Are the accounting curricula enough to equip the students to be the future accountants? *An examination of the accounting modules of universities.*

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Abstract

Research Question: Are the accounting curricula enough to equip the students to be the future accountants? An examination of the accounting modules of universities. Motivation: Big data and Artificial intelligence are playing a major role in overhauling of the accounting process and procedure. The role of the universities is to tune up the students for this role and prepare them for future challenges in the context of new emerging technologies. There is a need to scrutinize the curricula of the topmost university to see what efforts have been laid out by them to make the graduates competent enough to survive the new challenges. Purpose: The paper aims to study the new inventions in the field of accounting and auditing and how do the educational institutions take part in implementing the new inventions towards the students to make them ready for the challenge. We discuss the role of big data, artificial intelligence how have they changed the accounting procedures and why it is necessary for the accountants to get on with these subjects. Data: Document analysis were carried for the catalogues of each university selected, the main purpose was to look in detail about the how and what is being taught to the accounting students, additionally the college website was scrutinized to see additional efforts taken up by college in the form of seminars/events. Methods: Content analysis was used to collect the research data and weight ranking system was used to evaluate the effectiveness of curriculums. Findings: It was found that the top university ranked in the world have started integrating the data analytics and artificial intelligence in their module through various ways, however, there is still more work that needs to be done and we found a major change in the ranking of universities when ranked by giving preference to data analytics course structure. Result: The universities have put some efforts towards integration of technical courses and not only through theoretical teaching but also through internships and project-based learning, however, the accounting curricula still needs to be worked upon in these universities and should be taken on priority as these are the most prestigious universities of the world.

Introduction

Research Background

We all live in a world that is consistently adapting to new changes, whether it is environmental, political, social or economic every day there is some new challenge in front of us to adapt. One such aspect is technology, which is continuously evolving and has made our lives and easier. One needs to have some basic skills in the use of technology as it has become a ground requirement for jobs. This research deals with one aspect of the technological invention which is related to the field of accounting, how it has made the accounting and auditing profession dependent on technology. The accounting profession is one of the most challenging professions Greenman, Mendez and Steiner (2019) as one needs to make decisions that are going to affect clients and stakeholders financially and economically. Therefore, this makes it one of the most challenging jobs which require full expertise in accounting policies and standards. The traditional accounting is now being backed up by artificial intelligence (Bowling, 2019).In the past 2 years, artificial intelligence has evolved to such an extent that it has penetrated every single sector Stewart, Debapratim and Cole (2015) that we could have ever imagined, in some or other way. Kokina & Davenport (2017) mention in their research that artificial intelligence is driven by both demand and supply factors, in terms of demand there has been a surge in the use of technology that could help in the growth of productivity, there are decisions to be made which involves a huge amount of data and have to be done in less time which is hardly possible for human beings. On the supply side, there have been various tools from Microsoft, Google, Facebook available for use and study.

Key Concepts of Research

Future of accounting is largely impacted by Artificial Intelligence and big data analytics (Chua, 2013). This is because accounting is all about doing analysis of data and making a decision based on it. We can see this in an article published by one of the big four accounting firms that how are they using AI technology in extracting data from invoices, contracts etc, in context to automation and AI, they are also using drones to do stock audits (EY, 2019). AI has resulted in a decrease in time taken to perform tasks by 80-90%, which has helped the accountant to focus on counselling

related service to clients (Marr, 2020), in other words, it has helped the accountants to expand their business. AI has also helped in building up of RPA(Robotic Process Automation) which has helped in cutting down the time taken to perform repetitive tasks such as analysing financial statements and handling of documentation, with this technology in place, the accountant will be able to strategise its service into more of advisory and related work. AI technology will also help the internal auditors in certain processes which involves checking of authorisation of various aspects of a transaction like invoicing, purchase orders, cancellation, procurement etc. As we know that the compliance-related frauds are increasing day by day so with the help of AI-enabled system, the legal section of an organisation can see if the transactions are undertaken are complied with the existing laws, as AI implemented technology can raise a flag if any issues are detected (Marr, 2020). Therefore, there is a need for accountants to train themselves in such aspects of technology, so that the whole process of accounting can be made efficient and effective (Stancheva-Todorova, 2018).

Rationale for research

The rise of big data demands in the field of accountancy has shown that there is a huge demand in the market of accountants for learning data analytics related skills. This comes from the exceptional salary being offered to experts in data analytics in the US, where they are earning in six figures, and is also ranked among the best jobs in the United States (Reports, 2018). A survey conducted by Forbes Insights in 2017 shows that several executives of KPMG regardless of the location and industry believe that accounting when supported with advanced analytics, will be a must-have qualification for financial reporting and external audit. The future accountants are expected to be equipped with such skillset which would help them in a crucial part of the organisation in forming a strategy. This represents a critical challenge to all the upcoming accounting professionals and students who should be equipped with these analytical skills and knowledge through teaching the analytical topics with the existing accounting curriculum (Few, 2017).

Back in 2013, the AACSB has emphasized on integration on data analytics contents into the accounting curriculum and in support to this integration they have modified contents of Business Standard 9 and Accounting Standard A7(IT skills for accounting graduates) and have integrated data analytics. The A7 requires the schools to include

data analytics, data creation, data sharing, data mining, data storage in their respective accounting programs (International, 2016).

According to the report of IMA(Institute of Management Accountants) IMA, (2019), which talks about the extent to which big data and AI has been implemented in the field of accountancy and finance. From the statistics, we can see that more than 25% of organisations have started implementing data analytics in their business processes and in most of the organisations the executives have already mastered these skills while they welcome other employees to start learning. Therefore, it has become important for professionals like accountants to upskill themselves in this game as this will help them in exploiting the ongoing digital transformation of business and will also learn to apply analytical and critical thinking skills to address strategic issues and use data analytics to make decisions (IMA, 2019).

The research is worthy of study because after examining some key researches (Stancheva-Todorova, 2018; Gamage, 2016), it is clear that there is a gap when it comes to researching curricula provided by the best-deemed universities of the world. How are they justifying themselves and providing the required training to the students and preparing them for the future? Many research articles discuss the impact of artificial intelligence and what should be done. However, what is being done to equip the students can be researched and talked about in a detailed manner. The research proposes to investigate the curricula of the universities by looking into their catalogues, scanning the website, past exam papers, assignments, course structure, and concluding that "Are the accountants and auditors of the future properly equipped for the new technological workplace?"

Structure of Research

The thesis will examine the curriculum of top ten universities in the world offering masters in accountancy ranked by accounting.com, the prime focus will be how these universities have integrated the topics like data analytics and artificial intelligence in their curriculum and what are they teaching in those topics, then we will assign different weights to universities based on efforts/ways to integrate data analytics and AI in the curriculum and use these weights to rank the universities, which will help us to know that which university is ready for future challenges.

Literature Review

The research is based on the importance of artificial intelligence in accounting and auditing and then investigating the curricula of universities, to conclude that how universities are equipping the students with the present challenges in the field of accounting. The discussion will first discuss the integration of technology with Audit and Accounting. It is followed by challenges faced by auditors, accountants, employers and universities, due to the upcoming changes in technology and costs related to its training along with the measures taken to tackle the challenge. The conclusion will talk about the reason for the research.

The emergence of technological innovation in accounting

Accounting has evolved through a long process, from recording on clay tablets to the development of adding machines in the 1880s to development of the first spreadsheet software Visicalc innovated by Apple. This was followed by the advent of using various tools for relying on equipment like optical character readers; intelligent data capture led to another milestone in the automation process, artificial intelligence has come a long way (Untapped, 2018), many CPA(Certified Public Accountants) firms have started using robots for stock counting, inspecting fixed assets, check for bank confirmations and even simplified accounts payable process by tracking the late payments (Lin & Hazelker, 2019; Peiguang 2015).

Sakyi (2016) in his article mentioned that 21st century is considered the age of information technology, as everything is data-driven and handling of such huge amount data in a short time is not possible by a human being which is why we need the intervention of technology wherein we have tools which can handle data in short time with accuracy, with the advent of digitization the reports are to be transmitted through various channels like mobiles, laptops. One such tool is Big data analytics which is used to process unstructured data into a meaningful structured format with visuals. The use of big data in accounting is now prominent these days as we know that accounting procedure revolves around data analysis which makes big data analytical skill a primary requirement for the accountant in today's world (Khadija and Barghathi 2019). Therefore, an accountant needs to be well versed with the concepts of big data and data analytics (Alles, 2015).

