'Big results require big ambitions': Big Data, data analytics, and accounting in Masters courses

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Abstract

Purpose: Accounting education is re-inventing itself as technology impacts the practical aspects of accounting in the real world and education tries to keep up. Big Data and data analytics have begun to influence elements of accounting including audit, accounting preparation, forensic accounting, and general accountancy consulting. The objective of this paper is to qualitatively analyse the current skills provision in accounting Masters courses linked to data analytics compared to academic and professional expectations of the same.

Design/methodology/approach: The academic expectations and requirements of the profession, related to the impact of Big Data and data analytics on accounting education were reviewed and compared to the current provisions of this accounting education in the form of Masters programmes. The research uses an exploratory, qualitative approach with thematic analysis.

Findings: Four themes were identified of the skills required for the effective use of Big Data and data analytics. These were: questioning and scepticism; critical thinking skills; understanding and ability to analyse; and communicating results. Questioning and scepticism, as well as understanding and ability to analyse, were frequently cited explicitly as elements for assessment in various forms of accounting education in the Masters courses. However, critical thinking and communication skills were less explicitly cited in these accounting education programmes.

Originality/value: Whereas current literature focuses on integrating data analysis into existing accounting and finance curricula, this paper considers the role of professional qualification examinations with Masters degrees as skills provision for future practitioners in accounting and data analysis.

Keywords: Accounting education, Profession, Big Data, Data Analytics, Qualifications, Masters, audit, technology, future careers.

Introduction

'Big results require big ambitions'[1]. In recent years, accounting educators and the accounting profession have been seeking opportunities to develop further employability skills (Stoner and Milner, 2010). These additional skills are deemed imperative for the accounting profession to adapt to a constantly changing business environment (ACCA, 2016; CGMA, 2018; CPA, 2019; CPA Australia, 2019; ICAEW, 2019). With the challenge for UK universities in general to develop employment-ready graduates[2], this is increasingly on the agenda in accounting and finance departments in UK universities.

There have been calls for the integration of technology and data analysis into the accounting and business curriculum (AACSB, 2017; Davenport and Harris, 2007; PWC, 2015; Sagi and Jain, 2018). Accounting as an activity involving data, the processing of information, measurement, analysis, and reporting, clearly has a part to play in use of Big Data and data analysis (Basuony, Mohamed, Elragal and Hussainey, 2020, Gamage, 2016, Lui, Miklos and Vasarhelyi, 2014). Accountants have always provided decision-makers with information, and data analytics and the increase in technology within accounting gives accounting professionals both opportunities and challenges (Stein Smith, 2017). Big Data definitions include either three Vs – volume, velocity and variety (Laney, 2001) – or five, adding the ones most pertinent to accounting professionals, veracity (accuracy) and value (cost benefit) (Janvrin and Watson, 2017).

Other calls have been made for the assurance that accounting curricula include professional skills needed for future work in the 'real world' of the profession (Bui and Porter, 2010; Jackling and De Lange, 2009; Pan and Seow, 2016; Rebele and Kent St Pierre, 2019; Tan and Laswad, 2018; Watty, Jackling and Wilson, 2012; Willcoxson, Wynder and Laing, 2010).

In 2016, when reviewing the accounting education literature of the previous year, Apostolou, Dorminey, Hassell and Rebele (2016) observed that 'Big Data is transforming accounting practice, providing many opportunities for faculty to research and update curriculum' (p.46), explaining that the American Accounting Association had run a conference and held seminars and webinars on the subject[3]. In the previous year in their article on expectations of technology skills for management accountants in New Zealand, Spraakman *et al.* (2015) note that the 'fact that IT is continually evolving means the specifics of the required IT knowledge and skills change over time.' (p.419). They stress the importance of interaction with the accounting profession in order to stay updated with practice changes in IT. Thereby, researcher/practitioners would ensure that the core competencies being taught to students are indeed those required by employers and the profession. Lawson *et al.* (2014) focused on accounting curricula for graduates' long-term careers, with recommendations for a competency-based framework for accounting students.

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[1] This quote is from Heraclitus a Greek philosopher, born in 535BC in Ephesus, now Turkey, but then part of the Persian Empire. Heraclitus believed that the world accorded with 'Logos' (translated as 'word', 'reason' or 'account') and was known for insisting that the world was in a constant state of flux or change.

[2] Employability was central to the Government's National Committee of Inquiry into Higher Education (Dearing, 1997), then close to 20 years later the Quality Assurance Agency (QAA) for Higher Education in England, Wales and Northern Ireland, Higher Education Review Group (2014) identified employability as one of the two review themes for 2015–2016.

[3] Currently (April, 2020) the ACCA are running a webinar on 'Data analytics: accountants and the data revolution'.

This paper reports exploratory research which aims to qualitatively analyse (Miles, Huberman and Saldaña, 2014) the current skills provisions relevant to data analytics in Masters programmes, We identified these by considering academic and professional member organisations' expectations then looked at accounting and data analytics Masters programmes to identify any skills gap. The objective, and contribution to knowledge, of this paper is that of identifying any gap between the specialist literature and the profession's expectations, as compared with the current provision in accounting and data analytics Masters courses. Its practical contribution is that of informing current and future accounting courses with data analytics elements of the relevant practical skills in accordance with industry expectations.

The paper is presented as follows: A literature review identifies research exploring the impact of Big Data and data analytics on the university education of future accountants. This considers the literature outlining what is required and the literature investigating what is currently taking place. The next section discusses the qualitative methods employed. Thematic analysis was used to generate themes on the current literature and professional member bodies' expectations and applied to current academic provisions with regard to the nexus of accounting and data analysis skills. This section also expounds the research carried out for this paper, explaining first the data collected, then the method and process of analysis and then the findings of the research. This includes a table summarising special issues of the education and other academic literature in the area of Big Data and data analytics, and identifies the findings of these articles. The findings are elucidated in four themes from the literature: questioning skills and scepticism; critical thinking skills; understanding and analysis of the data; and ability to communicate and use the results. A second table outlines the professional qualification requirements of the professional bodies in the area of Big Data and data analytics, developing these themes, with a summary of the findings. There follows a section investigating the current Masters offerings from universities in the area of data analytics and accounting. These offerings are presented in appendix one and analysed in this section, following the themes above. Finally, there is a discussion and conclusion and some suggestions for further research.

