5-2019

How Artificial Intelligence and Machine Learning Will Change the Future of Financial Auditing: An Analysis of The University of Tennessee's Accounting Graduate Curriculum

Kaylee M. Giles
University of Tennessee, Knoxville, kgiles6@vols.utk.edu

Follow this and additional works at: https://trace.tennessee.edu/utk_chanhonoproj

Part of the Accounting Commons

How Artificial Intelligence and Machine Learning Will Change the Future of Financial Auditing and Analysis of the University of Tennessee Accounting Graduate Curriculum

A Thesis Presented to the
Chancellors Honors Program
The University of Tennessee, Knoxville

Kaylee M. Giles
May 2019

ACKNOWLEDGEMENTS

Thank you to my advisor, Ashley King, for all of your guidance and support during the research and completion of this thesis.

Thank you to the Chancellor Honors Program for the opportunities that you have given me over the last four years.

Lastly, thank you to my parents for their unwavering love and support. I would have never made it this far without you!

ABSTRACT

In today's world, the use of technology is no longer an option, but rather a requirement. Professionals from every field must adhere to this shift towards technology, and auditing is no exception. As financial auditing begins to rely more on automation, artificial intelligence, and machine learning, the next generation of auditors must be prepared to interact with the technology efficiently and effectively. This thesis strives to be a resource for college students that will soon enter the auditing profession, as well as perform analyses on the University of Tennessee Knoxville Master of Accountancy program as compared to highly-ranked programs at other public universities in regard to the integration of artificial intelligence and machine learning into their accounting master's curriculum as well as the statistical outcomes for the graduates of these programs.

TABLE OF CONTENTS

LIST OF TABLES

INTRODUCTION

When accounting firms come to campus to speak with students, artificial intelligence and machine learning are almost always mentioned. Professionals from these firms tell students that these technologies will change the future of accounting. When prompted with the simple question of "how?", though, they fail to come up with a cohesive or specific answer. While many of these firms' websites provide more technical details on these technologies, students may still feel lost as to how they should be preparing for this shift in their chosen career. This thesis works to answer the question of how artificial intelligence and machine learning will change the future of accounting, specifically in the area of financial statement auditing, and strives to be used as a resource for students when they begin to research what how they should prepare to enter the auditing profession. Additionally, this thesis will examine how the University of Tennessee Knoxville is helping to prepare students for this shift in financial auditing. This will be accomplished by comparing the University of Tennessee Knoxville Master of Accountancy program to the top 5 public university accounting master's programs, as ranked by US News & World Report, focusing on how these programs are introducing artificial intelligence, machine learning, and other technologies into their programs, as well as how these programs help their students achieve professional success after they leave the program.

LITERATURE REVIEW

Artificial intelligence ("AI"), first appeared in 1955 in a program called Logic Theorist, created by Herbert Simon, Allen Newell, and John Shaw, which was designed to "mimic the problem-solving skills of a human" (Logic Theorist). This, now considered basic, AI program helped flourish many other AI developments throughout the next 20 years as computers were able to store more information and computer scientists better understood how to select the correct machine learning algorithm to apply to their problem (Rockwell). This provided a great opportunity for accountants, who had to search through large amounts of data every day as a part of their jobs. Around the same time as Logic Theorist was being introduced, General Electric purchased the UNIVersal Automatic Computer to run payroll in its factories, marking the first time a computer was purchased solely for accounting (Medius). Just a decade later, in the 1960s, the U.S. transportation industry developed EDI to help streamline Accounts Payable processes (Medius). Today, artificial intelligence has helped make corporate accounting departments leaner and more efficient. One major area of focus is in Accounts Payable, where supervised learning models are able to detect payments that may be delayed or can even track 'problem' customers with multiple late payments (Hu).

Artificial intelligence was first used in auditing for many of the same reasons. Auditors have always had many transactions to sift through and spent the majority of their time organizing the data rather than analyzing it. Over the past 20 years,

an auditor's job has completely changed. With the introduction of AI, data can be organized and analyzed many times faster than human speed (MTI College). Many accounting firms have begun heavily investing in technology and software. Some of the bigger firms have entered into partnerships with AI companies as a way to quickly introduce technology into their practices. In March 2016, Deloitte announced a partnership with Kira Systems to help "free workers from the tedium of reviewing contracts and other documents" (Kira Systems). Kira's advances in machine learning allowed Deloitte professionals to use the technology to simplify complex documents, allowing for quicker analysis. While originally designed for contracts, Deloitte auditors now use Kira to find "foregone revenues or reduce third party cost and risk" (Kira Systems), and Kira recently released additional platforms for Deloitte's tax and advisory practices. Other Big 4 accounting firms have released similar software. Bloomberg BNA reported in July 2018 that PricewaterhouseCoopers is now incorporating AI technologies like natural language processing into their audit practice to review documents and "quickly pull information from paperwork for an audit" (Rozen). Even smaller firms are introducing technologies like the MindBridge Ai Auditor, a platform that examines and sorts financial records into risk categories, eliminating the need for a CPA to pull random samples of financial records and manually inspect them (Rozen).