Big Data's nucleus consists of the following features which help to define its versatility:- 1. Volume, Velocity, and Variety this helps in describing the characteristics of data, it can range from bits to gigabits. Velocity relates to the speed at which the data flow and the data type could be structured or unstructured. 2. Technology and Analytical methods which helps the user to know about the requirements so that they can make proper use of such information. 3. Value, this helps to describe the value which will be created after the transformation of data into valuable insights that will create economic value for an organization (Zhan *et al.* 2018).

It has become more challenging as big data analytics is being used to deal with a large amount of data and these technologies are now helping to convert the professional judgements to a logical fact supported by advanced evidence Greenman *et al.* (2019), therefore there is a need to equip the accountants with new technologies of Data analytics, blockchain, artificial intelligence. There is also a need to scrutinize universities, to see if they are facilitating the same to future-proof the students.

Data analytics is often misunderstood as descriptive whereas it is more of predictive analysis (integrates data from various sources and helps in predicting future outcomes based on statistical analysis) and prescriptive analysis (it is a combination of sophisticated optimization technique) which helps in suggesting favourable outcomes in a given situation (Tschakert *et al.* 2016).

In research done by J Coyne, G Koyne and Walker (2016) tries to link AIS(accounting information system) to the existing education system, they talk about new technologies that have evolved in the recent times and why is it important to integrate these courses in accounting curricula. The recommendations made however was not feasible as they did not mention how will the new modules be connected to existing accounting curricula. They talk about one university where they have included few data analytics courses but not in detail, there exists a gap where they could have worked on talking about the initiatives taken by universities in integrating these courses in their existing curricula, this gap will be addressed in this research where we will talk about the approach/method adopted by universities in grooming the accounting students with these new concepts.

The courses being taught to the students helps in building an understanding of the business decisions and their impacts in various ways. It is also believed that the

concept and importance of data analytics are derived from decision making using different analytics techniques and machine tools in a diverse organizational context. The techniques mentioned in the above para (predictive and prescriptive) would also make sense when they provide deep business insights which would help in decision making. Thus, an individual must acquire a deep knowledge of the organizational structure and its characteristics as it will help them in doing a better analysis using data analytics tools, and in all the above tools and skills the accounting students are not academically trained or ready, which is why there is a need to integrate the analytics curriculum in the existing accounting courses (Few, 2017).

Technological hurdles faced by accountants

Nowadays, accounting firms are looking for professionals who are trained in using the new technologies and possess the required skills to cope up with the changing business requirements (Rufino, Payabyab, Lim 2018). Davenport and Harris, (2017) discussed in their book about analytics and defined it as "extensive use of data, statistical, and quantitative analysis, explanatory and predictive models, and fact-based management to drive decisions and actions", they mentioned that analytics is something which could result from manual entries done by humans or could be fully automated business decisions. Recent studies have shown that most of the internal auditors now use advance analytics tools to verify and obtain information and this provokes a need for external auditors to be able to use the analytics tool to verify the information provided by internal auditors.

Global technologies have led to global connectivity which has created n number of opportunities, as the network of humans and technology continue to expand the means of communication with devices that have the enormous processing power, speed and storage, these capacities will further be increased with the inventions in the field of Artificial intelligence, robotics, 3D technology, biotechnology, nanotechnology etc. AI has already made its presence felt among us as we can see auto-driving cars, software, virtual assistants, drones working seamlessly. Significant progress has been made in the field of AI with the help of computing power and availability of the huge amount of data. "Digital fabrication technologies, are interacting with the biological world constantly" (Schwab, 2015).

Nowadays, blockchain technology is being used in almost all financial transactions. This technology enables automated audit, it also facilitates in tracking the transactions back and forth(Melnychenko and Hartinger, 2017), this has a substantial impact on accountants as they are required to be adept with the usage of such technologies. Khadija and Barghathi (2019) discuss in their research that big data is one of the most important aspects of auditing as it mostly revolves around collecting and analysing of data and how crucial it is for universities to integrate this into their curricula and also mention in their finding that most of the accounting/auditing curriculum lack this aspect of data analytics, their research focused on how important is data analytics in the current business environment for accounting students. However, there exists a gap where they do not discuss the initiatives or steps which are already being taken by the educational institutions around the world and this is where the current research focuses upon, in other words, we will examine the curricula of the universities and will evaluate that which university offers the best overall development of an accounting student.

As discussed by Greenman *et al.* (2019) accounting has become very susceptible to technology, the implication of data analytics has brought a better understanding of the financial statements. In recent times big accounting firms have launched many AI projects, which shows that companies have begun to work with new technologies (Issa, Sun and Vasarhelyi 2016). This should ring a bell for the universities pointing out that, now employers will look for resources who can handle AI projects. New technology has changed the approach for an audit from reactive to proactive, the automated programs now provide wide scope for testing in lesser time (MTI College, 2018). Presently, basic accounting tasks such as posting, calculation checks of financial statements have become automated and there is a strong possibility that most of the complex tasks such as business analysis, external reporting will be automated soon (Richins *et al.* 2017).

Accountingtoday (2019), published in their article that data analytics will help in transforming the role of an auditor from being historians to advisors, as DA helps in drawing out conclusions based on raw data. Previously, the auditors just used the data provided by clients to learn about their activities of the past, however now with the help of DA they can anticipate their needs too, this requires good data analytical skills. The accountants should know to differentiate between good data and bad data

as this will form the basis for their opinion, there are certain softwares like turnkey that can help in analyzing trend and producing useful information for the firms.

Recent innovations like cloud computing, have transformed the functioning of accountants, it enables the accountant to access and store data from any part of the world (Allaherdi 2017), such technology requires technical expertise which would enable them to deal with such software, to understand the risks associated with them and their implications. Thus, it is beneficial for a company to hire an employee who is already trained in such technology, which is why it becomes the responsibility of universities to facilitate such new modules so that their students would have edge over others.

As we know that technology is a double-edged sword (Austin and Macauley 2001), so it does has negative implications on businesses too which has to be handled with complete care. The risks associated with technologies are stretched to potential and financial threats, there are few inherent risks like loss of financial and accounting data, threats to one privacy as the data on the web could be hackable, risk of business continuity as everything is cloud-based it is important to ensure that there is no disruption in the process, legal and regulatory concerns and intellectual property theft (Brandas, Megan, Didraga 2015).

The future challenges facing employers and accounting courses

The advancement of technology has resulted in accounting firms recruiting graduates from Science and technology stream as they are moving towards artificial intelligence (Lin and Hazelker, 2019). This has now challenged the current universities teaching accounting courses to introduce similar modules of technology in their curricula. The analytical skills depend on whether the information is being produced or analyzed by the accountant, these skills require expertise over accounting policies and standards as they are the basis on which a decision will be formed (Gass 2018; Kingston 2014). Therefore, the failure of an accountant to learn these skills in the initial period could lead to extra cost for the firms. One question that revolves around this article is how we use technology to its best to minimize cost; it could be done by recruiting people who are trained in new technology (Cohn, 2020). Since companies are focusing on technological up-gradation (Doshi *et al.* 2020), thus the students who are already

trained in such technology by the universities have a perceived edge of getting recruited.

A research was conducted by Htaybat, Alberti-Alhtaybat, Alhatabat, (2018) it talked about how technological development has affected accounting studies, their research found out some topics that need to be incorporated in the accounting curriculum, they focused on Data analytics, dynamic business analytics and blockchain technology. Further in their research, they talked about how these could be implemented with the help of program administrators, professors and most importantly developing the current curriculum with these technological concepts. Their research focused on what has to be incorporated and also suggested a few ways to implement, however, there is a gap where they should have discussed that what is already being done in the universities and how are the universities tackling this challenge, this gap will be addressed in this research paper, where we look into the curriculum of the universities and examine the efforts taken by the universities in educating the students with these new concepts which will also help us in evaluating the worthiness of the universities in terms of imparting full-fledged accounting education.

