

The Impact of Disruptive Technologies on Accounting and Auditing Education

How Should the Profession Adapt?

By Chanyuan (Abigail) Zhang, Jun Dai, and Miklos A. Vasarhelyi

IN BRIEF

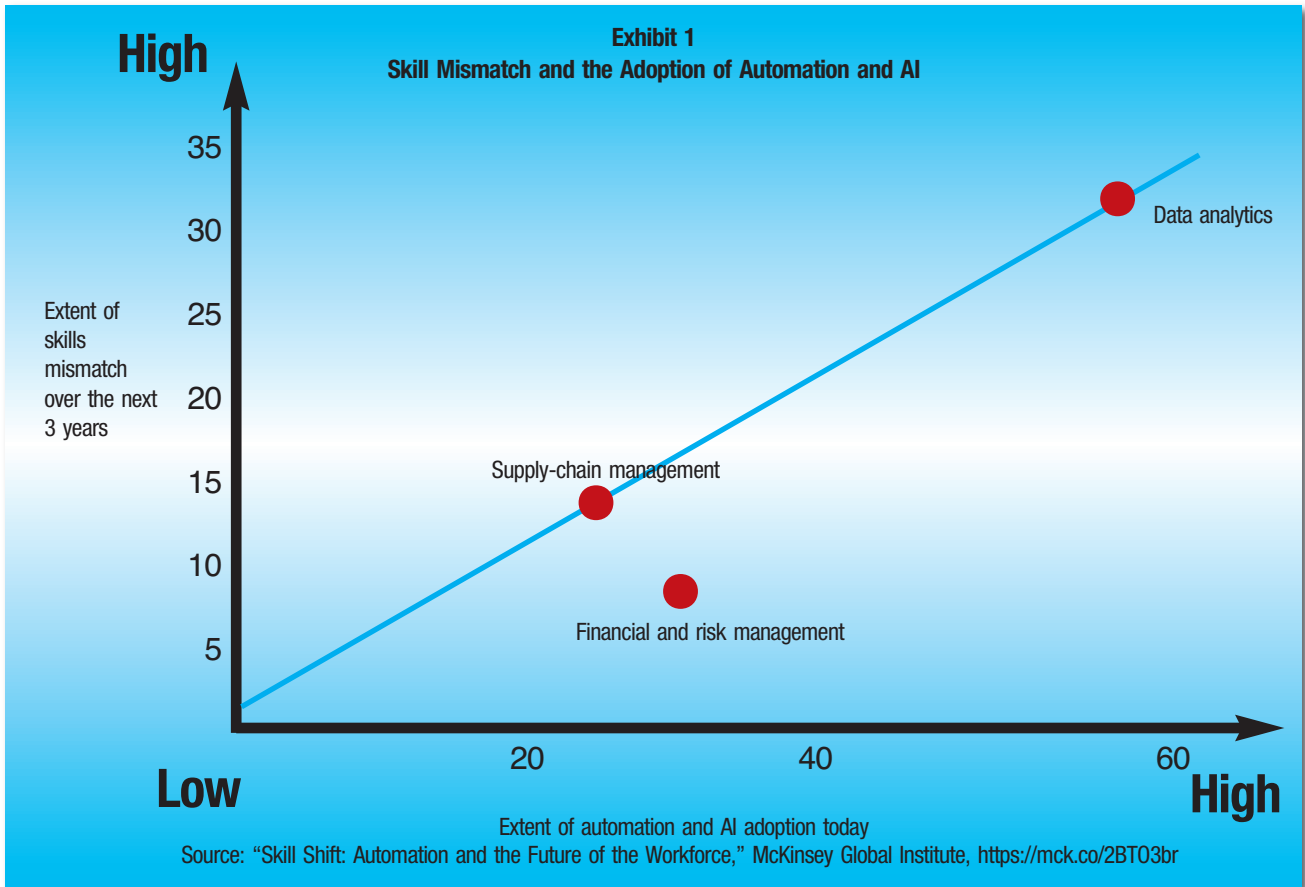
The rapid pace of technological change continues to disrupt traditional procedures in all spheres, including the accounting profession. The authors examine the potential effects that disruptive technologies will have on both the profession at large and accounting education specifically. They provide suggestions for educators and universities on how to shape their curricula to meet the needs of the new environment.

Both the accounting and auditing functions are experiencing a major wave of automation that most likely will result in substantive reduction of staff (see Li Zhang, Duo Pei, and Miklos A. Vasarhelyi, “Toward a New Business Reporting Model,” *Journal of Emerging Technologies in Accounting*, Fall 2017, <http://bit.ly/2odcUgD>; and Helen Brown-Liburd and Miklos A. Vasarhelyi, “Big Data and Audit Evidence,” *Journal of Emerging Technologies in Accounting*, 2015, <http://bit.ly/2obeab0>). It is predicted that the traditional mix of jobs in accounting firms will change substantially, and accountants will need to learn new skills when the more traditional tasks become automated and the technical maintenance and analytic needs of the work increase substantively. A major wave of educational change is also emerging with the advent of distance education, various forms of unorthodox training, and a large set of new learning needs.