Literature Review

The influence of Big Data on the business environments in which accountants operate are filtering through to influence the way in which accountants are educated in higher education (Coyne, Coyne and Walker, 2016; Apostolou, Dorminey, Hassell and Rebele, 2016). The changes to education of accountants include various information technology skills such as data analytics for Big Data (Janvrin and Watson, 2017; Sledgianowski, Gomaa and Tan, 2017). Students need to be able to organise data for analysis, frame queries, and structure data using statistical and analytical tools. Shah, Horne and Capella (2012) warn of the need for Big Judgement in analysing Big Data and suggest a sceptical attitude towards the information produced, a sentiment echoed and emphasised by McKinney, Yoos and Snead (2017) for accounting education. They highlight that students need to be trained to become educated sceptics in this area and suggest an amelioration of both database and analytical skills. However, whilst more of the analysis of Big Data will be done by accountants rather than data analysts (Krahel and Titera, 2015), there will not be sufficient trained accountant analysts to audit all the data generated (Yoon, Hoogduin and Zhang, 2015).

Whereas other literature in this area focuses on integrating data analysis into existing accounting and finance curricula, this paper considers the role of Masters degrees in accounting and data analysis for non-accountants and for those already qualified wishing to add to their data analytical skills. Our research emphasises the need for accounting educators to retain their focus on the developments of technology in accounting and to adapt courses to suit the requirements observed in the profession. This paper therefore seeks to analyse current recommendations by academics working in this area and in education. We consider recommendations of the accounting profession to determine what is required of practitioners and their professional bodies. Our contribution combines the two to ascertain the areas of competencies required for students in the area of Big Data and data analytics in Masters courses.

Previous literature in this area tends to focus on undergraduate accounting courses. Richardson and Shan (2019) carried out a survey of heads of accounting departments. They found that most of these (90.7%) think that data analytics should be a part of the accounting curriculum and have plans to introduce it within the next three to five years, with input on data analytics being both integrated into accounting courses and as stand-alone courses. However, as these courses are not planned to be available for another few years, our research is innovative considering what should be offered to fill the gap, the requirements for current undergraduates moving to Masters degrees, and those previously graduated.

Brink and Stoel (2019) identified skills and abilities that business professionals view as important for accounting graduates. They found preferences for data interpretation and communication, suggesting that accountants might act as intermediaries translating data analytics into language to be understood by businesses. This suggests that there is a place for postgraduate training in these skills for accounting graduates. Accounting graduates and graduates from other disciplines looking to move into the profession need further skills in the understanding and translation of data analytics. Leading academics have questioned the direction of the profession into the future (Guthrie and Parker, 2016) and have suggested that information technology will be one of the biggest drivers for change, agreeing with Roos (2015) that technology will impact on society more than anything we have previously experienced. Indeed, Susskind and Susskind (2015) suggest that it may well be the end of professions, as technology takes over the work of human experts. However, within the accountancy profession there has always been a history of adapting to change, to ensuring the profession stays relevant and provides society with what is required to ensure the profession stays ahead.

We examine the skills suggested as required by accounting academics and those proposed and required by the profession, via an analysis of websites and other public pronouncements of the accounting profession. We analyse the current offerings of Masters programmes to fill the gap identified between those who will graduate with accounting degrees including teaching and practical experience of data analytics and those professionally qualified or graduating with accounting and finance degrees with no data analytic experience, as well as those who see accounting as an opportunity and wish to take a Masters in accounting and data analytics.

Research

Data collection

Our data was gathered in three separate strands, the three separate elements making up the framework of our research: academic perspectives on accounting and data analytics/Big Data education, the global professional bodies' requirements and expectations with regards to the skills required of potential members, and the current global university provisions in the form of Masters courses in accounting and data analytics/Big Data.

For the academic strand, the researchers searched for special issues in academic journals on the subject of accounting and data analytics for Big Data education in the last five years. The reason for the choice of focusing on special issues was that the concentration of edited articles on the topic in a single location was deemed to have more impact and influence on the educational sector than single academic journal article publications. The researchers wanted a concentrated set of papers on the topic, rather than adopting a scattergun approach to article selection. The limitation of this approach is, of course, that some relevant articles may not have formed part of the thematic analysis, but relevant papers of this nature were included in the literature review, rather than forming part of the analysis itself for the reasons discussed above. A special edition of the Journal of Accounting Education (2017) on Big Data included seven articles, and a Forum: Big Data (2015) published eight articles. We have summarised these in the table below where we determined the themes for core competencies in this area.

For the professional body strand, the websites of the global accounting bodies were reviewed for specific references to accounting data analytics and/or Big Data. The websites of the professional bodies in the UK and Australia have been analysed to investigate suggested core competencies required of students for future occupations, matching these with the themes identified and developing those themes. Again, a global approach was deemed more appropriate, so CPA was purposely excluded from the data, to ensure that results reflected the global view, rather than a US-centric one.

For the university offering strand, we used the themes generated from the above publications, both academic papers and professional websites to analyse current offerings of stand-alone Masters degrees pertaining to data analytics and accounting. All global Masters courses with a concentration on accounting and data analytics and/or Big Data that were offered in English as at February 2020 were included in the sample of data. There will, of course, be accounting degrees where data analytics is integral to the degree, although the name of the degree does not allow that to be identified. However, we were interested to see whether there are currently degrees in data analytics for accountants or degrees that offer data analytics and accounting for those with little or no previous accounting experience, rather than looking at accounting degrees with minor data analytics components as part of a broader accounting Masters provision.

Method

An exploratory qualitative approach was taken in this research, to enable the researchers to investigate the content of Masters degrees, and to address the research question.

The method of analysis chosen for this study was the qualitative approach of thematic analysis. Thematic analysis is a widely used qualitative approach for analysing interviews or written documents. Braun and Clarke (2006) outline thematic analysis as a method used for 'identifying, analysing, and reporting patterns (themes) within the data' (p.79). The idea being that a 'rigorous thematic approach can produce an insightful analysis that answers particular research questions' (Braun and Clarke, 2006, p.97). We use a bottom-up and a top-down thematic analysis (Braun & Clarke, 2006). Firstly, a bottom-up, or inductive approach to determine the themes from the articles and the professional websites, then we applied a top-down thematic analysis, driven by these identified themes to the university offerings. What constitutes a theme is something which captures the key ideas about the data in relation to our research project questions and represents a pattern or meaning within the data set (Braun and Clarke, 2006, p.82). They stress that the primary objective of this inductive approach is to allow research findings to emerge from the main, frequent, or significant themes within the data, without the constraints imposed by quantitative or structured methodologies in the process of determining the themes.

Using the above approach to analysis, the three separate strands considered were the three separate elements making up the framework: academic perspectives on accounting and data analytics/Big Data education, the global professional bodies' requirements and expectations with regards to the skills required of potential members, and the current global university provisions in the form of Masters courses in accounting and data analytics/Big Data. Thematic analysis was then conducted on the data gathered as above, in line with Braun and Clark (2006, 2012). Broadly following their six-part process of: familiarisation (getting an overview of the data); coding (finding short summaries of relevant parts of the text); generating themes (looking at codes, identifying patterns and finding themes); reviewing themes (ensuring these are accurate and representative summaries of the data); defining and naming themes (giving the themes a summarising understandable name) and writing up the themes. This qualitative framework of organic analysis was used to develop the themes outlined (Braun and Clark, 2016) from the items analysed, so that phrases with similar meanings were grouped together as a single theme. The three separate pools of data were coded into the themes discussed in the Findings section and were cross checked, in line with Saldaña (2016).