Vasarhelyi *et al.* (2017) talk about the importance of data analytics and big data in today's time and how can the universities incorporate these courses into their curriculum. In their research Lawson *et al.* (2014) talk about the major changes required in accounting curriculum, how should the accounting studies respond to organizational changes, in other words, they talked about giving more attention to subjects beyond public accounting and they talk about new technological concepts and recommended that these subjects should be integrated into accounting curriculum. However, they do not put any details on the technological aspects of the accounting profession, for instance, the technologies that are being used in accounting like data analytics and artificial intelligence this gap will be addressed in this research where we talk about the data analytics and artificial intelligence and how the universities are working towards integrating these subjects in their existing curriculum.

One of the most important challenges faced by institutions is how to integrate the courses like Big Data analytics with the traditional accounting subjects like Accounting, auditing and taxation, therefore the involvement of professors is needed for better integration of these courses (Zhan *et al.* 2018). The American Institute of

certified public accountants (AICPA) has also directed the institutions to include courses like "Data creation, data sharing, data analytics, data mining, data reporting, and storage within their curriculum (Schneider *et al.* 2015) which shows the urge in demand of these courses in industries.

It is also important to note that depending on the demographics the method and content of teaching differs and each method would have its benefits and drawbacks, in other words, there is no one-stop-shop solution to this problem (Dzuranin *et al.* 2018). For instance, when following focused approach students can learn data analytics without giving up their normal lectures on fundamental accounting, this approach would also help in identifying the appropriate faculty who would deliver this course. However, the accounting curriculum in the universities are already packed in such a way that the students need to take up an additional course for learning data analytics, therefore integrating the existing module with data analytics will be the only solution which would give students a better training without signing up for an additional course.

In research conducted by Clayton and Clopton (2019) they talk about different ways to integrate data analytics in the existing curriculum, they also discuss certain hurdles which cannot be overlooked some of them are: 1. Looking for qualified instructors is a difficult process, as hiring trained faculty could leave a financial strain on the universities and it is important to hire because the existing business schools do not have well-equipped faculty in these new topics. 2. Mode of class delivery is important to be decided that will it be purely theoretical, practical or a mix of both, if practical the universities need to have a computer lab set up for the students to practice. 3. Having a correct textbook for the modules is one of the important aspects of integrating the modules, as the concepts are new to everyone finding an appropriate book could be a challenge for the faculty, also the materials have to be frequently updated so that they are in-sync with the changing technology. 4. Big datasets are also one challenge for the universities because the students need to have experience of good data sets so that they can learn with practice, for this it is important for universities to build up partnerships with the industry so that they can provide data sets to practice, which would also give a real-life exposure to students. Their research provided a good insight of how the integration of data analytics should be done in accounting curriculum, however, there is a scope of further research where

they could discuss the efforts which are already being taken by the universities and what further could be done to improve, this is what we aim to discuss in our research.

Conclusion

Based on the above discussed industrial demands, a survey done by Robert Half shows, how technical skills that are majorly acquired, during on-the-job training leads to further cost. Nowadays, the general skillset requirement within the industry are:

1. Good technical skill
2. Understanding the business context
3. Analytical mindset

They admit that an ideal employee is rare to find, resulting in the need to invest a lot on the training of employees, both for conducting the analysis which is done by a robot (MTI College, 2018) and analyzing the data. The studies above shows, that how the new technology has impacted the work of accountants and the challenges faced by employers in training the existing employees which would lead to an additional cost (Gass 2018), and in hiring already trained human resource. There is a gap about how the can universities, keep up with this challenge of equipping the students to be future accountants. Therefore, this research will investigate the curriculum of top universities to see what modifications they have introduced in their modules to deal with such challenges.

Research Problem and Aims of Research

The primary research question is, are the accounting curricula enough to equip the students to be the future accountants? An exploration of the top ten universities ranked by accounting.com of the world offering masters course in accounting will be conducted, to find out if they are producing the desired resource for the industries by incorporating artificial intelligence and data analytics curriculum in their modules. The reason behind choosing the top ten universities in the world is to know about the standard of education in top institutes, that are these universities doing justice to their rank and position by imparting the trending courses and skillsets among the students.

The top ten universities ranked by accounting.com are:

1. University of Pennsylvania
2. Northwestern University
3. University of South California
4. Washington University
5. Vanderbilt University
6. University of Michigan-Ann Arbor
7. Rice University
8. University of Notre Dame
9. University of Rochester
10. Emory University

The research will focus on

1. Highlighting the modules are being taught by the universities about data analytics and artificial intelligence.

2. How are the students trained in these modules for instance, what methods are adopted by universities in providing exposure to real-life situations to students?

3. To answer the question "are the accounting curricula enough" we would set up different benchmarks that would revolve around data analytics and artificial intelligence which will help us in evaluating the performance of each university and this would help us in concluding that as per the current ranking do these universities justify themselves by providing the required training and facilities.

For our research we have chosen Masters degree for evaluation because masters are considered of the very important aspect in one's professional development as it provides in-depth knowledge of the subject, helps one in learning new theories, and develop a new perspective towards the field of study. It also opens up more opportunities and offers an enhanced position in the labour market when compared to that of graduates where only general topics of education are covered (Bouret, 2017). As we see the benefits of pursuing masters, it also gives an edge to students in getting hired by companies because firms will be benefitted if they choose an individual who has done masters over under-graduation.

The ideal future accountant is one who is ready to work in the world of Artificial intelligence and big data. The Big data analytics itself includes many modules like data mining, data creation, data use, data storage. The development to watch out will be related to how the universities are integrating this course, as they will be needing the help of someone outside the accounting expertise (Dzuranin *et al.* 2018).

Tschakert, *et al.* (2016) discuss in their article that data analytics in itself is a big curriculum, it has a "certain potential to turn into a core business discipline", therefore it is, important for business schools to start teaching this with a pragmatic approach, and most importantly the main goal should not be to turn the accountants into programmers. Thus, it makes it crucial for the universities to segregate between a whole lot of DA and DA for accountants which will help them in designing a curriculum

that would be effective and efficient and could be delivered along with the existing modules. This directs us towards the research question where we are examining the catalogues of the universities to see how are they implementing the data analytics module.

The rationale behind studying this topic is: Big accounting firms and accounting bodies now recommend the integration of big data analytics, artificial intelligence in the accounting curriculum, for instance (PriceWaterhouseCoopers, 2015) mentioned in their article that there is need to update the accounting curriculum with these concepts. This has now posed a challenge for universities to integrate these courses into the existing curriculum. The reason behind testing the universities is to test, that the benchmarks which are being set by these universities are up to the required standards of today's technological advancements and whether these universities are updating their curriculum to educate the students in a way that they are future-ready for the challenges. Therefore, this research will seek to examine whether universities are future-ready with artificial intelligence modules and we aim to examine the catalogues of the university which will help us in answering the main question that "is the accounting curricula enough", in other words, are the study program effective in these universities?

Methodology

Introduction

The research is exploratory, and it aims to answer how artificial intelligence and data analytics is infused accounting curriculum. The scope of research is to provide a comparative analysis of the modules included in the curriculum of accounting-based programs offered by public universities. The research is based on interpretation of information collated through various sources as used by (Castellan 2010).

The research will study top ten universities in accounting and finance sector as ranked by "Accounting.com", this website ranks the universities based on information provided by experts, students and educators this technique helps in gathering a perspective image given by experts as well as a real-time image provided by recent graduates and educators. The university rankings are decided on this website based on current accounting trends in the market and relating it with professional opportunities. The data collected is influenced mainly from federal sources, also the data is cited from various sources like U.S Bureau of Labor Statistics, The U.S Department of Education, National Centre for Education Statistics. Thus, the source is considered reliable for taking the university's rankings.

Approach of Research

The reason behind choosing the top ten universities are two, one is the time factor researching in the curriculum of ten universities takes time and is also a time taking activity for the reader, therefore, to keep it swift and effective ten universities were chosen, second- it is as per psychology that people usually go for "top ten" when they look for comparisons between anything. When the researchers did a further study they found that it is called "top 10 effect" which means that the user will usually go for numbers ending with 0 or in other words round number category because the round numbers are mostly prevalent in the daily communication(Isaac & Schindler, 2014 and Jaffe, 2014). Therefore, based on this theory and to facilitate an effortless analysis so that it is easily grasped and preferred by the end-user and also taking the limitation of time in consideration we have chosen to analyse the top ten universities.

