develop valuable insights.
Business Analytics with SAS

- Use SAS 20 Chapters to learn

- Overall, you will specify, design and build a small management information analysis and presentation system to analyse some of the Journey data that can be found at [http://research.microsoft.com/en-us/projects/geolife/default.aspx](http://research.microsoft.com/en-us/projects/geolife/default.aspx). The .plt files are actually CSV files which can initially be read in Excel. You will need to omit the first 6 rows of data which have no relevance and import some into SAS.
Soft Skills used to assess Technical Skills

Assessment Strategy
Introduction to Data Analysis (1st year – SAS)

- **Portfolio**
  - 4 x CBT based on Base SAS Certification
    - Demonstrates SAS competency
  - 5-7 minute presentation (in pairs) about using SAS
  - 4 minute (individual) reflective video demonstrating their small system
    - Best will be posted to YouTube in a couple of weeks after final assessments
Emerging IT Product Developments

- Requirements Specification
- Critical Reflection Presentation (simulating a Post Implementation Review)
  - PowerPoint with voice over, to cover
    - Quality of Presentation (SFIA levels linked (20%)
    - Requirements specification and justification of the project (20% weighting)
    - Design, development and implementation (20% weighting)
    - Insights gained from the project (40% weighting)
      - Technical integration issues
      - Data sourcing / cleansing / integration issues
      - Analytical insights
      - Data for Humanity principles embodied
  - See https://www.youtube.com/playlist?list=PLWT0aRqpyk1oBwS8t5QVz-qVeX_ndURi0 for examples scoring 70% and over
Analytics Challenge Videos

Applying IBM Bluemix and Watson Analytics to Gain Insights

This Playlist contains the best presentations produced by final year students from the University of Derby and its partner the British American College in Dhaka, Bangladesh, as part of the assessment for the Emerging IT Product Developments module... more

1. IBM Watson Analytics Presentation by Luke McDonnell
   by Richard Self

2. IBM Bluemix and Watson Analytics Presentation by Mainul Aion
   by Richard Self

3. IBM Watson Analytics Presentation by Miroslav Spiridenkov
   by Richard Self
Business Analytics with SAS

- **Portfolio**
  - 4 x CBT based on Base SAS Certification
    - Demonstrates SAS competency
  - Requirements Specification
  - Artefact Demonstration
  - Critical Reflection of the project

- The research and projects contribute to my own research and publications in the Location Services field
  - See [http://computing.derby.ac.uk/c/accuracy-of-location-services-on-smart-devices/](http://computing.derby.ac.uk/c/accuracy-of-location-services-on-smart-devices/)
Details of Assessment Criteria

- Examples can be found in the paper that supplements this presentation
Questions?