Bazeley (2009, p.6) notes that themes only attain full significance when they are linked to form a coordinated summary, suggesting 'describe, compare, relate' as a straightforward three-step plan for reporting the results. In this paper we initially describe our findings or the themes we have identified from the articles and the professional websites. These are then compared with the descriptions of the universities' offerings in relating our findings.

Findings

Our research findings suggest that four main themes come from the articles, the professional websites, and literature. These can be structured broadly chronologically; first students need questioning skills and scepticism. Second, critical thinking skills are needed to determine what is required and how, along with practical experience. Third, they need to understand the data and be able to analyse it. Finally, they need to be able to communicate the results of this analysis.

These themes will not necessarily happen one after the other in this order, although all are needed for the full experience of learning about data analysis. They may happen at different stages, at the same time, or out of order, and there will be movement backwards and forwards between the themes. Table one below shows the analysis of the two special issues of accounting journals considering Big Data and data analytics. The table shows the areas where the literature suggests education of accountants is necessary to ensure the profession remains the experts, including in data analytics. Below the table we describe our findings, the four themes we have identified from the articles and reference these to the articles in the table (to show how they were generated), thus using the 'describe, compare, relate' three-step plan described above.

Table one – Special Issues on Big Data

Authors and title	Summary	Approach	Competencies recommended[4]
Journal of Accounting Education 2017			
Janvrin & Watson, "Big Data": A new twist to accounting	Considers the importance of Big Data in an accounting context. Suggests this technology should be integrated through the curriculum to prepare students for future careers.	Editorial Discussion paper Gives details of Big Data teaching resources.	Need to ensure students can understand and work with Big Data. Accounting programmes should integrate business and accounting IT throughout the curriculum. An interdisciplinary, integrated accounting curriculum should give students statistics, data management and analytics skills and use of appropriate tools for Big Data, in order to provide information to decision makers. Thus, students are prepared for their future careers in accountancy and the ever-changing nature of the challenges that will bring.
Enget, Saucedo & Wright, Mystery, Inc. : A Big Data case	Considers Big Data in the context of journal entry testing. The article presents a case study for students on the interpretation of data analytics results using current audit practice.	Case Study Examines issues faced by external auditors	Students should practice practical audit procedures to consider reports prepared by the data analytics group of an accounting firm - planning and scoping, identifying anomalies and determining necessary audit fieldwork. Higher level skills observed during the use of real-world techniques and procedures. Practices should reflect current practices of Big 4 accounting firms. Professionals need skills with data analytics and critical thinking and judgement.
Riggins & Klamm, Data governance case at KrauseMcMahon LLP in an era of self-service BI and Big Data	Considers data governance issues around Big Data and data analytics. Gives a scenario of data governance issues around the trade-off between control over a company's data and enabling employees to use self-service business intelligence tools to analyse the data of the company.	Case study Examines data governance issues.	Students should be able to consider Big Data and data analytics from different perspectives, organisational, financial and technical, and make recommendations. This leads to acquiring necessary cross-disciplinary, broad management competencies and high-level skills.
Fay & Negangard, Manual journal entry testing: Data analytics and the risk of fraud	Considers the tests to be carried out by the external auditor to analyse transactions of an audit client to identify fraud.	Case study Students act as an external auditor validating accounting entries.	Students should be able to conduct various tests to validate data and ensure data files are complete. To use IDEA or perform other tests to identify areas of possible fraud. Students learn data analysis skills needed to improve decision making. They use analytical tools to interrogate the data and to draw meaningful conclusions from it.

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[4] The articles in accounting education specifically recommend the approaches outlined here.

Kokina, Panamanova & Corbett, The role of data visualization and analytics in performance management: Guiding entrepreneurial growth decisions	Considers the internal operations of an internet company and allows students to use the information to act as management accountants developing a performance management system to assist in meeting growth objectives.	Case study Hands-on practice with data analytics software.	Provides hands-on experience of analytics for managing performance. Use of accounting techniques and analytical techniques to examine sales data and solve issues. Illustrating how accountants incorporate various types of data to inform decision making for strategic management. Students understand the use of analytics by accountants to assist in performance management decisions.
McKinney, Yoos & Snead, The need for 'skeptical' accountants in the era of Big Data	Defines Big Data for accounting and business, providing a literature review of the key concepts to be included in accounting courses. Identifies seven topics, with examples from the author's courses.	Discussion paper Useful to those seeking to offer a Big Data course.	Encourages instructors to develop students' questioning skills. Enabling them to ask pertinent questions in appropriate areas. Students to be encouraged to employ critical thinking skills to be informed sceptics of Big Data analysis results, to understand and ask questions of the analysis. To be able to articulate and communicate the findings and the issues with the data.
Sledgianowski, Gomaa & Tan, Toward integration of Big Data, technology and information systems competencies into the the accounting curriculum	Provides a framework for the integration of Big Data, technology and information systems into the accounting curriculum. Uses accounting and management competencies to identify five accounting areas for introduction: financial, management/cost, auditing, information systems and taxation.	Discussion paper Uses the Competency Integration for Accounting Education Framework for competencies into the accounting curriculum.	Provides examples of how Big Data and Information systems can be integrated into the different accounting courses. With a reminder that curriculum requirements should focus on accounting students' long- term career requirements.
Accounting Horizons Forum Big Data 2015			**Competencies extrapolated[5]**
Griffin & Wright, Commentaries on Big Data's importance for accounting and auditing	The commentaries present a challenge to the accounting and auditing profession. Accountants and auditors need to move faster to meet the real time implications of Big Data and data analytics. Academics as teachers and researchers need to ensure the necessary skills are provided.	Editorial Analysis of commentaries looking at the challenge of Big Data and data analytics for accounting and auditing. Consideration of threats and opportunites.	Accounting academics as educators should rework accounting and auditing courses to ensure the required skills are acquired for Big Data in accounting and auditing.
Vasarhelyi, Kogan & Tuttle, Big Data in accounting : An overview	Argue that Big Data fundamentally changes our understanding of information, giving us the capability of viewing 'sequential causational processes' on a real time basis. Acknowledges the changing nature of accounting records, including the inclusion of non-traditional sources of data and new opportunities for audit analytics.	Article about impact on accounting, and new opportunities for audit analytics.	Consideration of skills needed to interrogate Big Data using real-time data analytics. Students should be introduced to the change in ideas of what is meant by information, to enhance their future careers.