In this research, common benchmarks will be chosen among the selected universities, so that the comparative study is justified, we will be using the weighted rank method as done used by (Xing and Ghorbani 2004), where they used an algorithm to rank webpages based on their popularity. Similarly, the same weighted ranking method was used by (Alguliyev, Alguliyev, Yusifov 2019), where they ranked the individuals standing for election based on factors like age, education, work experience, professional competency, personal traits. Our research is based on the same concept however instead of using an algorithm, we will be deciding various factors/benchmarks which will be common for universities and assign weights to them according to their importance and then use them for evaluation. The primary source of information for this research will be module descriptors on the university websites. The motivation behind choosing this methodology arises from the research by (Ahmad, Khan and Ahmad, 2018; Maali and Al-Attar, 2020). Ahmad, Khan and Ahmad (2018) in their study emulated this methodology where they used the college catalogue to write about the streams offered by colleges and the subjects being taught. It gave them the upper hand by enabling them to carry out a further analysis like a survey/questionnaire. Mali and Al-Attar (2020) used the Jordanian university catalogue to study the knowledge field, credit hours required in each course and they used this information to frame survey questions. However, this methodology could have been used in a more detailed manner, investigating other aspects which are mentioned in the below paragraphs.

The above researchers in their research methodology chose both public and private universities for their analysis, likewise, this study will also focus on public and private universities and come to a conclusion which university performs better in terms of offering students a detailed training in data analytics and artificial intelligence.

Data collection

College websites and module descriptors are the first choices for employers and any stakeholders to get information about the modules being taught, so that when hiring they can match the skill requirements. These are also one of the reliable sources because of their official authenticity, global accessibility and are also regularly updated (Palm and Bisman, 2010). Analysing curriculum is helpful as it helps in determining the validity of assumptions and motive behind the course structure, it helps to identify the beliefs and ideas to which the universities were committed and

what they aim to produce through these ideas (Odabasioglu, Selcen and Kevser 2012). By using the web content analysis we can easily conclude on what educational institutions are doing rather than what they can do. While examining the websites and curricula we could not verify the credibility of the information however their prima facie validity can be verified as the universities are responsible for the information. Apart from the module the college website also tells us about the student life, in other words, they tell us about the initiatives taken by universities to enhance the practical exposure of students, for instance, information about clubs, societies, events, workshops, guest lectures, internships, career treks, student exchange program these are few initiatives that would help the students to learn how to implement the knowledge that they have gathered from their theory classes. Hence, the university website is the primary source of information for the world, which is why it was chosen for investigation in the first place.

These universities will be analyzed on some common grounds like which of them is offering the modern concepts like big data and artificial intelligence in their curriculum, their method of delivering a module, either by following a standalone or an integrated approach (Dzuranin *et al.* 2018), this can be examined by looking into the module structure i.e if AI topics are included within the existing modules or is there a separate module overall, besides the curriculum there is a need to investigate among universities, which of them have dissertation/internship as electives because an internship will give them practical exposure to these challenges. There is a need to know which university facilitates guest lectures and with what modules to understand that students are gaining exposure to technological changes within the industry.

Alternatives and Limitation of methods

Few alternative methods like questionnaire, the survey is avoided because it is often biased due to difference of demographic factors like age, as older age people might feel that conventional accounting theories are enough to produce good accountants as they are not well versed with the technological concepts, on the other hand, the young generations will be in favour integrating such concepts in their curriculum (Richards *et al.* 2018). Conducting of interviews did not look convincing as it was assumed that if the interview was conducted, it would be done with the professor's of the university and it highly unlikely that they will be critical about the institution they

are working for and it is also a time taking process because evaluating the outcome of learning through interview would require interviewing candidates from each university and properly setting up technical questions to evaluate their teaching.

This approach also comes with a limitation that the brochures used will only provide details of specific topics, the approach taken to deliver that module could not be examined and sometimes universities come up with add-on courses which are not mentioned in the brochures. Sometimes the university does not put detailed information about the course in the brochures, which makes it difficult for the end-user to conclude about the outcomes of the course studied, this aspect can affect our study when we will compare the outcomes of different universities as we might have detailed course structure of one university and just a brief overview of another university. The quality and depth of teaching cannot be measured- this aspect of the examination will be lagging when using this methodology, and because of this the research will lack the unbiased evaluation of the outcomes of the courses being taught and also our study will be limited in approach as we will only be evaluating the universities based on their face value which is the curriculum in our context, there could be a possibility of universities which do not provide in detail overview of the curriculum but the outcome of their teaching is better than the other, this can be one of the recommendations topics for further research.

Analysis

The study revealed the following facts about the universities which helps in forming a perspective about the importance of these universities and how have they implemented the courses like Data Analytics and Artificial intelligence in their curriculum. The analysis pattern is similar to a research conducted by Jorge, Pena and Reyes (2017) where they have analysed the curriculum of the universities to understand which universities need integration of CSR and ethics courses, for the same they analysed the college websites and curriculum to see if it is possible to integrate into the existing curriculum, in the below analysis we have taken a similar approach to analyse the curricula of the universities and came up with the information provided so that we could answer our research question "Are the accounting curricula enough", also in context to the literature review we could see that there were gaps in the some of the findings, we aim to fill to those gaps by looking into the efforts done by the universities. We selected the top 10 University from Accounting.com, the ranking of universities are shown in figure 1:

Ranking	University
1	University of Pennsylvania
2	Northwestern University
3	University of South California
4	Washington University
5	Vanderbilt University
6	University of Michigan
7	Rice University
8	University of Notre Dame
9	University of Rochester
10	Emory University

[1]

Figure 1

1. University of Pennsylvania: The university offers an MBA in accounting through Wharton School of Business, it accepts entry through GMAT/GRE, the university is also accredited by (MSCHE- Middle state commission on higher education). The course has 19 units to complete in 20 months, which covers accounting major, corporate finance, fundamental accounting, macroeconomics, legal studies, microeconomics, management, marketing,

[1] https://www.accounting.com/degrees/accounting/masters/best-programs/#UNC

statistics, management communication and electives. As part of electives, students are given the option to study business analytics where they are taught using analytical tools and their implementation on procedures, they mainly cover optimization, decision making and simulation. Apart from these the university does not provide any module that related to Artificial intelligence or Data Analytics. The course offers various summers programs like a) The course also offers 3.5 months Internships that allow the students to gain exposure of one or more functions at a company, b) Career treks: these programs are organized by student committee that provides an opportunity for students to visit US cities and companies to equip students with industrial experience and allow them to make connections with the companies that does not come for campus hiring, also this gives the student an insight into what is current skillset requirement in the companies so that they can focus on learning those skills in their college time. One of the best features of the MBA is they offer a wide variety of core subjects to choose from and students are allowed to take more than one major too, which gives them wider perspective, for instance, students can choose business analytics and accounting as two majors which would help them in competing with the current challenges in the accounting world. The school also organizes international conference each year where they invite industry leaders who guide the students. The Wharton School has alliance with INSEAD and 17 other countries around the world in which they provide the opportunity to the students to participate in their exchange program and widen their learning experience(Catalogue). For the enhanced learning experience the school has some innovative techniques of imparting courses some of them are:

a. In one of the analytic course "MGMT 610", the learning teams use an interactive pedagogy, learning teams do a role play where they act as a member of management and observe how the students perform in a team and under pressure situations, this helps the students to use their learning and apply them in real-world and understand its implication.

b. The school organises various speaker events where they invite renowned authors to share their ideas on a topic for instance in 2016, Adam

Alter(Author of *Irresistible: The Rise of Addictive Technology and the Business of Keeping Us Hooked)* was invited (CourseExtra).

c. The school has a club for analytics "Wharton Analytics Club" where they invite guest speakers from companies like Google, Facebook, Amazon who conduct workshops on Data analytics, Python, SQL, R, Tableau and other tools, the school is doing its best to integrate these courses into the courses through different ways (WhartonAnalytics).

d. Wharton school has almost 20 research centres, one of which is Analytics which focus on AI for business, this motivates students to get involved in the subject and also get to know more about the subject from the faculty who are continuously releasing research papers on this subject and also learn from them (AnalyticsResearch).

e. The faculty of accounting at Wharton School of Business is actively involved in publishing research articles on the accounting curriculum and changes in the modern world, with such renowned faculty students, get the best experience while learning accountancy and also learn about upcoming challenges through their research articles (AccountingResearch).