There are three major areas of financial auditing that have been impacted by AI - fraud detection, sample sizes, and document review:

I. Fraud Detection

Ever since the big accounting scandals of the early 2000s and the passage of the Sarbanes Oxley Act in 2003, the entire financial auditing profession has been focused on reasonably assuring that companies' financial statements are materially correct and free from fraud. Many steps have been taken to set standards and enact laws that strive to eliminate the ability to commit fraud, and technology has enabled auditors to better detect fraud. In the realm of machine learning, professionals have been developing algorithms and regressions for years in order to come up with a method of determining fraud. In 2000, Timothy Bell from the University of North Florida and Joseph Carcello from the University of Tennessee Knoxville actually developed and tested a regression to estimate the likelihood of fraud for an audit client, based on several fraud-risk factors. Similar research is continuing to be done almost two decades later. In 2011, Johan Perols from the University of San Diego compared six of the most popular statistical and machine learning models being used to detect fraud and determined an overlap in six of the 42 predictors that were consistently chosen by the programs. These predictors included auditor turnover, total discretionary accruals, unexpected jumps in employee productivity, and others that some auditors may have not noticed. Even if they did notice these irregularities in certain factors within the firm, being able to put these facts into a machine learning software and compare the firm's behavior to other companies helps

determine the possible presence of fraud faster and more efficiently than if the auditor were to cross-reference all of these facts themselves. In March 2017, Perols furthered his research by explaining the challenge of detecting fraud, mainly due to its rarity, overabundance of identifiable variables seen in research like Perols' in 2011, and the overall broad definition of what constitutes fraud. While fraud will never be easy to detect, advances in research are continuing to emerge, with new machine-learning algorithms being able to uncover fraud through detecting accrual manipulation (Rahul, Kumar, et al.) and using hybrid models that combine financial and non-financial data to calculate and analyze the factors that may cause fraudulent behavior (Kamesh, V, et al.).

II. Sample Sizes

When choosing a sample size for testing, there are many risks that are introduced. Traditionally, auditors have been able to reduce sampling risk, but not eliminate it entirely. Auditors could always increase the sample size for riskier parts of the audit or ensure that every item being tested had an equal chance of being sampled, but there was still a risk that the sample would not be representative of the population or would fail to catch an error that may be material. Today, auditors use Computer Assisted Auditing Tools and Techniques ("CAATTS") to perform analysis without having to pull sample sizes. Tools like IDEA already have these capabilities, but all data processing and organization had to still be done by the auditor. Now,

5

the International Federation of Accountants ("IFAC") reports, auditors can "push an entity's entire ledger through automated analysis," eliminating sampling risk. With these new advances, though, comes new risk. The ability of a program to correctly analyze an entire population is dependent on the person creating the program, and, in the case of machine learning, training the program to catch exceptions and perform similar tasks. In other words, these technologies are not immune to human error. IFAC gives this example of flagging exceptions - many programs with machine learning skills can pull exceptions from the population for the auditor to review and determine whether the exception should be confirmed or dismissed. If the auditor were to incorrectly dismiss the exception, the program would never flag those items with that characteristic, and the exception would be lost. (IFAC) Many firms recognize this risk and have review systems in place to mitigate any exceptions that have been wrongly dismissed. The level of risk from errors in human judgment can over time be mitigated and eliminated, while sampling risk can never be eradicated due to the inherent nature of sampling risk. The shift from sampling to machine learning technology has improved the quality of substantive testing in financial audits, allowing the auditor to spend less time sampling data that may or may not be representative of the population and more analyzing results and ensuring the company's financial statements are materially free of error.

III. Document Review

One of the most mundane, lengthy, and therefore expensive parts of an audit is the time it takes to review and extract key terms from contracts. With artificial intelligence, this process has become automated, with systems being taught how to review the same documents and then identify and extract key terms. Deloitte experienced this challenge across all of their other service lines, describing the process as "tedious and time-consuming" (Deloitte US). To solve this problem and speed up the document review process, they developed an automated document review platform that natural language processing (NLP) to read electronic documents and machine learning to identify relevant information and flag key terms within the documents. Over time, as it is exposed to wider range of documents, it has been able to improve its accuracy. These technologies also eliminate sampling, the program being able to review an entire population of documents in a matter of minutes. The Journal of Accountancy further discusses this technology, called Argus, and how it is able to use machine learning to "identify and visualize items of interest to an auditor, and then extract its findings into a working paper" (Raphael). The Journal goes on to say how this enables auditors to find "needles in a haystack" of seemingly consistent contracts by allowing them to inspect entire populations and see the differences among documents. Similar technologies are used across many firms, with the focus being to eliminate mundane tasks like document

review and focus on analyzing the information and getting to the root of why there may be inconsistencies across documentation.

The biggest question now is how the next generation of auditors can begin to prepare to use and understand these technologies. While all firms will provide some version of on-the-job training, MTI College advises that students should already begin to become familiar with technology in order to enter the workforce as more valuable employees. MTI recommends learning accounting software such as Intuit, OneUp, Sage, or Xero, alongside traditional skills and knowledge of Microsoft products like Excel and Visio. As company's systems become more automated, it will also be important for auditors to understand the language that builds these programs and how information can be extracted from it. Understanding coding languages like SQL, Visual Basic, and Python will enable auditors to inspect how evidence for the audit was obtained and review code to ensure the population is error-free and complete. It is also becoming a requirement for auditors to obtain and master data analyzation skills earlier in their career. The required skills for a lower-level accounting professional are shifting from being able to perform data reconciliation and document review to being able to understand the output from a program that does these tasks for them. As mentioned earlier, being able to understand software that the firm and its audit clients are using as well as correctly analyzing the output from said software to come to specific conclusions will become required skills for auditors as they are entering the profession. In January 2017, Professor Sarah Stein from Virginia Tech released

an article describing 'tomorrow's auditor.' While basic accounting knowledge will always be required, with or without technology, technology skills will also become a requirement of auditors in the future. "Mining structured and unstructured data from a wide range of sources, "identifying potential data risks and problems," and "applying and interpreting statistical methods and advanced analytics to turn raw data into useful insights" are just a few of the technology skills Professor Stein lists as essential for the future auditor. Future auditors must also know how to take all of the information they have collected and analyzed and use visualization technologies to form a narrative of the data for workpapers or partners working on the audit. Basically, auditors must obtain the knowledge already required for professionals in the accounting field while also obtaining skills in dealing with big data, new technologies, and business analytics to be an effective auditor in our ever-changing, technology-based world.