[5] Whereas above competencies were recommended, as the articles were education articles, here the articles are more generally about the issues investigated, we have used the information and conclusions in the articles to induce the recommendations for accounting education

Warren, Moffitt & Brynes, How Big Data will change accounting	Argue that Big Data will have an impact on behaviour within organisations, affecting management control systems and leading to new performance measures. Budgeting may change and may include other external data. Observe that Big Data will lead to productivity gains. Drawbacks include legal and ethical issues from monitoring and tracking.	Article about impact on accounting. Suggests impacts on financial reporting and reporting standards.	Consideration of skills required for budget modelling that includes external accessible data. Big data is a further technology shift that will change how measurements are made and financial transactions evidenced. Management accounting and budgeting. Also impact on financial accounting and reporting. Providing additional evidence to justify values, may remove differences between IFRS and US GAAP regarding fair value accounting.
Krahel & Titera Consequences of Big Data and formalization on accounting and auditing standards.	Suggest that extant accounting and auditing standards have the wrong emphasis by focusing on 'presentation, aggregation and sampling', as the future will focus on supplying the user with raw data they can examine themselves.	Article about impact on accounting and auditing. Real-time future of accounting and auditing.	Consideration of skills needed to interrogate Big Data using real-time data analytics. Need for a different paradigm of reporting and assurance. Suggests that paper based financial statements will be replaced with accessible data to be extracted and investigated by the user.
Cao, Chychyla & Stewart Big Data analytics in Financial Statements audits	Audit work will rely on real time data analytics. Includes ideas of how Big Data is already assisting auditing e.g. the SECs MIDAS and examples of data analytics to assess risk and audit pricing.	Article about the impact on auditing.	Consideration of skills needed to interrogate Big Data using real-time data analytics.
Yoon, Hoogduin and Zhang, Big Data as complementary audit evidence	Questions arise as to what constitutes audit evidence in a time of Big Data, but suggest that Big Data is a valuable compliment to traditional audit evidence.	Article about impact on auditing. Observes that, as with responses to previous changes, the audit profession will take on Big Data challenges due to client pressure rather than by seizing opportunities.	Training in skills for the audit of Big Data based ERP systems. In education the curriculum should inform about the changing sources of audit evidence and have additional content on data analytics. Highlights need to train specialists in the audit of Big Data based ERP systems.
Alles, Drivers of the use and facilitators and obstacles of the evolution of Big Data by the audit profession	Paper that discusses how Big Data will change auditing practices to use of Big Data, following their clients. Audit work will rely on real time data-analytics. Questions what constitutes adequate audit evidence in an era of Big Data.	Article about the impact of Big Data on auditing.	Consideration of skills needed to interrogate Big Data using real-time data analytics. Need to explore questions of what constitutes sufficient audit evidence.
Brown-Liburd, Issa and Lombardi, Behavioural implications of Big Data's impact on audit judgement and decision making and future research directions	Consider challenges for the auditing profession relating to behaviour around audit judgement. They warn to be cautious when faced with the huge amounts of information from Big Data. Suggesting human limitations may be exaggerated, leading to incorrect audit judgements.	Article about the impact of Big Data on auditing. How the use of Big Data and advanced data analytics might impact on auditor judgement.	Encouragement of a questioning attitude. Move away from traditional auditing to take advantage of data analytics, but also how that will impact on auditor judgement. Behavioural implications of issues of information overload, relevance of information and pattern recognition.

Zhang, Yang & Appelbaum Towards effective Big Data analysis in continuous auditing	Consider the challenges around the four Vs of Big Data: volume, velocity, variety and veracity. Suggest auditors need to develop auditing standards of audit evidence that embrace Big Data analytics. Outline issues that would lead to increase auditors' use of data analytics, data inconsistency, integrity, and aggregation.	Article on the impact of Big Data on auditing. Veracity presents the largest challenge currently in the use of Big Data for auditing.	Learning about the challenges around Big Data and data analytics. Need to be aware of issues around data inconsistency, data integrity, and data aggregation.

Questioning skills and scepticism

The literature in our table suggests that students need to be encouraged to look beyond the obvious. As informed sceptics, students need to understand and ask questions of the analysis using critical thinking skills. Educators can help develop the questioning skills of students, so they ask relevant questions in the correct areas (McKinney *et al*., 2017). In doing this, the students will develop their questioning skills, interrogating Big Data using data analytics, conducting tests to ensure data files are complete, validating data (Alles, 2015; Fay and Negangard, 2017), and encouraging a questioning attitude (Brown-Liburd, Issa, and Lombardi, 2015).

There is a requirement for a different paradigm of reporting and assurance (Krahel and Titera, 2015). Students need information about changing sources of audit evidence and on data analytics (Yoon *et al*., 2015), whilst being aware of issues around data integrity, aggregation, and inconsistency (Zhang, Yang, and Appelbaum, 2015).

This theme matches with professional publications around the idea of 'professional scepticism' in auditing (IAASB, 2012; FRC, 2012). These publications highlight the importance of scepticism as a professional attribute to be used during an audit and are extended here to apply to the use of Big Data and data analytics.

Critical thinking skills

Students will need critical thinking skills to determine what is required and how to address these requirements. This is mostly addressed by practical experience via case studies or work experience and consideration of different perspectives. Cross-disciplinary, high-level skills and real-world techniques are required, with students learning broad management competencies (Rebele and Kent St Pierre, 2019; Enget, Saucedo, and Wright, 2017). Particularly important are the hands-on, practical skills, using data analytics with critical thinking and judgement (Kokina, Panamanova, and Corbett, 2017; Riggins and Klamm, 2017; Enget *et al*., 2017).

Critical thinking skills are needed to use real-time data analytics to interrogate Big Data. This along with an understanding of what is meant by information and how to critically use and interpret this will enhance students' future careers (McKinney *et al*., 2017; Krahel and Titera, 2015; Vasarhelyi, Kogan, and Tuttle, 2015; Cao, Chychyla, and Stewart, 2015).

Technology such as Big Data and data analytics will change how financial transactions are evidenced and measurements made (Warren, Moffitt, and Byrnes, 2015) and understanding and using these will require critical thinking skills of professional accountants.

Understanding and analysis of the data

Students need skills to understand and interpret the data produced. The table shows that the articles suggest that a key objective of data analysis is to assist accounting in providing information to decision-makers, both internal and external. Accounting and auditing courses

need reworking to ensure skills are acquired for the use of Big Data and data analytics in accounting and auditing (Griffin and Wright, 2015).

Practical experience, via case studies, gives experience of data analytics for performance management to ensure students can work with and understand Big Data (Janvrin and Watson, 2017; Kokina *et al*., 2017), illustrating various uses of data and analytics for strategic management decision-making (Kokina *et al*., 2017). Consideration of the use of external accessible data for management accounting and modelling budgets is also needed, as well as financial accounting and reporting (Warren *et al*., 2015).