2. Northwestern University: The university offers an MBA in accounting through Kellogg School of Business, it accepts entry through GMAT/GRE. It is a two-year program; the university is accredited by (High learning Commission). The course offers major in accounting where it covers following modules of accounting where a student needs to complete at least four to complete the major: Managerial Accounting, Financial Planning for mergers and acquisition, financial reporting analysis, Issues in financial reporting, Global financial management and reporting, sustainability reporting and analysis. The schools offer waivers to students who have done under-graduation or have relevant experience in the same field, this helps the students to choose other subjects which would give them a broader perspective and enhance their knowledge. Students are also given an option to either choose a major for MBA or go with general management, for the research purpose we have chosen accounting as a core subject. The MBA module offers pathways wherein a student can choose industry-

related subjected and build their expertise in it, for the research we choose Data analytics where at foundation level we have Business Analytics I and II, Business Analytics I teaches them how to establish a connection between data, analytical tools, and business decision making, Business Analytics II covers advanced form of level 1 wherein students are trained on how to use basic regression skills including modelling and estimation, students are taught how to do hypothesis testing and make conclusions about the data. The competitive advantage course gives the student option to learn.

1. Analytics for strategy- This module helps in learning to make strategic decisions with the help of advanced analytics, students will learn how to perform advanced regression analysis and interpreting the results.

2. Retail analytics- This will help the student to understand how to use data analytics to address the decisions taken by manufacturers and retailers it helps in understanding the limitations of different types of data and how can a better planning help in performing analytics and increase the reliability.

3. Strategy implementation- The course focuses on strategy implementation with an emphasis on decisions, actions and analytical situations which help in the attainment of the strategic objective.

4. People analytics and strategy- This course will help the students to learn how to make the personnel strategy for an organization with the help of data analytics, it is based on life-cycle of an employee in a company starting from hiring till retirement.

5. Customer Analytics- This course will enable the students to learn the use of databases, analytics, machine learning and computing systems to help in collecting and analyzing customer information. Students are taught R in customer analytics and AI in this module.

6. Social dynamics and network analytics- This course prepares the leaders to use the tools of computational thinking and network analysis which will help them to evaluate and respond to challenges like connectivity and unpredictability.

7. Critical thinking in digital and social media marketing- This module helps the students in learning effective marketing leaders in areas which require digital and social media initiatives and trains them to make strategic decisions.

8. Human and Machine Intelligence- The course helps a student to understand the fundamentals of AI and its implications, students are taught to build AI models and evaluate how this model is better from traditional decision making.

9. Analytical decision modelling-The course focuses on managing, analyzing and solving various executive management problems using spreadsheets. Students are taught how to address problems of risk analysis, decision analysis and forecasting.

10. Applied Analytical- Students are taught to apply optimization, simulation and decision theory methodologies to modelling and analysis on excel platforms.

The Deep dive course includes

1. Visualization for persuasion- This course covers the presentation part of the analysis, it helps the students to understand the neuroscience behind the path from understanding to memory, and importance of how brain networks through visual presentation.

2. Technology in the age of analytics- The course provides an overview of enterprise and cloud technology and how they help in data analytics.

3. Introduction to software development-Since the program aims at training the students from the non-developer background this course teaches the essentials of coding, how to create a website and design applications.

4. Data exploration- The students are taught the usage of R and they are also taught about data acquisition, cleaning, data manipulation, data normalization and visualization.

5. Decision making and modelling- This course provides knowledge about the fundamentals of modelling tools for decision making under uncertainty, it includes teaching spreadsheet modelling of managerial problems.

The experimental course includes-

1. Analytical consulting lab- This is an experimental course that helps the students to use the data analytic techniques to solve real client problems.

2. Data analytics decision- This course provides the student with an opportunity to develop their business decision-making skills using predictive and evaluative analytical tools. These courses are different from the other three discussed above as they provide practical experience in the domain and allow the students to apply the skills learned from deep dive and competitive advantage courses to real case studies which help in preparing them for a real-world challenge. The school also focuses on giving practical exposure, it also offers field study, wherein the student is allowed to work outside in a company and gain practical experience and learn to address the real-world challenge (Course Structure). The school has various clubs and societies for students for instance Tech club and High-tech Club where they organize seminars which would be conducted by industry experts, these sessions help the students to get first-hand knowledge of the industry requirements (KelloggClub). The school also organizes various events where they have guest lecturers who would take special sessions on current issues and challenges, for instance, there is an event for "Leveraging Artificial Intelligence for Innovation and Organizational performance" these type of events helps the students who are from non-technical backgrounds like accountancy to learn about innovations and their implication in real life (KelloggEvent).

3. University of Southern California: The USC's Marshall school of business offers 1-year master's in accountancy and it is accredited from (WASC-Western association of schools and colleges), the entry to the school is taken based on GMAT/GRE scores. The college offers various master's in accounting out of which we have chosen "master's in accounting, Emphasis on Data and Analytics" as it is related to our research question. The course

is aimed at equipping students with the latest industrial demand for Data analytics. The course modules for data analytics include (Catalogue):

1. Technological innovations in accounting and auditing: This course aims at offering the students the insight into potential technologies for accounting and audit, emphasizing data and analytics, it helps them to understand the actual and potential benefits of technology in the field of accounting.

2. Auditing in the enhanced data age: This course provides a framework of the audit model including the use of large data sets with automated audit tools.

3. IT audit and data applications: This module explains the role that systems play in an organization, the technology which is used to develop these systems and also tells about the issues/risks related to technology, system application and system review audit.

4. Data Warehousing, Business Intelligence and Data Mining: These modules bring the introduction of basic DA tools where students are taught about multi-dimensional databases, on-line analytical processing, and survey of business intelligence application that extract useful information from data warehouses.

5. Statistical Computing and Data Visualization: Students are taught data reshaping and cleaning, the difference between good and bad graphics, univariate, bivariate, trivariate, hypervariate and time-series graphics. In addition to this, they are also trained in web-related computing and extensive use of application R.

The school also offers students the option to choose three electives which also has data analytics modules like:

a. Business Analytics: This module offers foundational knowledge for data analytics, use of basic tools and methods which are integrated with business analytics and help in decision making.

b. Applied modern statistical learning methods: This module provides an overview of modern statistical learning methods, applications of

regression, neural networks, this would help the students in making business models.

c. Designing spreadsheet-based models: This trains the students who would be leaders of tomorrow in decision making based on spreadsheet models which will help them in getting a broader analytical view of the situation.

d. SQL Databases for Business Analyst: The module is designed to deliver basics of SQL language and to equip the students with concepts like relational database management system, data storage, data manipulation, data aggregation.

e. The Analytics edge: Data, Models and effective decisions: Students opting for this elective are taught decision making under uncertain situations using real data by applying the optimization and statistical methods.

Looking at the modules, it is evident that the apart from traditional accounting curriculum the school offers students to include accounting principles with Data analytics technologies and methods which can be used in a highly complex environment. The Data analytics curriculum will help the students to integrate data tools and languages and communicate the answers logically. The major benefit of this course is that the students must have a commitment from any audit firm to undergo an internship in summers, as the classes will be based on the internship experience. This approach is very interesting as the student knows the real-life challenges which he will be facing during the internship and then they can come back and discuss it in class and work on it to polish their skills (Module descriptor). The school has various clubs and societies that give the students an out of the box experience so that they move out of the typical study routine to join and broaden their network, this involvement also helps the students to get the attention of the recruiter in demonstrating one's skill and commitment to a specific industry. There is one such club call Marshall Data analytics club which helps the students from a technical and non-technical background to be data-driven leaders across different industries, they organize various events and workshop on data analytics tools like Tableau,

Alteryx which helps in expanding the scope and exposure of students (StudentClubs).

4. Washington University St Louis: The University's Olin business school offers 18 months master in an accounting course the university is accredited from "HLC- Higher learning commission", the entry to the school is done through GMAT/GRE scores. The course does not have any module related to data analytics and artificial intelligence they only focus on traditional accounting curriculum which helps the students to ace CPA (Certified Public Accountant) qualification and progress in the accounting career (Course Map). However in their electives, they have a module "Practicum" where the students are allowed to work in groups on a real-life project by using the knowledge learned through the modules under faculty supervision, this helps the students to develop an understanding of the problems and discover different perspectives on the approach towards a problem. The curriculum also offers internship opportunities which allow the students to leverage the knowledge they learned in class and apply them in real-life scenarios. The school also has Olin Big Data Association, that helps the students from any academic background to get insights into big data analytics, they organise various events, seminars by inviting professors, alumni and also conduct analytics workshop, which also helps the students to build connections with industry people (OlinAssociation).