Machine learning and AI will not only affect the job description, but the job prospects of auditors as well. Mundane tasks that are typically performed by lower-level staff and seniors in public accounting firms will now be done through AI. While a reduction in the number of lower-level jobs may occur, data from the Bureau of Labor Statistics shows that the job outlook for auditors is growing faster than average at a rate of 10% through 2026. The main reason for this job growth is due to the differences in knowledge between auditors currently in the profession and students that are beginning to enter the workforce. Accounting firms are looking for students familiar with data analytics and new technology that can take

information and analyze it efficiently and effectively. Firms need employees who understand technologies like machine learning and artificial intelligence as well as concepts like blockchain and big data. As mundane skills become less prevalent, the human aspect of auditing, like critical thinking, analyzing, and communication skills, will become essential to running an audit smoothly. Being able to communicate findings to audit committees, executives, and even audit partners in a way that is understandable will become very important as new auditors use technology that more experienced professionals have never encountered. While technologies like artificial intelligence and machine learning may soon replace the tasks of today's auditors, a new generation of auditors will still be needed to take the results of these technologies and use them to perform more efficient and higher-quality audits.

ANALYSIS OF THE UNIVERSITY OF TENNESSEE'S ACCOUNTING GRADUATE CURRICULUM

Methods

Each year, the U.S. News and World Report publishes their official ranking of the best graduate accounting programs in the nation. This list includes accounting master's programs as well as Master of Business Administration (MBA) programs with concentrations in accounting. In determining which schools were to be chosen for this analysis, there were several criteria established in order to accurately compare each program to The University of Tennessee Knoxville Master of Accountancy program. First, only public universities were chosen due to differences in funding, student options for attending these schools, and basic comparisons among programs. Next, only accounting master's programs were chosen, since the differences in curriculum between MBA and accounting master's programs and the goals of students attending the two programs were too different for accurate comparison. Lastly, the program must offer either an audit concentration or the opportunity to take audit or assurance classes. In other words, programs without exposure to audit will not be included.

Due to these three criteria, the 2019 U.S. News and World Report ranking has been slightly filtered, eliminating the following schools for not meeting at least one of the three criteria:

I. University of Pennsylvania (originally ranked #3)

University of Pennsylvania is a private university (U.S. News and World Report). Due to its classification as a private university, this program cannot be accurately compared to the University of Tennessee's program. Also, Wharton Accounting does not offer an accounting master's program, but rather an MBA program with an accounting major (*MBA Program*). While this path does offer adequate requirements to sit for the Certified Public Accountant (CPA) exam, the program differs too greatly for adequate comparison.

II. Brigham Young University Marriott (originally ranked #4):

Brigham Young University is a private, non-profit research university owned by the Church of Christ of Ladder-day Saints (*Mission & Aims of BYU).* Due to its classification as a private university, this program cannot be accurately compared to the University of Tennessee's program.

III. The University of Chicago (originally ranked #6):

The University of Chicago is a private research university in Illinois (U.S. News and World Report). Due to its classification as a private university, this program cannot be accurately compared to the University of Tennessee's program.

IV. The University of Southern California (originally ranked #7):

The University of Southern California is a private research university (*About Us*). Due to its classification as a private university, this program cannot be accurately compared to the University of Tennessee's program.

V. Stanford University (originally ranked #8):

Stanford University is a private research university in California (U.S. News and World Report). Due to its classification as a private university, this program cannot be accurately compared to the University of Tennessee's program.

VI. New York University (originally ranked #9):

New York University is a private research university in New York (*About NYU).* Due to its classification as a private university, this program cannot be accurately compared to the University of Tennessee's program.

After eliminating universities based on the previous three criteria, the top five remaining programs were selected for comparison:

I. The University of Texas at Austin Master in Professional Accounting:

The Texas McCombs School of Business MPA program has three tracks for obtaining a Master in Professional Accounting (*Texas McCombs MPA*). For comparison purposes, the one-year traditional MPA has been chosen.

II. The University of Illinois ("Illinois") Master of Accounting Science:

The Illinois Gies School of Business has three main accounting master's programs (*Graduate Programs*). For the most accurate comparison, the Master of Accounting Science (MAS) was chosen due to its classification as a program for students who already hold a bachelor's degree in accounting (*Master of Accounting Science (MAS)*).

III. The University of Michigan ("Michigan") Master of Accounting

The Michigan Ross School of Business Master of Accounting Program integrates an eight-month MAcc program with the MBA program (*Master of Accounting Curriculum*). While MBA programs were not included based on the established criteria, the distinct difference was that the Michigan MAcc program is an accounting master's program, whereas other programs were business master's programs with an accounting major.

IV. The Ohio State University ("Ohio State") Master of Accounting

The Ohio State University Fisher College of Business Master of Accounting Program offers a somewhat-different approach to the Master of Accounting program, having 78% of their curriculum based in elective business coursework (The Fisher MAcc Difference). While this may be similar to a MBA program curriculum, the Master of Accounting program is independent and not just a major of the MBA program.

V. The University of North Carolina ("UNC") Chapel Hill Master of Accounting

The University of North Carolina Kenan-Flagler Business School offers only an online degree to students who have an undergraduate degree in Accounting (*Program Formats*). While this is different from other programs on the list, it does still offer similar credits and is therefore included in this comparison.

The selected programs were compared to the University of Tennessee Knoxville Master of Accountancy (MAcc) by obtaining information from the program's website regarding overall curriculum and courses involving artificial intelligence, machine learning, or similar technologies as well as statistics released by each school for job placement rates and CPA exam pass rates. Lastly, an overall analysis was completed on how the University of Tennessee Knoxville could alter their graduate accounting curriculum to better compete with these schools.