For audits, procedures, reports planning, scoping of audits, and other experience of determining the fieldwork required and then identifying anomalies should be practiced, via realistic examples (Enget *et al*., 2017).

There is an emphasis on ensuring real-world procedures and techniques (Enget *et al*., 2017). Learning requirements include how to interrogate Big Data using real-time data analytics tools to interrogate data, extract useful information, and draw conclusions (Kokina *et al*., 2017; Fay and Negangard, 2017; Vasarhelyi *et al*., 2015; Yoon *et al*., 2015), whilst remaining informed about the inherent challenges of Big Data and data analytics (Zhang *et al*., 2015).

Ability to communicate and use the results

Once data findings are understood, students also need the ability to communicate the results in a clear way. Students should be able to articulate and communicate both the findings and the issues with data (McKinney *et al*., 2017), having considered the data analytics from differing perspectives when making recommendations (Rebele and Kent, 2019).

It is suggested that paper based financial reports will be superseded with data that can be accessed and investigated by the user (Krahel and Titera, 2015). Some suggest that the possibility of being able to provide additional evidence to clarify values may remove fair value differences (between IFRS and US GAAP) (Warren *et al*., 2015).

With a move away from traditional auditing to exploit data analytics, there is a need to articulate what constitutes sufficient audit evidence (Alles, 2015). This move will also have an influence on auditor judgement, with the related issues of relevance of information, pattern recognition, and information overload (Brown-Liburd *et al*., 2015).

General

It is suggested that accounting courses should integrate data analytics for business and accounting throughout the curriculum (Janvrin and Watson, 2017) and the journal articles analysed provide examples of how this can be done in different accounting areas (Sledgianowski, *et al*., 2017).

The articles remind the reader that the curriculum should remain focused on students' long-term career requirements (Sledgianowski *et al*., 2017), which include the need to train specialists in areas pertaining to Big Data and data analytics (Yoon *et al*., 2015). The practices and procedures learnt should reflect current practices of the profession and the Big 4

accounting firms (Enget *et al*., 2017). In this way, students can be ready for their future careers in accountancy and the changing nature of the challenges brought by that (Janvrin and Watson, 2017), including changes in ideas of what is meant by information (Vasarhelyi *et al*., 2015).

Requirements of professional qualifications

Having analysed what is suggested by academic literature in accounting for integrating Big Data and data analytics into the curriculum, the next part of the paper explores what is currently being required in these areas by the professional bodies. Table two, below, shows some of the professional bodies and the requirements of their exam syllabi regarding Big Data and data analytics. Below the table we describe our findings, developing the four themes we have identified from the articles with reference to the requirements of the profession, thus using the 'describe, compare, relate' three-step plan described above.

Table two – Big Data and data analytics requirements of the profession

Membership body	Website	Special Interest Groups	Membership credentials	Membership exam courses
ACCA	https://www.accaglobal.com/uk/en.html	Discussion groups by industry and sector only (none specifically mentioning data)	ACCA	Data analytics unit in Ethics and Professional Skills module. Syllabus area E2 in the Strategic Business Leader study guide contains the following outcomes: a) Discuss how information technology and data analysis can effectively be used to inform and implement organisation strategy. b) Describe big data and discuss the opportunities and threats big data presents to organisations. c) Identify and analyse relevant data for decisions about new product developments, marketing and pricing. The Advanced Audit and Assurance syllabus includes the following learning outcomes: Assess and describe how IT can be used to assist the auditor and recommend the use of Computer-assisted audit techniques (CAATs) and data analytics where appropriate, and Discuss current developments in emerging technologies, including big data and the use of data analytics and the potential impact on the conduct of an audit and audit quality.
CIMA	https://www.cimaglobal.com/	Unclear	CGMA	Operational Level: E1: Managing Finance in a Digital World – includes part B: Technology in a digital world 1. Technologies that affect business and finance 2. How the finance function uses digital technologies to fulfil its roles and part C: Data and information in a digital world 1. Data and the finance function 2. Data to create and preserve value for organisations Strategic level: E3: Strategic Management - includes part F: Digital strategy P3: Risk Management - includes part D - cyber risk CIMA also offer an application of data analysis certificate
CPA Australia	https://www.cpaaustralia.com.au/	Discussion groups by region only	CPA	Advanced audit and assurance Other risk assessments for specific matters that have the potential to be significant risks are discussed, along with a variety of techniques commonly used for conducting strategic analyses and analytical procedures to better understand

				business risk and the audit implications. This discussion includes an overview of contemporary tools such as data analytics and visualisations. The use of audit data analytic techniques is also considered. Global strategy and leadership In the era of 'big data', the analysis of the increasing amount of data available about the external environment is an important role for CPAs.
ICAEW	https://www.icaew.com/	Community by professional specialism: Data Analytics; Excel Industry/ sector Community: Academia and Education	ACA	Requirements for data analytics in the syllabus for Audit & Assurance include the impact of data analytics on the extent of tests of controls and of substantive procedures. It also includes benefits and limitations of analytical procedures, including data analytics. The Business Strategy syllabus has content relating to Big Data and data analytics. This includes an assessment organisational and operational capabilities, information systems capabilities. This also includes the analysis of large data sets and the ability of an entity to analyse outputs to assess performance, position and processes. The Strategic Business Management syllabus includes the analysis of data relating to markets, industry and performance, including the capture and analysis of Big Data. This requires an understanding of the nature and complexities of Big Data and of how that data can add value to decision making to give competitive advantage. At a higher level, it also requires an understanding of the enabling impact of strategic management information on the entity (eg for the borderless business). In the Corporate Reporting learning materials, there is increased content on Big Data and data analytics. This includes issues of audit quality as well as the problems of data capture, extraction, validation and transformation. The issue of risk analytics is also addressed.
CAS	https://www.icas.com/	None relevant visible on specialisms list	CA	Test of professional skills: Assurance and Data. Predictive Analytics & Data Science (CSPA) The material in the syllabus includes, for example, data analytics, new auditing tools and the requirement for scepticism and a critical mindset.

All the professional bodies require Big Data and data analytics knowledge from students, the future professionals currently taking their qualifications. In all cases, these skills are integrated in other papers. The themes identified in the previous section of the paper, those of questioning and scepticism, critical thinking skills, understanding and ability to analyse, and communicating results, are all apparent when reading the information on the websites that back up these requirements. The ACCA, for example, specifically uses the word 'professional scepticism' when outlining the requirements of the ethics and professional skills module. ICAS also note there is a requirement for scepticism.