5. Vanderbilt University, Nashville: The university's Owen's management school accredited to "Southern Association of Colleges and Schools Commission on Colleges" offers one-year master's in accountancy, the school offers two programs majors 1. "MACC Assurance" 2. "MACC Valuation", we will be focusing on "MACC Assurance" as the course focuses on enhancing the core accounting knowledge of students that makes them eligible to work in accounting firms as an associate. During the summers the course provides training for attending the CPA exam through Becker CPA courses, which enables the students to secure a professional qualification while pursuing Masters (Course Map). The course has a module on "Data and analytics in business" which gives the students a competitive edge over others in the recruitment process as Data analytics

is one of the most important]tools to be equipped with (Todorova, 2018). In the last part of the semester school also helps the students in preparation of the CPA(Certified Public Accountant) exam which helps them to earn a professional qualification alongside Masters and also this is one the most important aspects to cover in Masters education as data analytics is not being asked in CPA exams which are a major boost for students to learn Data analytics (ROGERCPA, 2019). On the positive side, the university provides an opportunity to do 10 weeks paid internship which gives students a full insight into the real work environment. The course also conducts various sessions by the executives who are specifically trained to train the students to be leaders of the future, these executive has prior accounting experience and are certified by "International coach federation" (Events). Towards the extra-curricular side, the schools are an immense list of clubs and societies that help in the overall grooming of students, and for grooming the students with technologies like Data analytic tools they have "Owen Tech club" where they organize seminars on tools like "Tableau" which help the students to widen their scope and exposure and help them grow (Clubs).

6. University of Michigan: This is one of the Public Universities (accredited by "Higher Learning Commission") in our category, whose Michigan Ross's master's in accounting is chosen for analysis. Entry to the course is done through GMAT/GRE scores. The course is spread over 8 months and helps in preparing the students for the CPA exam which in itself is helping the students to gain knowledge of Data analytics as it is now a part of exam structure (ROGERCPA, 2019). Being a public university, it reflects the efforts of the government on training the students and after looking at the curriculum, the university offers one of the most desirable curricula for desiring accounting professionals. The university offers "EY Accounting and Public policy symposium" where they take the students to Washington DC, this helps the students to understand how the public policy shapes business-standard, this course is unique to this university which helps the students to step out of the classroom and get insights of real world's business and policies (Curriculum). The school also provides the students

with an opportunity to study data analytics as part of elective from its full-time MBA curriculum, in this module the students are taught MySQL, Tableau, and Python which are one of the needed tools for data management and visualization in today's time (Alekseev, *et al.*, 2016). Some of the major electives offered to students are:

1. Advanced Big Data Analytics: This course teaches the students to apply machine learning algorithms to various big data sources in a business scenario. The students are taught the use of R and Microsoft azure, the main outcome of the course is they are taught various applications of machine learning, and how to convert data into a meaningful context.

2. Applied Regression and Data Analysis: The students are taught data mining using regression analysis, it focuses on data collection, effective analysis, and interpretation for management control and planning and forecasting. Students are taught with examples of the latest business scenario which helps them to understand current challenges and gives them practical insight data analytics.

3. Artificial Intelligence for Business: The module aims to educate the students about the fundamental concept of AI, techniques of AI, how can AI be applied to various business problems, future potential of AI and related risks of AI. This module will help the student to understand the world they are going to enter and what can they expect to come across while working in the business.

4. Big Data Management: Tools and techniques: This module mainly focuses on the visualization part of data analytics, students will learn how to store, manage, and query databases via SQL and learn to present them with tableau, they are also taught the use of Python programming language to manage data. These tools teach the students to form a hypothesis based on the visualization created after performing analytics on the datasets (Electives).

The classes will be conducted in Lab and class that will give students hands-on experience with the tools, and finally, the students will be assigned a project based on a real-world scenario which will help them to use the knowledge learned during their lectures. The school has a "Data analytics consulting club" where students can join from any stream and learn from the real-world data analytics business questions posted by the members of the organization, therefore in this way the club helps in enhancing the knowledge of the students (Clubs).

7. Rice University, Houston: The University's Jones graduate school of business offers 10 months master's in accountancy and is accredited by Southern Association of Colleges and School commission on colleges. The entry to the curriculum can be made through GMAT/GRE scores. The course also helps the students to ace CPA exams, which will benefit them in achieving a professional qualification while pursuing masters and also equip them with modern concepts like data analytics which is now being asked in the exams (ROGERCPA, 2019). In 2019, the school added a data analytics module to its master's course which makes it competitive and a better place for the future accountants to get trained. The different modules for data analytics are

   1. Data analytics for accountants I:- In this course, the students are introduced with data analytics in context to accounting, the module includes how the data is structured, various methods of cleaning data, and merging them to form a better visualization.

   2. Data analytics for accountants II:- This course focus on the advanced method of implementing data analytics in the accounting context, students are taught how to use coding to extract, organize and develop various types of structured and unstructured data, the module also includes an introduction to machine learning.

   3. Auditing: A data analytics approach: - course focuses on

   a. Methodologies of transforming raw materials and unstructured data into workable data sets.

b. How to interpret data sets.

c. The presentation of data to decision-makers. The school in addition to teaching the module provides the opportunity for students to take up internship and leverage the knowledge gained through lectures in real-life problems (Course Map).

The school also has a tech club where they organize workshops in data analytics tools like "Tableau", "SQL" and "R", these courses help the students to equip themselves with these tools and also helps them to use the training they got in their module to apply on workshops and learn their implication (Clubs).

8. The University of Notre Dame, Indiana: The university's Mendoza school of business 10 months master's in accountancy program and is accredited to higher learning commission. The entry to the school is accepted through GMAT/GRE scores. The course is designed in a way, that it helps the student to ace the CPA exams and also prepare them for data analytics as now this aspect is covered in CPA exams (ROGERCPA, 2019). The course offers two different pathways 1. Assurance and Advisory track 2. Tax track. As our focus is in accounting we will be looking into Assurance and advisory modules. The school offers data analytics in accounting as one of its electives where the students are taught about data mining, optimization, simulation model building which would help them in real-life scenarios in forming a critical decision, this addition was introduced from fall 2020, below is the list of subjects also offered as electives in the analytics field.

   a. Business Intelligence

   b. Spreadsheet decision modelling.

   c. Strategic business technology.

   The school does not offer any internship that could have been a plus point in training the students with real-world problems, however, they have a student exchange program with the countries like "South America, South Africa, Asia" which would help them in broadening their exposure and perspective towards this profession as they would learn about the ways

and challenges in these continents. On the minus side, the school does not have any record of organizing events, workshops in data analytics which would give students a real-time experience of industry problems and would also help them in understanding the implication of the tools being taught (Curriculum).

9. University of Rochester: The Simon business school offers Master of Science in Accountancy and is accredited to Middle states commission on higher education. The entry to the course is accepted through GMAT/GRE scores. The course's credits help the students to make in total 150 credits which makes them eligible to sit for New York CPA exams, the preparation for CPA exam also equips the students with the latest concepts of Data analytics in accounting as this now a part of the exam (ROGERCPA, 2019). The course offers two tracks to students 1. Internship track: where they are allowed to go for internship and get some real-life experience (Course stretches to 17 months), 2. Non-internship track: where students are required to complete the module only(10-month course). The school has integrated modules for Data analytics in their curriculum which would help the students to compete with the current demand of data analytics in the accounting world (Khadija & Barghathi, 2019). The modules for analytics are 1. Programming for analytics, 2. Core statistics using R, 3. Applied financial statement analysis using data analytics (Curriculum).The school also has a "Data analytics club" that helps the students of MBA and MS to come together and learn data analytics tools and visualization techniques, it helps to enhance the knowledge of data analytics in students and also helps them to understand its implication in business (Club). Students are given practical exposure by allowing them to work on the projects which are related to the real-life scenarios, this method of teaching equips the students with the practical knowledge of the concept. (Projects)

10. Emory University, Atlanta: The university's Goizueta school of business offers a two-year MBA program with a concentration in accounting, it holds accreditation from "Southern Association of Colleges Schools and Commission on colleges". The entry to the university is accepted with GMAT/GRE scores. The course offers a concentration in accounting which

helps in building a proper understanding of accounting policies and standard. The course offers one module for data analytics "Data and decision Analytics". There is no further description of the module available on the website, and there is no initiative from the school to promote practical exposure of students towards data analytics or Artificial intelligence (Catalogue).