For the analysis of the six programs, information was mainly collected from the program's official website. This method was chosen because that is where students as well as accounting firms would first look for information regarding these programs. These websites also serve as the best resource to find the most updated information, while a third-party website's information may be outdated. While this may bring bias to the analysis, the logical reasoning outweighs the minimal risk of bias. For each program's curriculum, the most updated catalog year on the website was used.

Analysis

Program Curriculum

The University of Tennessee Knoxville's Masters of Accountancy program is a 10-month program offered through the Haslam College of Business. Students take a total of 30 credit hours, with 12 hours in the fall and spring, and 6 hours during the first summer session, which takes place in the month of June (*MAcc Academics*). Students in the program must choose one of three concentrations upon entering the program. For this analysis, the Audit and Controls concentration was chosen since this concentration would be the track chosen for a student wanting to become a financial statement auditor. According to the 2018-2019 graduate catalog, students in the Audit and Controls concentration take two information management courses that focus on technology. The first class, titled 'Systems Audit Security and Controls,' is described as a course that "discusses information systems security, auditing/assurance, planning, and control issues," further explaining that the course "examines security and control issues primarily at the operating system level" (2018-2019 Graduate Catalog). The second course, titled 'Corporate Applications,' is described as a course that focuses on "large systems in corporate environments," covering topics including "audit of enterprise resource management systems and database systems" (2018-2019 Graduate Catalog). The program also offers a unique experience for students called the Neel Corporate Governance Speaker Series. This speaker series "brings national experts to campus for lectures and networking. Past speakers include leaders of public accounting firms, audit committee members, Chief Financial Officers,

PCAOB board members, SEC commissioners and institutional investors" (*Master of Accountancy*).

When compared to the length of The University of Tennessee Knoxville's Masters of Accountancy program, the majority of the other institutions' programs are shorter in length, with most schools having programs that last two semesters. Two exceptions were found at Ohio State and UNC Chapel Hill. Students in the Ohio State program have the option of completing a winter internship and extending their Master's program into the summer semester (*Program Structure*). At UNC Chapel Hill, the Masters of Accounting program for students with undergraduate degrees in accounting is strictly online, so the program length can vary depending on the student's preferred timeline. The website lists the program length as anywhere from 12 to 36 months (*Program Formats*).

Each institution's program differs slightly from the Audit and Controls concentration offered at Tennessee. The University of Texas at Austin has four tracks in their traditional Master in Professional Accounting program (*Degree Requirement Summary*), with the Financial Reporting and Assurance track being most similar to Tennessee's Audit and Controls concentration. The University of Illinois only has two options in their Master of Accounting Science program – Tax and Audit (2019-2020 Academic Catalog). The University of Michigan offers a slightly different curriculum, mainly because of its integration with the MBA program (*Master of Accounting Curriculum*). The program's website explains that the Master of Accounting program offers five to seven core accounting courses,

17

with the total number per student dependent on whether they completed similar courses when completing their undergraduate degree. Each student then selects a core elective from an offered list of additional accounting courses. Finally, each student can take additional graduate electives outside the realm of accounting. Ohio State Master of Accounting program also does not have specific concentrations. Instead, students take core courses in accounting during their fall semester (*Program Structure*) , then take additional elective courses in the spring, with most electives being within the realm of accounting while a few others cover topics like logistics and operations management (*Curriculum*). Finally, The University of North Carolina at Chapel Hill's Master of Accounting program allows students to choose from three concentrations, with the Audit concentration being chosen for this analysis.

The main difference in the University of Tennessee Knoxville program when compared to others is the lack of flexibility. While Tennessee has a set course curriculum for all of its students, all of the other programs allow students to take at least one elective of their choice during their time in the program. The Ohio State and UNC Chapel Hill programs both allow students flexibility in terms of how long it may take them to finish the program, as seen in Ohio State's option for a winter internship and UNC Chapel Hill's all-online format. This added flexibility offered in the other programs also allows students to take more technology-based courses than at The University of Tennessee Knoxville.

In the other five program's curriculums, there is a definitive difference in the amount of technology-based courses offered to students. The following is a short description of technology-based courses offered by each of the top-five programs offered to auditing students as a part of their curriculum:

I. The University of Texas at Austin ("UT Austin")

UT Austin's traditional MPA program does not directly require any technology-based courses in its Financial Reporting and Assurance track curriculum (*Degree Requirement Summary*). As part of their electives, students have the option of taking Management Information Systems courses, one of which is titled 'Predictive Analytics and Data Mining.' (*MBA Electives*). After researching courses in the Accounting electives field that may have technology-based course material, no definitive evidence was available to confirm the existence of such material.

II. The University of Illinois

The University of Illinois Master of Accounting Science program "emphasizes the emerging trend of data analytics in the practice of accounting, with a standard course plan that leads to a graduate concentration in data analytics in accountancy to fulfill the graduate electives" (*MAS Curriculum*). Students also have the option of developing an alternative course plan by picking an alternative concentration in place of business analytics. One of these concentrations is in Information

Technology and Control, which provides courses in database system management, big data, and other courses that financial auditors may find useful (2019-2020 Academic Catalog). In the traditional data analytics concentration, students take courses that the university explains will help students understand how to "apply data analytics in a variety of accounting and business contexts, critically solve business problems using data-intensive business and accounting information, and synthesize and effectively communicate data-intensive information, findings, and conclusions" (2019-2020 Academic Catalog).

III. The University of Michigan

While the University of Michigan's Master of Accounting program does not have any core curriculum or core elective courses that are technology-based, the program does offer several electives to students that introduce them to accounting technology. Like Illinois, Michigan has also heavily integrated data analytics into the master's program, offering a wide variety of courses in big data management, data mining, visual basic, spreadsheet modeling, and many other technological topics (*Master of Accounting Curriculum*).