The syllabi require critical thinking skills. Most of the Big Data and data analytics requirements are in the final papers of the professional bodies, generally tested by case studies which require a wide practical appreciation and understanding of higher-level issues. Most (80%) use the word 'strategic' in their descriptors of how and where data analytics are to be used. There does not appear to be an emphasis on practical application or examples.

Matching with the theme of understanding data and ability to analyse, two (40%) of the professional bodies use 'understand' within their descriptors and all use 'analysis / analytic'. There is also no clear indication that students should have the ability to communicate the results of the analysis, although this may be tested. However, two (40%) of the professional bodies refer to 'professional skills' which could be deemed to include communication skills.

Current Masters offerings from universities

Having analysed what is suggested by academic literature in accounting for integrating Big Data and data analytics into the curriculum and the expectations of the profession, the next part of the paper explores what is currently being offered by various universities in Masters courses. We focused on Masters courses because we were interested in the options available to students who had not originally signed up for an accounting course which included data analytics, and to investigate the options for professional accountants wishing to improve their data analytics skills.

Appendix one shows the current Masters courses offered by universities in the areas of accounting and data analytics/ Big Data. We searched for Masters degrees that have data analytics as part of the title of the degree, or which have a clear indication in the description that a substantive part of the course relates to data analytics. In February 2020, we found 13 courses being offered, and a programme organised by KPMG to train professional accountants in data analytics, run at 8 universities in the USA. The other courses were mostly UK-based, with one course each in China, Ireland, Portugal, Singapore, and the USA.

Considering the themes identified in the previous section of the paper, those of questioning and scepticism, critical thinking skills, understanding and ability to analyse, and communicating results, the courses address various of these. In the description of the courses, there is an emphasis on the third of these, understanding and ability to analyse. All courses stress the understanding and analysis aspects of their degrees, with six of the universities (46%) actually using the word(s) understand/understanding in the description of the course and eight of the universities (61.5%) using the word(s) analysis/analyse/analysing.

There is also an emphasis on the practical, on real-world experience and skills and future employability, with ten of the universities (77%) and the KPMG programme stressing the practical aspects of their courses. Using phrases such as 'designed to develop desk-ready industry professionals'; 'prepares you to work in …organisations of the future'; 'preparing you for some of the most competitive …positions in the global workplace' (University of Lanacaster); 'transferable skills' (University of Portsmouth) and 'enhance employability' (University of Stirling).

In relation to our second theme, critical thinking skills and practical experience, there is an emphasis on the case study/ work experience element of the degrees, with five (38%) of the universities and the KPMG programme mentioning practical related elements to the courses. These include Bloomberg and other packages, a Trading boot-camp, guest lectures, and collaboration with industrial partners.

However, none of the universities include reference to the case studies which feature highly in the academic literature, suggesting a skills gap. Questioning skills are also not mentioned directly, although this may be implied in phrases such as 'critical analysis', 'investigate', 'uncover patterns and insights' or within a dissertation project (found within two of the courses), which would normally involve questioning.

The final theme highlighted by the literature, that of being able to communicate the results of the analysis, is only included by one university in their description. In fact, this university seemed to consider it important, as it is included twice in their description.

Conclusions and further research

With professional and academic calls to ensure the inclusion of technology, Big Data and data analysis into the accounting curriculum, this research has investigated the integration of these professional skills, as required for the future work in the real world of the accountancy profession. The literature in this area of accounting education tends to focus on the requirements of current and future undergraduates. However, many accountants and students who are currently graduating trained in a world with less technology and less emphasis on Big Data and data analytics. There seems to be a gap for training and education of these professionals, which Masters courses can fill, despite some of the skills gaps identified in the previous section within the academic courses themselves.

The research identified the requirements for education in the skilled use of technology, those pertaining to Big Data and data analytics. This was investigated via an analysis of publications relating to these areas, both in the education literature and other academic accounting journals. We identified four themes of the skills required for the effective use of Big Data and data analytics. These were: questioning and scepticism; critical thinking skills; understanding and ability to analyse; and communicating results. We then investigated whether these were included in the current professional requirements for those training and taking examinations to become qualified accountants. Further, we identified Masters courses offered throughout the world to ascertain whether these courses offered training in the identified areas.

In undertaking these investigations, we identified some skills gaps between the academic suggestions and requirements for education and training in the use of Big Data and data analytics, and the requirements of both professional education and Masters degrees. Even after performing website search analysis, it appeared that professional syllabi do not make explicit to potential students, at least at the outset, the necessity for practical experience and critical thinking skills. There appears an emphasis on the concepts and use of Big Data and data analysis, on understanding and analysing, rather than on communicating those results in a pertinent manner. Further research could review detailed requirements of exams and/or core texts in order to determine whether the higher-level interpretative and communication skills are being made explicit to students.

Looking at the Masters courses that are currently offered, it would appear there is an expectation gap between what academics are suggesting should be prioritised and what students are being offered. The literature around this area prioritises higher level skills, practical experience, and a questioning attitude. The themes we found in the literature emphasised scepticism and questioning skills with critical thinking and practical expertise, ability to understand and analyse the data, as well as to communicate the results of that analysis. The Masters courses being offered by universities throughout the world tend to be advertising the understanding and analysing of data, practical experience, and the increased opportunity to work in this area in their future careers. This is understandable as the descriptions are aimed at potential students, but also surprising as potential students would surely see benefit in increased questioning, critical thinking skills, and an ability to communicate results. Future research could review student perspectives on the courses, the input and the value added in terms of increased ability to question and think critically, and to communicate analyses performed.

This investigative piece of research has uncovered some anomalies between the academic suggestions for training and education in Big Data and data analytics. There is a gap between the academic literature and the expectations of the professional industry and the emphasis of Masters course provisions in relation to accounting and data analytics skills and competencies, which can be addressed by higher education teaching and research staff.

Future research could investigate these concerns further. Another area for potential future research involves the empirical testing of the findings in this paper, such as generating statistical measures for the identified issues and testing for trends and significance. A more detailed analysis could be carried out of professional websites, forums, blogs, and training offered, in order to ascertain the skills demanded by employers of the profession. This could then determine key themes to ascertain requirements for training and education around data analytics in accounting.