References for the universities are mentioned separately in "Work cited for university analysis section".

Discussions and Results

After analyzing the top accounting masters programs and comparing them to each other, the question to be answered is how are these universities justifying their rank based on the updated curriculum which includes data analytics. First, there is only limited data that can be considered when ranking the universities, for instance, the GMAT score, the results of students etc. However, in reality, the programs are assessed more deeply by hiring firms and students, which is based on the different methods of teaching such as organizing workshops, clubs and societies, career treks, internships, project-based learning and also what part are the universities playing in preparing the students for the CPA exam. In our research, we have assigned weights to these factors and then ranked the universities, these weights aim to fill the gap that we talked about in the literature review that we will be analyzing the efforts taken by universities in imparting the data analytics/artificial intelligence subjects in their existing curriculum.

The weighted system method was also used by Alguliyev, Alguliyev and Yusifov (2019) in their research where they used weights to ranks the individuals based on certain factors like personality traits, age, education, work experience and professional competence and then they assigned weights based on "Very good, Good, Fair, Poor Very poor" from 1-5 respectively and then they added the weights and the highest total of weights were assigned as 1st rank, they also used an algorithm/formula for weight calculation. Similar to their methodology in our research we did not use any formula but assigned weights based on the importance of factors for data analytics and summed up to find out the ranks.

The factors used in below figure will help us in summarizing the efforts made by universities and help us to come to a conclusion that are the accounting curricula of these top universities enough for the students to take stand in today's world and if not what should be the ideal ranking of these colleges based on the efforts taken by them which will be decided by a total of weights. In figure 2 we can see the weights assigned to these factors(7 to 1, 7 being the highest), the explanation behind the assigning of the weights is as follows :

Factors	Weights	With in Depth modules
Data analytics	7	14
Internship	6	
Project based learning/Case Study	5	
Speaker events/Workshops	4	
Professional Qualification	3	
Career treks	2	
Student exchange program	1	

Figure 2

1. Data analytics has been divided into two parts, A. In-depth modules(curriculum which has more than two modules of data analytics tools and they cover a deep understanding of different aspects of data analytics tools). B. The other parts cover one or two basic modules of data analytics which aims to give just an overview of the subject. Since this subject is the most important aspect of our research they have been ranked at the highest "14" for in-depth modules like analytics for business, spreadsheet models, analytics in auditing etc and "7" for the curriculum that have only one or two basic tools of data analytics like python, R, tableau. Based on our discussions above, the universities that have fallen in this criteria are Northwestern University, Rice University and the University of South California.

2. The internship has been ranked at second-highest "6" as the opportunity for the students to learn with practical experience in the field plays a major part in their grooming and an internship also gives one an edge over others as they already would have experience about the role (Šimičević, Snežana, 2017). One of the reasons for ranking this factor as the second-highest is internship opportunity gives the student an edge over other students during the recruitment stage as they already have experience of working in the business. Based on our discussions the universities providing internship opportunity are University of Pennsylvania, Northwestern University, University of South California, Washington University, Vanderbilt University, Rice University, University of Rochester, and Emory University.

3. Project-based learning/Case study has been ranked as "5" because next to the internship this is one of the methods that could give the students exposure into the implementation of the tools they have learnt and also work on real-life

projects. As data analytics is a new subject to learn, with the help of case studies and projects, students gain confidence in the functioning of these tools. Similar to internship project-based learning gives the student an edge in the recruitment process where they can showcase the cases they have worked in and how did they use data analytics to solve the problem, this experience makes them an important candidate to be hired. The universities covered under this aspect are the University of Pennsylvania, Northwestern University, Washington University, University of Michigan, University of Rochester.

4. Speakers Events/Workshops has been ranked as "4" as this is one the important aspect of education in a university because it helps the students to get insight from the people who have experience of the industry and also learn about the challenges they face in their daily work life with the new technologies and what could be done to improve on them. Since some of the guest lecturers are from other universities or country, this gives global exposure to the students as they get to know about the requirement or trends in other countries which helps to learn new techniques, trends and make themselves a global competitive edge. The Universities delivering course module with this aspect are the University of Pennsylvania, Northwestern University, University of South California, Washington University, Vanderbilt University, University of Michigan, Rice University, University of Rochester, Emory University.

5. Professional qualification is ranked as "3" as it is important for someone who wants to get into the accounting field to get a professional qualification, as the university is based in the US they helped the students to ace in CPA examinations, and from 2019 CPA exam have included a curriculum of data analytics which is why it gives the students a competitive edge over others and also help the universities to cover some parts of data analytics curriculum. The university providing MBA in accounting are majorly not providing support for the CPA exam, therefore the universities covering this aspect are Washington University, Vanderbilt University, University of Michigan, Rice University, University of Notre Dame, University of Rochester.

6. Career treks have been ranked as "2" because these help the students to explore the industry they would want to work into and get insights about the

current trend and requirement so that they can groom themselves in that particular aspect which is being demanded, also as the students travel to different cities and get a chance to meet a representative to different companies they get an unmatched opportunity to build connections. Career treks are offered by only the University of Pennsylvania, and no doubt why it is ranked number 1 by accounting.com, it helps the students in all-round development by providing them exposure in different ways. One of the reasons for ranking it as number 2 is that career treks are not directly related to data analytics, there could be a possibility that a college organizes career treks but it does not relate to the data analytics field however considering the ongoing trend career treks in accounting curriculum would relate to exploring opportunities in data analytics field which is why we have considered this factor in our evaluation.

7. The student exchange program is ranked "1", it is ranked at last because it does not give any significant contribution in learning data analytics module for students as this just aims to give them global exposure, however, there are little chances that the universities covered in the global program could be offering a data analytics module which could be beneficial for the students, however, if any students get an opportunity in a university where they have data analytics curriculum it could be tremendous opportunity to learn and widen the scope in a different geography, in a way it would equip that student with the global exposure of data analytics. The university that offers student exchange program is the University of Pennsylvania, the University of Notre Dame and Emory University.

From the above discussion, we were able to rank the university based on the weights assigned, we can see in figure 3 that the ranking of universities has changed when compared to the initial ranking provided in figure 1 by Accounting.com. In the ranking we can see that for some universities the weights are same, in that case, we have decided the rank based on factors covered by that university, if the particular university covers a higher number/factor with higher weights, it has been ranked highest against the another.

Rank	University	Data analytics	Internship	Project based learning/Case Study	Speaker events/Workshops	Professional Qualification	Career treks	Student exchange program	Total
1	Northwestern University	14	6	5	4	0	0	0	29
2	Rice University	14	6	0	4	3	0	0	27
3	University of Pennsylvania	7	6	5	4	0	2	1	25
4	University of Rochester	7	6	5	4	3	0	0	25
5	University of South California	14	5	0	4	0	0	0	23
6	Vanderbilt University	7	6	0	4	3	0	0	20
7	University of Michigan	7	0	5	4	3	0	0	19
8	Washington University	0	6	5	4	3	0	0	18
9	Emory University	7	6	0	4	0	0	1	18
10	University of Notre Dame	7	0	0	0	3	0	1	11

Figure 3

Based on our analysis we narrowed down our research to ranking the universities based on the support provided by them to the students in data analytics/artificial intelligence field and we tried to rank the universities based on the weights, this helps us in concluding our research question "are the accounting curricula enough", because based on the weights distributed we can observe which universities are doing best and which has to work harder in providing support in the subjects of data analytics and artificial intelligence. We could also relate our findings to the gap discussed in our literature review where we talked about the research done by Khadija, Barghathi (2019); Htaybat, Alberti-Alhtaybat and Alhatabat, (2018) as they spoke about the integration of data analytics and artificial intelligence that could be done in the accounting curriculum but lacked the aspect of discussing the efforts which are already made by the universities. Our analysis will start from University ranked the highest and will speak about the efforts made and what could be done better in those universities about data analytics/artificial intelligence.