IV. Ohio State University

The Ohio State University Master of Accounting program expose students to analytical learning in their core course 'Fundamentals of Accounting and Data Analytics' (*Curriculum*). Since this program is 80% elective courses,

students have many opportunities to learn more about the problems facing the next generation of accountants, with the university even stating that, in partnership with KPMG, they have recently altered the curriculum to "expose our students to large data problems, and provide them with the necessary tools that will allow them to solve these problems" (*Master of Accounting Curriculum*) The program offers courses in 'Data Mining for Business Intelligence,' and even two courses in Fraud Examination (*Master of Accounting Curriculum*).

V. The University of North Carolina at Chapel Hill

At UNC Chapel Hill, there is a core course all students must take in data analytics. This class is described as a "an introduction to the systems, tools and practices used to derive the most insight from data" (*Core Curriculum*). The program even states how accountants are essential in helping companies "access, analyze and make decisions from the growing mass of data they collect" (*Core Curriculum*). Auditing concentrations take a course titled 'Information Management and Analytics Technology for Accountants' (*Concentrations*) which furthers their understanding of how to account for and assess large amounts of data.

Overall, there are two major advantages to other programs when compared to the University of Tennessee Knoxville's program. The first is the major integration of business analytics into these programs. Programs like Illinois,

Michigan, and Ohio State have all taken measures to introduce their master's students to data analytics before entering the workforce. These students are working with tools like data mining and handling big data while there is no evidence of Tennessee students being exposed to those technologies. Two of the programs have entered into partnerships with either other established graduate programs or accounting firms to prepare their students for the changing accounting and business world. By partnering with their university's MBA program, Michigan was able to bring a more diversified education to their Master of Accounting program and enable their students to interact with more technology, even outside the field of accounting. As previously mentioned, Ohio State entered into a partnership with KPMG in order to offer students a unique experience with emerging analytics technology. Ohio State students in the KPMG Master of Accounting with Data and Analytics program also have the possibility of being sponsored by KPMG, which means a full-time position with the firm after graduation and all expenses paid by the firm while participating in the program (*KPMG Partnership*). Partnerships help these programs advance to offer more technology and training to their students, meaning that their students will be more prepared for the auditing future filled with artificial intelligence and big data.

Learning does not fully take place in the classroom, as seen by the University of Tennessee Knoxville's Neel Corporate Governance Speaker Series. Each of the other five programs also offer some unique experience for their students. Both Ohio State and Illinois have received STEM-designations, which

Illinois described as a representation of its students' "commitment to data analytics and an understanding of how emerging technology will impact the future" (*Master of Accounting Science (MAS)*).This enables accounting graduate students to be looked at by firms as a professional that will understand how technology works and how to analyze data to come up with solutions, making them more valuable than students from other schools without this designation. Michigan master's students work with Michigan's Sanger Leadership Center, participating in two seminars that "foster understanding of leadership, ethics, teamwork and how to make a positive difference" (*Master of Accounting Curriculum*). Students are also required to attend the EY Accounting and Public Policy Symposium in Washington, DC as a part of a required core course that "delivers an understanding of the public policy process of business and accounting through visits from top-level speakers and trips to relevant sites around the nation's capital" (*Master of Accounting Curriculum*). The University of Texas at Austin offers two five-week summer programs in Buenos Aires and Prague, both of which give students six credit hours towards their MPA degree (*Unique Opportunities*). UT Austin also offers a Distinguished Speaker Series Lyceum Class, which occurs throughout the fall and is a required course in the MPA program (*MPA Core Courses*). While all of these experiences cannot be directly compared, they do provide some insight as to how these programs invest in their students.

Outcome Statistics

Curriculum always plays a major factor when deciding which program to attend, but outcomes are also very important. Programs can state that they have high job placement rates or that their curriculum prepares students for the CPA exam, but without data backing them up, the curriculum is not taken as seriously. When examining which programs are considered the 'best,' students and accounting firms look at a wide range of statistics on how the program's students perform once they are out of the program. Two of these statistics, job placement rates and CPA exam pass rates, will be analyzed for the five schools and compared to the University of Tennessee's rates.

Job Placement Rates

Table 1. Job Placement Rates*

Institution	Job Placement Rate
University of Tennessee	100%
University of Texas at Austin	93% (domestic)
University of Illinois	98%
University of Michigan	100%
Ohio State University	97% (domestic)
University of North Carolina at Chapel Hill	98%

*Refer to Works Cited for sources of job placement rates.

There are two shortcomings of the above information. First, The University of Texas at Austin and Ohio State did not release information regarding overall job placement rates of their graduates. Instead, they offered two percentages – one measuring U.S. domestic students and another measuring international students. Also, there is some inconsistency in reporting among institutions, so some figures

are based on a different time period than others. The University of Texas at Austin reports figures before the students have graduated. Ohio State University and the UNC Chapel Hill both reported figures for three months after graduation. Lastly, the University of Michigan, the University of Illinois and the University of Tennessee reported figures six months after graduation. Due to this inconsistency in reporting, these numbers cannot be directly compared, and additional research and statistics must be publicly released in order to accurately compare these rates. That being said, of the top programs, the University of Michigan released the same depiction of job placement rates as the University of Tennessee, and the two numbers matched. This says a lot about the performance of the University of Tennessee program, especially when comparing rank and size of the two programs. 100% job placement is not an easy statistic to live up to, but the University of Tennessee has been at or near that number consistently (*Placement Stats*).

CPA Exam Pass Rates

Table 2. CPA Exam Pass Rates

Institution	First-Time CPA Exam Pass Rate
University of Tennessee	80.3%
University of Texas at Austin	78%
University of Illinois	80%
University of Michigan	82%
Ohio State University	77.5%
University of North Carolina at Chapel Hill	75.3%

*Refer to Works Cited for sources of CPA exam pass rates.