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Appendix one: Table of Masters courses

Institution	Course title	Country	Course Description	Main content of the Degree
Swansea University	MSc Finance and Big Data Analytics	UK	The Master's (MSc) in Finance and Business Analytics is designed to pair the key areas of finance and business analytics. This programme takes a data driven approach to the analysis of financial, market and organisational information. In addition, to cover the key principles of finance, financial modelling and financial markets, the programme includes modules on business analytics and data mining to equip students to work in the data driven areas of finance and financial management.	Modules on the Finance and Big Data Analytics may include: Independent Project (MSc Finance and Big Data Analytics) Principles of Finance International Financial Markets Financial Statement Preparation and Analysis Quantitative Research Method Empirical Finance Big Data in Finance Applied Data Analytics Risk Management Corporate Governance & Ethics Asset Management Behavioural Finance International Banking and Regulation
University of Lancaster	MSc Advanced Financial Analysis	UK	Designed to develop desk-ready industry professionals in the areas of investment management and financial analysis, the programme sets out to give you the level of knowledge required for the CFA Level II examination. The modules we offer are therefore both more academically advanced and more practice-oriented than those you will find on a typical UK Masters programme in finance.	**Compulsory modules:** Fund Management; Financial Modelling and Analysis; Programming and Databases for Financial Applications; Personal Development for Careers in Finance; Advanced Financial Market and Investment Management; Advanced Financial Reporting and Analysis; Advanced Investment Risk Management; Advanced Investment Research Methods; Advanced Topics in Fund Management and Investment Analysis (Dissertation). **Optional modules**: Regulation and Compliance OR Quantitative Methods for Finance. Students without CFA Level 1 will take Topics in Professional Financial Analysis.

Arden University	MSc Data Analytics & Finance (Distance Learning)	UK	This programme will help you to develop key strategic skills in both data analytics and finance. Studying these two disciplines together will prepare you with a sound approach to management accounting and an understanding of how data analytics can inform strategic financial decisions. Developing higher level financial management skills including qualitative and quantitative accounting and an understanding of corporate financial reporting will allow you to lead on the financial and business decision making process in your organisation.	Modules: Data Design Data Handling and Decision Making Data Visualisation and Interpretation Business Modelling for Decision Making Financial Management Reporting Corporate Performance Research Project
University of Essex	MSc Finance and Data Analytics	UK	How does big data influence financial and statistical modelling? Will the future of finance be driven by our ability to apply quantitative, statistical and technical skills to analyse information? The finance industry needs students who can understand statistical modelling in the context of the growing, and increasingly complex, data available to financial firms. Our MSc Finance and Data Analytics prepares you to work in the financial services organisations of the future, by equipping you with the quantitative, statistical and technical skills needed in a world powered by big data.	**Compulsory modules:** MSc Finance and Investment: Dissertation; Research Methods in Finance: Empirical Methods in Finance; Data Analytics in Finance; Trading Global Financial Markets; Portfolio Management. **Optional modules choose three:** Corporate Finance; Derivative Securities; Asset Pricing; Financial Modelling; Behavioural Finance; Risk Management; Fixed Income Securities; Finance Research Techniques Using Matlab; Modern Banking; Bank Strategy and Risk; Industry Expert Lectures in Finance.
University of Glasgow	MSc International Financial Analysis	UK	International Financial Analysis aims to develop your awareness and understanding of international finance and financial analysis, preparing you for some of the most competitive financial analysis and investment positions in the global marketplace.	**Compulsory modules:** Financial Analysis and Equity Valuation; Financial Reporting and Interpretation; International Capital Markets; International Corporate Finance; Statistics for Business Research. **Optional modules:** Alternative Investments; Financial Management in Banking; Financial Risk Management; International Financial Management; Risk Management and Derivatice Securities.

| University of Portsmouth | MSc Accounting and Data Analytics | UK | On this Accounting and Data Analytics Master's course you'll:

Combine big data theory, business acumen and communication ability into a sought after skill set
Improve your financial analysis and data visualisation skills
Learn how to prepare and analyse accounts
Get experience with analytical software
Learn how to effectively analyse financial data to achieve certain goals, such as internal auditing
Access the same data, analytics and software used by city traders in our Bloomberg Suite
Study alongside students from our MSc Forensic Accounting and MSc Accounting and Finance courses, so you'll experience other areas of accounting and get a better idea of what to expect in the workplace
Develop transferable skills such as business acumen, professional ethics, critical analysis, report writing, communication skills and data analysis
Be able to attend guest lectures, which illustrate how you can apply the knowledge and skill you learn in industry
Study modules that accelerate the path to membership of accounting professional bodies after the course | Core modules on this Accounting and Data Analytics Master's course are:

Financial Accounting
Financial Analysis
Statistics and Data Modelling
Data Concepts and Management
Corporate Governance and Ethics
Strategic Management Accounting
Data Processing and Visualisation
Dissertation

Optional modules include:

Corporate Finance
Fraud Examination and Forensic Investigations
Business Valuation
Valuations and the Expert Report |

Xi'an Jiaotong-Liverpool University	MSc Business Analytics	UK	By the time you graduate from the MSc Business Analytics, you will have: a rich understanding of the opportunities and threats posed to organisations by the current increase in data availability an ability to analyse, model and investigate large networks of peoples and companies knowledge of current practices, theories and issues in a traditional field of business studies skills in data processing (descriptive statistics, econometrics and machine learning), problem-solving, and decision-making (using statistical and data analyses to resolve organisational problems) proficiency in the use of a wide variety of statistical packages suitable for analysing large data sets.	Core modules Introduction to Business Analytics Contemporary Issues in the Ethics of Business Analytics Econometrics Databases and Data Management Data Mining and Machine Learning Social Network Analysis Big Data – Applications in Business Business Analytics Dissertation Specialised pathway modules Financial Analysis Social Media Marketing Strategic Business Analysis Marketing Management Portfolio Management International Marketing Strategic Operations Management Modelling and Simulation of Operations

Singapore Management University	MSc Accounting and Data Analytics	Singapore	The programme is designed for professionals who are interested in developing expertise in applying data technology into their domain knowledge to solve business problems, especially in the finance and accounting sectors. The availability of massive amounts of data has created a high demand for skilled data analytics professionals who can analyse such data and obtain the insight needed for decision-making. This is extremely vital to accounting and financial services firms, as they have been dealing with large amount of information produced by their clients. In the MSA, you will learn how to analyse large amounts of data and uncover patterns and insights that will give your firm a valuable competitive advantage.	Accounting Booster: Financial Reporting in the IFRS World (Part I) Financial Reporting in the IFRS World (Part II) Managing for Value Creation Accounting Information Systems Data Technology: Applied Statistics for Data Analysis Programming with Data Data Management Data Modeling and Visualisation Accounting Analytics: Forecasting and Forensic Analytics Analytics for Financial Instruments Analytics for Value Investing Accounting Analytics Capstone (SMU-X)

| University of Stirling | MSc Finance and Data Analytics | UK | This course equips you with data analysis skills that are in short supply, including algorithmic trading, use of machine learning, and artificial intelligence.

As you study, you'll develop core skills in finance, investments and data analytics – all of which can be applied in a final dissertation on a finance-related topic of your choice. You'll also be taught how to use programming languages (e.g. Python, R) to analyse data and get a thorough understanding of core financial theory and investment practices. In addition, you'll have the opportunity to use professional financial databases, such as Bloomberg, Eikon and S&P Capital IQ.