Based on our analysis and weight calculation we could see that the Northwestern University, initially ranked second jumped up to first as it covers all the important factors including in-depth teaching of data analytics module. They need to work on providing support for professional qualification, career trek and student exchange program because if worked upon the university could be one of the best universities to study as it would result in the overall development of a student. Rice University is ranked second as it does not cover project-based learning which is an important aspect because it gives the student a practical exposure, in other words, they learn the implementation of their knowledge in real-life scenarios. They need to provide support towards career treks and student exchange program which could help in widening the exposure of students, the university jumped from the seventh position to second majorly because of the in-depth training provided in subjects like data analytics. The University of Pennsylvania is one of the most desirable universities in the world which

is why it is ranked first by Accounting.com, and during our analysis, it justifies its rank as it covers six out seven factors, the seventh factor being the professional qualification support, which is not an important aspect in our evaluation. It also falls behind in providing in-depth modules related to data analytics/artificial intelligence to accounting students which is why it is ranked the third place, with more focus on data analytics curricula the university can rise to our ranking. University of Rochester's contribution to training the students is similar to some extent to the University of Pennsylvania as it covers all the aspects except for career treks and student exchange program and most importantly, it has to put more effort for introducing in-depth modules for data analytics/artificial intelligence and this is one of the major reasons they stand at fourth place in our ranking. The University of South California ranked at fifth contributes exceptionally well in data analytics factor as they provide in-depth learning of the subject to their students, however, the university should provide some real-time project-based learning to students which will help them in learning the practical skills. By working towards providing support for a professional qualification, career treks and student exchange program could be additionally helpful as it would provide the overall development of the student. Vanderbilt university initially ranked as fifth is now in the sixth position as the university does not provide any project-based learning which is one of the important aspects of practical learning in data analytics. They do not provide any support for career treks and student exchange program, however, on the positive side they provide support for a data analytics program but on a limited scale and this is something they need to put more effort so that they can introduce more in-depth modules of the subject. The University of Michigan is the only public university in the list has done a great job in working towards the future of students by equipping them with concepts of data analytics, it was initially ranked at sixth and is now ranked at seventh, the reason behind the downfall in the rank is that the university does not provide any internship opportunity to its students, which is one of the major setbacks as internship provides the opportunity to learn about the job they want to land into (Šimičević, Snežana 2017), the challenges they could be facing and what they need to learn more. Washington University which was initially ranked fourth has fallen drastically to rank eighth, and this is because the university has not attempted to integrate data analytics module in their curriculum which is a major drawback when competing in today's world, in addition to this they do not provide support for career treks and student exchange program, however, they have done well in providing

support with the other factors but if those factors were supported with data analytics module it could have resulted in a better position for the university. The University of Notre Dame fell from the initial rank of eighth to tenth and Emory University rose from the tenth rank to ninth, when comparing these two universities the Emory University is better off in providing internship opportunities to students and also they have taken initiatives in organising workshops/events which helps the students to gather knowledge of the subject from external faculty. On the positive side, both the universities have taken efforts to introduce data analytics module in their curriculum for which they could be chosen by the students for higher studies.

Based on this ranking we tried to bridge the gap we found in a few of the studies mentioned in our literature review, the analysis helped us to know how efficient is the current accounting curricula of the top universities of the world, what are efforts that have been taken by these universities to stand in the era technological innovations and most importantly how are they imparting these courses to the students like using workshops, projects, internships etc. As mentioned in one of the researches conducted by (Lawson *et al.* 2014), where they spoke about the few recommendations to be included in the accounting curricula, they spoke briefly that accountants should be the use of software, spreadsheet models, and basic use of technology to enhance communication. Our research aimed at bridging the gap because the recommendation lacked specifics it was just a general overview, we narrowed it down to specific technological needs for the accountant, we studied the existing curriculum of the top universities and evaluated if they are enough for the students or do they need to work more on it. On the critical side, our analysis could not cover the qualitative aspect of the courses, in other words, we could not analyse the outcome of the teachings which could have been an important factor as this would help the end-user like hiring firms to know the quality of teaching, and this aspect could have been possible if one to one interview was conducted with students of each university.

The weights assigned in our evaluation technique are subject to change depending on the improvement in universities, for instance, if the university of Pennsylvania and Rochester introduce more deep learning modules in data analytics and artificial intelligence then they will be pushed to rank 1 and 2 if the Washington University introduces data analytics course in their existing curriculum they could advance to rank 5, the chosen factors are variable so if the universities improve on certain

factors in future they can climb up in the rank, based on the above discussion we can see the new ranks of the universities in figure 4. This presents a kind of robustness check on our weighting system where our weight will keep on changing based on circumstances explained above.

Rank	University	Data analytics	Internship	Project based learning/Case Study	Speaker events/Workshops	Professional Qualification	Career treks	Student exchange program	Total
1	University of Pennsylvania	14	6	5	4	0	2	1	32
2	University of Rochester	14	6	5	4	3	0	0	32
3	Northwestern University	14	6	5	4	0	0	0	29
4	Rice University	14	6	0	4	3	0	0	27
5	Washington University	7	6	5	4	3	0	0	25
6	University of South California	14	5	0	4	0	0	0	23
7	Vanderbilt University	7	6	0	4	3	0	0	20
8	University of Michigan	7	0	5	4	3	0	0	19
9	Emory University	7	6	0	4	0	0	1	18
10	University of Notre Dame	7	0	0	0	3	0	1	11

Figure 4

Conclusion And Recommendation

Post the review of the existing literature about the technological innovations in the field of accounting, and after examining the curricula of the top universities we came to few conclusions about the future of accounting curricula and technological innovations. We could believe that being solely dependent on technology is not a far reality as almost all the firms are becoming dependent on technology that would help the accountants in doing the preliminary accounting tasks. This shows how the accounting profession has shifted and undergone a major change in its processes which has ignited a spark among the accountants to learn data analysis instead of just giving time on the processing of data. The future accountant must realise the importance of technological innovations in their field and should work on polishing their skills according to the requirements. Therefore, the advent of technology is not going to hamper the job of accountants/auditors however they are going to adapt to the innovations.

The top ten universities selected for the examination have been putting great efforts in integrating the data analytics and artificial intelligence subjects in their curricula, some of the universities like Northwestern University, Rice University and the University of South California have already gone a step ahead and introduced in-depth courses for data analytics with accounting curriculum, on the other hand, all the other universities except Washington University have introduced few basic courses in data analytics but they still need to work more to integrate more in-depth modules which would help the students to get full-fledged training in these subjects. We also observed that only a few universities are offering support for the professional exam like CPA, this could be a major factor for improvement as the CPA exams now have data analytics section covered in them, providing support for the exam could give the universities an edge over the other universities. In our evaluation, we saw only one public university," the University of Michigan" this could be a motivating factor for other government universities to take initiative and improve the education standard of their courses this would be a major boost in the education sector as the government colleges are more affordable Karikari, Dezhbakhsh (2013) thus it covers

a major section of the society and if they improve their education standard it could benefit a large section of students in a country.

Our study could not cover the qualitative aspect of the evaluation with the help of which we could have decided the outcome of the programs and due to this, there might be a possibility that the universities which are offering in-depth module in data analytics are not effectively teaching them and the universities which are covering only one or two modules produce extremely skilled accountants in data technology and artificial intelligence, this could also be one of the turning factors in our weighting system and could result in shuffling of the ranks. The research solely depends on the module descriptors and in some cases, the universities did not provide details of their courses instead, they just provided the brief subjects headings and because of this, we could not conclude that if the course being delivered was in-depth or is just a basic level course.

There is further scope for research in this topic, which could not be completed due to time limitations, like in-person interviews and questionnaire could be done as a part of methodology which would give an idea about the outcome of the courses being taught and questions in these interviews could be about the subjects taught, or related to any technical topic which could help to evaluate the extent to which course is delivered and would also help in ranking the quality of education in the university. Additionally, the research could also be performed on taking the qualification of professors in consideration, because the universities need to hire new professors or provide in-depth training to existing professors so that they could impart those to the students, so the research could focus on the level of training provided to professors and this could be evaluated with other universities, which would be helpful to students in deciding the quality of education they would be getting in any university.

Towards, the end we would like to say that data analytics, artificial intelligence and machine learning has and will completely reform the functioning of accountants. We could already see the effects in the hiring patterns of the company and the changes in the eligibility requirements and will continue to see in foreseeable future. Students need to buckle up for this shift before they enter the job market and the universities we have evaluated are doing a great job in preparing the students for this shift.

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