Many of the CPA exam pass rates were from AccountingEdu's ranking of the best school in each state based on first-time exam pass rates. These rates were taken from NASBA's *Report on the CPA Exam, University Edition*. The only two rates not found on this ranking were the University of Texas at Austin and the University of Illinois, both of which reported exam pass rates on their respective websites. Of this ranking, the only school with a higher first-time CPA exam pass rate is the University of Michigan. The University of Tennessee is much higher than some of the other universities, and only slightly higher than the University of Illinois. These rates mean that the University of Tennessee is doing an excellent job in preparing their students to sit for the CPA exam.

RESULTS AND DISCUSSION

After analyzing the top public accounting graduate programs and comparing them to the University of Tennessee Knoxville's Master of Accountancy program, the question to be answered is how these programs are ranked higher than Tennessee's program, and what the University of Tennessee could be doing to improve the program's ranking and better compete with the highest-rated programs? First, there is only so much data that can be taken into account when ranking programs. Rankings are based on hard data, like GMAT scores, undergraduate GPAs, and more. In reality, programs are assessed more holistically by students and firms alike. There are some things that the University of Tennessee could be improving, but there are many things that the program is already excelling at, like job placement and CPA pass rates, which are both equivalent and, in most cases, better than the top programs' rates. These two statistics are very important to students and employers, and should not be forgotten when thinking about how to rank a program. This does not mean that other factors should not be equally considered. For one, most of the top programs have a very flexible curriculum that each student can adapt to fit what they want to achieve from being in the program. The University of Tennessee does not do this, but instead requires students to pick a concentration before beginning the program, with each concentration having a set curriculum that the students are unable to change. While this choice may be intentional in order to set Tennessee apart from other schools, the program may be too structured for many students

when deciding on a program, and may not be broad-based enough for possible employers who want well-rounded students who have had graduate courses in areas other than accounting. Tennessee also lacks the integration of business analytics courses and technology seen in top programs. The STEM accreditation acquired by Illinois and Ohio State could be something that the University of Tennessee works toward in the future, because it shows potential employers that the students in their program are able to use business analytics to make important business decisions. Lastly, the lack of technology-based classes in the Audit & Controls concentration compared to other schools is something that may be keeping Tennessee from gaining rank against some of the top programs. While the Information Management concentration in Tennessee's Master of Accountancy program does offer more technology-based courses, the Audit & Control concentration is lacking some classes directly dealing with the technologies that students will immediately face when entering the workforce. This could be mitigated by introducing concepts like artificial intelligence and machine learning into some courses and show students how they can effectively and efficiently deal with these technologies in the workplace. The University of Tennessee is already highly competitive with the nation's top public accounting master's programs, as seen in the statistical outcomes of their students, but by creating a more flexible, technology-focused auditing curriculum, the University of Tennessee could be on its way to being ranked as one of the top programs in the nation.

CONCLUSIONS AND RECOMMENDATIONS

After first reviewing the existing literature regarding the future of financial auditing, then analyzing the University of Tennessee Knoxville's Master of Accountancy program, and finally comparing Tennessee's program to the top public accounting masters programs, several conclusions have been confirmed. First, becoming reliant on technology is not a distant future, but rather a close reality. Almost all firms are becoming reliant on technology in one form or another, and are slowly starting to let technology do the tasks that entry-level accountants used to be doing. This means that the accounting profession has shifted, causing young accountants to quickly learn how to analyze data instead of organizing and processing it. Future auditors must accept this reality and adjust their skills in order to become successful. They should learn new technologies, understand how popular accounting and auditing systems work, and be able to use these systems to quickly and accurately analyze and translate data. Auditors must also work on their communication and people skills, mainly due to the widening gap between executive-level accountants who have never interacted with this technology and the lower-level auditors working with the technology on a daily basis. The lower-level auditors must be able to transfer their knowledge to understandable terms as they explain their audit findings to their superiors. Auditors will not be going away, but rather adapting to the environment that they are in, like they have done for the last twenty years.

The University of Tennessee Knoxville is doing an overall great job at preparing their students for this shift in auditing. They introduce technology during the undergraduate program through the Information Management collateral, with classes in database management and coding logic (2019-2020 Undergraduate Catalog). While this education continues into the accounting master's program for students concentrating in Information Management, the Audit and Controls concentration lacks the knowledge necessary for the next generation of auditors to become familiar with technology that they will be working with as soon as they enter the job market. In order to better compete with the nation's top public accounting graduate programs, the University of Tennessee needs to introduce more technology and hands-on learning into the Audit and Controls concentration to deal with topics like business analytics, big data, data mining, artificial intelligence, and more. The program is already exceling at job placement and preparing their students to sit for the CPA exam. If they slightly adjust their curriculum to directly compete with higher-ranked programs, they could see a rapid increase in national ranking.

In conclusion, artificial intelligence and machine learning will completely alter the way that auditors function in their profession. It already has shifted the way audits function today and will continue to do so for the foreseeable future. Students must prepare for this shift before entering the auditing profession, and the University of Tennessee is already doing a great job at preparing students to tackle the ever-shifting auditing world.

WORKS CITED

About NYU, New York University, www.nyu.edu/about.html.

"About Us." *Master of Accounting*, The University of Southern California, www.marshall.usc.edu/programs/graduate-accounting-programs/master-accounting.

"Accountancy, MAS." *2019-2020 Academic Catalog*, The University of Illinois, catalog.illinois.edu/graduate/graduate-majors/accountancy/accounting-mas/.

"Accounting Major, BS in Business Administration – Collateral Option." *2019-2020 Undergraduate Catalog*, The University of Tennessee Knoxville, catalog.utk.edu/preview_program.php?catoid=26&poid=11050.

Anyoha, Rockwell. "The History of Artificial Intelligence." *Harvard University*, 28 Aug. 2017, sitn.hms.harvard.edu/flash/2017/history-artificial-intelligence/.