Other features of the course include the Amplify Trading Boot Camp, where you can get first-hand experience of real-world trading, and the Student Managed Investment Fund, which provides experience of managing actual funds through targeted investments. All these features help to enhance employability, give you practical skills, and play a part in a world-leading student experience. | Compulsory modules:
Flying Start Leadership Programme (MANPFSL)
Corporate Finance (INVP001)
Representing and Manipulating Data (ITNPBD2)
Quantitative Methods in Finance (BFIP013)
Blockchain Technologies (ITNPFT1)
Data Analytics (ITNPBD6)
Applied Data Analytics Using R
Dissertation (40 cr)

Option module
Select 30 credits from Finance & Data Analysis options list
Empirical Methods in Finance and Accounting (ACCP009) 10 credits
Behavioural Finance (FINP006) 10 credits
Financial Risk Assessment (FINP007) 10 credits
Investment Regulation and Ethics (INVP005) 10 credits
Derivatives (INVP010) 20 credits
Investments: Equity Portfolios and Pricing (INVP012) 10 credits
Investments: Fixed Income and Alternative Investments (INVP013) 10 credits
Cluster Computing (ITNPBD7) 20 credits
Stochastic Processes and Optimisation (MATPMD4) 20 credits |

| University of Lisbon | Masters in Data Analytics for Business | Portugal | The Masters in Data Analytics for Business aims to:

develop professional skills to use advanced quantitative decision-making methods;
develop research skills in the field of data analysis;
prepare students for a cross-national cultural environment, with colleagues from several nationalities. | Programme courses
Business Intelligence and Decision Support

Data Platforms for Analytics

Decision Making and Optimization

Enterprise Analytics

Programming Foundations in Python

Statistical Methods and Visualization

Advanced Statistical Methods

Big Data Tools and Analytics

Forecasting Methods

Machine Learning and Data Mining

Programming for Data Science

Research & Development Seminars |

Northumbria	Business with Business Analytics MSc	UK	Develop expertise in business analysis using contemporary tools and techniques for analysing big data Prepare yourself for the SAS Global Certification in the Business Intelligence module Newcastle Business School is part of a select group of business schools worldwide, following accreditation by the Association to Advance Collegiate Schools of Business (AACSB) in business and accounting – the first in Europe to gain the double accreditation Upon completion of your programme, you will be eligible for the QA Professional Pathways programmes which will enable you to further develop your skills with one of the UK's largest providers of IT and project management training	All modules are core unless otherwise stated. Developing Global Management Competencies I (20 credits) Developing Global Management Competencies II (20 credits) Strategic Management for Competitive Advantage (40 credits) Marketing Metrics and Analysis (20 credits) Business Intelligence (20 credits) Academic and Professional Development (0 credits) Dissertation Preparation and Research Methods (0 credits) The Newcastle Business School Masters Dissertation (60 credits) - Optional The Newcastle Business School Masters Consultancy Project (60 credits) - Optional
University of Nottingham in China	International Management (Business Analytics) - MSc	China	Our MSc International Management (Business Analytics) programme is a one year, full-time programme consisting of 6 core modules, and 2 elective modules from a choice of 7 elective modules. The core modules are conducted via lectures, tutorials, and computer laboratory sessions. Students undertake the dissertation project in Business Analytics in collaboration with one of our international industrial partners. Graduates of the programme will have gained the necessary skills and knowledge in a range of fields, including business operation, database, statistics, informatics, data analytics, machine learning and big data technologies in real-world business contexts.	Semester 1 Compulsory modules BUSI4389 Data at Scale: Management, Processing and Visualization (20 Credits) BUSI4390 Foundational Business Analytics (20 Credits) Semester 2 Compulsory modules BUSI4391 (20 Credits) BUSI4392 Analytics Specializations and Applications (20 Credits) BUSI4393 (10 Credits) Summer module BUSI4391 (60 Credits)

KPMG Campus - Program being run from 9 Business Schools	Master of Accounting with Data Analytics	US	All KPMG-sponsored students will have an Audit or Tax internship focused on D&A with KPMG during the spring semester/term of the university they are attending. Students will put the D&A knowledge learned in the classroom to immediate practical use. Performing at a level beyond a typical intern, students may have the opportunity to provide assistance in carrying out the engagement team's approach to using advanced D&A enabling technologies. The demanding coursework at participating universities will go beyond traditional accounting principles and tax regulations to include use of technologies and methodologies used in today's highly complex, data-centric accounting environment.	Each university has integrated KPMG's Program into its Master of Accounting or Master of Taxation degree for the required 30 hours of credit. The coursework includes subjects such as those listed below: — Data Analysis and Visualization — Systems for Data Analytics — Auditing through Information Systems — Probability, Uncertainty and Statistical Decision Making — Auditing with Automated Audit Procedures — Innovation, Emerging D&A and Cognitive Technologies — The Future of Data and Analytics in the Tax Practice — Data Mining for Business Intelligence — Fraudulent Financial Reporting.
Florida Atlantic University	Masters in Business Analytics	US	Why business analytics? Business Analytics (BA), also known as Business Intelligence (BI), is strategically important for every organization to maintain competitive advantage by extracting meaningful information from the flood of digital data collected by businesses, government, and scientific agencies. Business Analytics involves information technologies, applications, and practices for collection, integration, analysis, and presentation of business data and information. Electives are required on the MBA course to specialise in Business Analytics	To obtain a specialization in Business Analytics, you would need to take 4 courses from the list of five courses below: ISM 6136 - Data Mining & Predictive Analytics ISM 6404 - Introduction to Business Analytics ISM 6405 - Advanced Business Analytics ISM 6555 - Social Media & Web Analytics QMB 6303 - Data Management & Analysis with Excel

| NUI Galway | MSc Business Analytics | Ireland | 1) Understand and be able to use specific IT which is used in developing business analytics.

2) Analyse and solve business problems using applied data analytics tools and techniques.

3) Understand and apply techniques for managing Information Technology in organisations.

4) Identify, analyse and solve applied problems in individual and team-based settings.

5) Apply effective decision making to global business problems. | MS805: Database Systems
MS806: Business Applications Programming
MS5104: Decision Theory & Analysis
MS5105: Statistical Techniques for Business Analytics
MS5107: Business Modelling & Analytics
Elective Modules (choose one)

MG557: Strategic Management
 MS804: Systems Development & Project Management
Semester II

MS802: Information Systems Strategy and Innovation
MS809: Enterprise Systems
MS810: Information Systems Security & Ethics
MS810: Advanced Applications Programming
MS5106: Data Science & Big Data Analytics
MS5108: Applied Customer Analytics
MS5109: Business Intelligence with SAP Business
MS5103: Business Analytics Project (Group Project) |