"Automated Document Review: Case Study | Deloitte US | Market Development." *Deloitte U.S.*, 29 Nov. 2017, www2.deloitte.com/us/en/pages/about-deloitte/articles/business-innovation-automated-document-review.html.

Bell, Timothy B., and Joseph V. Carcello. "A Decision Aid for Assessing the Likelihood of Fraudulent Financial Reporting." *AUDITING: A Journal of Practice & Theory*, vol. 19, no. 1, Mar. 2000, pp. 169–184., doi:10.2308/aud.2000.19.1.169.

Bureau of Labor Statistics. "Accountants and Auditors." *Occupational Outlook Handbook*, U.S. Department of Labor, 2019, www.bls.gov/ooh/business-and-financial/accountants-and-auditors.htm.

"Concentrations." *UNC Kenan-Flagler Business School*, The University of North Carolina at Chapel Hill, www.kenan-flagler.unc.edu/programs/master-of-accounting/curriculum/degree-requirements/tax-audit-tracks.

"Core Curriculum." *UNC Kenan-Flagler Business School*, The University of North Carolina at Chapel Hill, www.kenan-flagler.unc.edu/programs/master-of-accounting/curriculum/degree-requirements/fall-spring.

"Curriculum." *Fisher College of Business*, Ohio State University, fisher.osu.edu/graduate/macc/academics/curriculum.

"Graduate Concentration in Data Analytics in Accountancy." *2019-2020 Academic Catalog*, The University of Illinois, catalog.illinois.edu/graduate/graduate-majors/accountancy/data-analytics-conc/.

"Graduate Programs." *Gies College of Business*, The University of Illinois, giesbusiness.illinois.edu/programs/graduate.

"How Artificial Intelligence (AI) Impacts Accounting." *MTI College*, 4 Jan. 2019, mticollege.edu/blog/business/accounting-technician/artificial-intelligence-accounting/.

Hu, Peiguang. "Predicting and Improving Invoice-to-Cash Collection through Machine Learning." *Department of Civil and Environmental Engineering*, Massachusetts Institute of Technology, 2015, hdl.handle.net/1721.1/99584.

"Information Technology and Control Concentration." *2019-2020 Academic Catalog*, The University of Illinois, catalog.illinois.edu/graduate/graduate-majors/bus-admin-ms/grad-conc-info-tech-control/index.html.

Kamesh, V, et al. "Real-Time Fraud Anamaly Detection in E-Banking Using Data Mining Algorithm." *South Asian Journal of Engineering and Technology*, Aug. 2017, doi:https://www.journals.eleyon.org/index.php/sajet/article/view/212/152.

Kira Systems. "Deloitte Alliance." *Kira*, 7 Nov. 2018, kirasystems.com/partners/deloitte-alliance/.

Kira Systems. "Deloitte Forms Alliance with Kira Systems to Drive the Adoption of Artificial Intelligence in the Workplace." *Kira*, 8 Mar. 2016, info.kirasystems.com/news/deloitte-forms-alliance-with-kira-systems-to-drive-the-adoption-of-artificial-intelligence-in-the-workplace.

"KPMG Partnership." *Fisher College of Business*, Ohio State University, 27 Aug. 2018, fisher.osu.edu/graduate/macc/academics/kpmg-partnership.

"Logic Theorist." *Logic Theorist - Complete History of the Logic Theorist Program*, history-computer.com/ModernComputer/Software/LogicTheorist.html.

"MAcc Academics." *Haslam College of Business*, The University of Tennessee Knoxville, haslam.utk.edu/accounting/masters/accountancy/academics.

"MAS Curriculum." *Gies College of Business*, The University of Illinois, giesbusiness.illinois.edu/mas/curriculum.

"Master of Accountancy." *Haslam College of Business*, The University of Tennessee Knoxville, haslam.utk.edu/accounting/macc.

"Master of Accounting Curriculum." *Michigan Ross*, The University of Michigan, michiganross.umich.edu/programs/master-of-accounting/curriculum.

"Master of Accounting Science (MAS)." *Gies College of Business*, The University of Illinois, giesbusiness.illinois.edu/mas.

"MBA Electives." *McCombs School of Business*, The University of Texas at Austin, www.mccombs.utexas.edu/~/media/Files/MSB/Program%20MPA/MBA_Electives_Flyer.pdf.

MBA Program, University of Pennsylvania Accounting Department, accounting.wharton.upenn.edu/programs/mba/.

Medius. "History of Accounting | From Record Keeping to Artificial Intelligence." *Untapped: AP Invoice Automation Insights from Medius*, 29 Aug. 2018, www.mediusflow.com/en/untapped/articles/people/history-of-accounting.

Mission & Aims of BYU, Brigham Young University, aims.byu.edu/.

"MPA Core Courses." *McCombs School of Business*, The University of Texas at Austin, www.mccombs.utexas.edu/~/media/Files/MSB/Program%20MPA/tMPA_Core_Courses.pdf.

Perols, Johan L., et al. "Finding Needles in a Haystack: Using Data Analytics to Improve Fraud Prediction." *The Accounting Review*, vol. 92, no. 2, Mar. 2017, pp. 221–245., doi:10.2308/accr-51562.

Perols, Johan. "Financial Statement Fraud Detection: An Analysis of Statistical and Machine Learning Algorithms." *AUDITING: A Journal of Practice & Theory*, vol. 30, no. 2, May 2011, pp. 19–50., doi:10.2308/ajpt-50009.

"Placement Stats." *Haslam College of Business*, The University of Tennessee Knoxville, haslam.utk.edu/accounting/masters/accountancy/careers.

"Program Formats." *UNC Kenan-Flagler Business School*, The University of North Carolina at Chapel Hill, www.kenan-flagler.unc.edu/programs/master-of-accounting/program-formats.

"Program Structure." *Fisher College of Business*, Ohio State University, fisher.osu.edu/graduate/macc/academics/program-structure.

"Program: Accounting Major, MAcc." *2018-2019 Graduate Catalog*, The University of Tennessee Knoxville, catalog.utk.edu/preview_program.php?catoid=25&poid=10751.

Rahul, Kumar, et al. "Spotting Earnings Manipulation: Using Machine Learning for Financial Fraud Detection." *Lecture Notes in Computer Science Artificial Intelligence XXXV*, Nov. 2018, pp. 343–356., doi:10.1007/978-3-030-04191-5_29.

Raphael, Jon. "Rethinking the Audit." *Journal of Accountancy*, 1 Apr. 2017, www.journalofaccountancy.com/issues/2017/apr/rethinking-the-audit.html.

Rozen, Courtney. "Small Firm Blazes Trail in Artificial Intelligence Use for Audits." *Bloomberg Tax*, 10 July 2018, www.bna.com/small-firm-blazes-n73014477358/.

"Stanford University." *U.S. News & World Report Best Colleges*, U.S. News & World Report, www.usnews.com/best-colleges/stanford-university-1305.

Stein, Sarah, et al. "Developing Tomorrow's Auditor." *FEI*, 3 Jan. 2017, www.financialexecutives.org/Topics/Accounting/Developing-Tomorrow-s-Auditor.aspx.

"Texas McCombs MPA." *McCombs School of Business*, The University of Texas at Austin, www.mccombs.utexas.edu/MPA.

"The Best Accounting Programs, Ranked." *U.S. News & World Report*, U.S. News & World Report, www.usnews.com/best-graduate-schools/top-business-schools/accounting-rankings.

"The Fisher MAcc Difference." *Fisher College of Business*, Ohio State University, fisher.osu.edu/graduate/macc/fisher-macc-difference.

"Traditional MPA Degree Requirement Summary." *McCombs School of Business*, The University of Texas at Austin, www.mccombs.utexas.edu/~/media/Files/MSB/Program%20MPA/tMPA_Degree_Requirement_Summary.pdf.

"Unique Opportunities." *McCombs School of Business*, The University of Texas at Austin, www.mccombs.utexas.edu/MPA/MPA-Experience/Unique-Opportunities.

"University of Chicago." *U.S. News & World Report Best Colleges*, U.S. News & World Report, www.usnews.com/best-colleges/university-of-chicago-1774.

"University of Pennsylvania." *U.S. News & World Report Best Colleges*, U.S. News & World Report, www.usnews.com/best-colleges/university-of-pennsylvania-3378.

"Why Accountants Must Embrace Machine Learning." *IFAC*, 18 Apr. 2018, www.ifac.org/global-knowledge-gateway/technology/discussion/why-accountants-must-embrace-machine-learning.

Table 1. Job Placement Rates

"Career Services." *UNC Kenan-Flagler Business School*, The University of North Carolina at Chapel Hill, www.kenan-flagler.unc.edu/programs/master-of-accounting/career.

"MAcc Career Outcomes." *Fisher College of Business*, Ohio State University , fisher.osu.edu/graduate/macc/macc-career-outcomes.

"MAcc Graduate Overview." *Michigan Ross*, The University of Michigan, michiganross.umich.edu/sites/default/files/uploads/Programs/MAcc/pdfs/18 _macc_lr_f.pdf.

"Master of Accountancy." *Haslam College of Business*, The University of Tennessee Knoxville, haslam.utk.edu/accounting/macc.

"Master of Accounting Science (MAS)." *Gies College of Business*, The University of Illinois, giesbusiness.illinois.edu/mas.

"MPA Fact Sheet." *McCombs School of Business*, The University of Texas at Austin, www.mccombs.utexas.edu/~/media/Files/MSB/Program%20MPA/FactSheet.pdf.

Table 2. CPA Exam Pass Rates

"Academic Excellence - CPA Success." *McCombs School of Business*, The University of Texas at Austin, www.mccombs.utexas.edu/MPA/MPA-Experience/Academic-Excellence.

"Best in State for 2018-19: Top Accounting Graduate Programs in the Nation: Michigan." *Accounting Master's and Grad Cert Programs with the Best CPA Exam First-Time Pass Rates*, AccountingEdu, www.accountingedu.org/best-masters-degree-programs-in-accounting-for-2018.html#michigan.

"Best in State for 2018-19: Top Accounting Graduate Programs in the Nation: Ohio." *Accounting Master's and Grad Cert Programs with the Best CPA Exam First-Time Pass Rates*, AccountingEdu, www.accountingedu.org/best-masters-degree-programs-in-accounting-for-2018.html#ohio.

"Best in State for 2018-19: Top Accounting Graduate Programs in the Nation: Tennessee." *Accounting Master's and Grad Cert Programs with the Best CPA Exam First-Time Pass Rates*, AccountingEdu, www.accountingedu.org/best-masters-degree-programs-in-accounting-for-2018.html#tennessee

"CPA Exam." *UNC Kenan-Flagler Business Schoo*, The University of North Carolina at Chapel Hill, www.kenan-flagler.unc.edu/programs/master-of-accounting/why-the-mac/cpa-exam.

"Master of Accounting Science (MAS)." *Gies College of Business*, The University of Illinois, giesbusiness.illinois.edu/mas.

Vita

       Kaylee Giles was born in Newport, Tennessee. She is currently a senior at the University of Tennessee Knoxville, majoring in Accounting with a collateral in Information Management. After graduating in May of 2019, Kaylee will intern with Deloitte in Nashville, Tennessee before returning to Knoxville in August to enter the Master of Accountancy program, where she is concentrating in Information Management and working as a Graduate Assistant.