The CPA exam is a key driver for the content of accounting classes. One of the key determinants of the content of the CPA exam is a survey performed every six or seven years examining what tasks are typically performed by CPA firm employees in the first two years of employment. When discussing with exam preparers the absence of modern audit analytics and the low content of information technology (IT) material in the exam, the typical response is that students are not prepared for these topics and the boards of accountancy will not accept these changes. Although the



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CPA exam has changed to include simulations that examine analytic skills, it has not turned its content to the forthcoming disruption of the profession through digitization (Marilyn Greenstein and Miklos A. Vasarhelyi, "Underlying Principles of the Electronization of Business: A Research Agenda," *International Journal of Accounting Information Systems*, March 2003, <http://bit.ly/2ofrkg4>).

This article examines the breadth of the changes that automation and other technologies will bring to the accounting profession. The authors suggest potential solutions that will help graduating students be better prepared for the accounting workplace of the future.

Disruptive Technologies in Accounting

Recently, disruptive technologies such as robotic process automation (RPA),

artificial intelligence (AI), blockchain, smart contracts, and advanced analytics have reshaped existing business models and facilitated the emergence of new ones wherein repetitive and mundane tasks are becoming less important and the need for high-level skills is increasing. Though it still will be some time before these technologies affect the workplace at a significant scale, the current "entry-level" jobs that require no- or low-level cognitive skills may eventually disappear. It has been estimated that at least 50% of the work that accountants and other professionals are paid for is automatable through currently available technologies, with an additional 15% automatable through forthcoming technologies (James Manyika et al., "Jobs Lost, Jobs Gained: What the Future of Work Will Mean for Jobs, Skills, and Wages," McKinsey

Global Institute, November 2017, <https://mck.co/2LCunZd>).

This constant disruption and the static focus of the CPA exam create a mismatch between the supply and demand of the necessary talents. Students graduating from traditional accounting programs usually do not have the knowledge and skills required by employers, and this is especially true of workplaces with high-level adoption of automation and AI (see *Exhibit 1*). To catch up, students must usually reeducate themselves through online courses or by training programs offered by employers or third parties.

Currently, the CPA exam requires mostly practical skills, followed by comprehension and analysis skills (*Exhibit 2*). Since the rule-based and repetitive tasks that require the above-mentioned skills are prone to automation, however, high-level cognitive skills should be

more emphasized (*Exhibit 3*). The Big Four (Cooper et al., 2018) are trying to hire people who have not only accounting and auditing knowledge, but also analytical skills and computer programming or coding experience (L.A. Cooper, D.K. Holderness, T. Sorenson, and D.A. Wood, "Robotic Process Automation in Public Accounting," working paper, 2018). Ernst & Young points out that the audit of the future requires "accounting plus" skills (expanded in *Exhibit 4*), including a mindset that is innovative, global, and questioning/challenging; leadership skills; the curiosity to ask better questions; the emotional intelligence to better connect and communicate with clients; and knowledge of techniques such as data analytics (*The Future of Audit: Preparing Students to Succeed*, Ernst & Young whitepaper, 2018). Several of the other large and midsize firms have expressed similar opinions.

"Accounting plus" presents a very high bar for the profession. A much more realistic set of expectations is expressed by Mike Leonardson, from the audit analytics leadership of Ernst & Young:

We will always need auditors with backgrounds in accounting and auditing. However, our auditors will also need to have some level of proficiency in data analytics. We need our staff to be aware of the tools and techniques that are available to them to address audit risks. We need our professionals to be able to identify risks (frame out their questions) and to think about what data would be useful in addressing those risks (answer those questions). Our auditors can leverage the skills of specialists in capturing and transforming that data. Our auditors need to think about how they could analyze that data and to visualize the data in order to provide the information or evidence necessary to reach their conclusion. (Mike Leonardson, personal interview)

Such an approach has significant implications on curricula, recruiting, and research. This framework must, however, be considered within the evolving framework of education and business schools.

Impact of Online Education on Traditional Business Schools

Harvard Business School professor Clayton Christensen predicted in 2017 that "50 percent of the 4,000 colleges and universities in the U.S. will be bankrupt in 10 to 15 years" due to the disruption of online education (Abigail Hess, "Harvard Business School Professor: Half of U.S. Colleges Will Be Bankrupt in 10 to 15 years," CNBC.com, Nov. 15, 2017,

Compared to traditional business schools, in which the creation and approval of new courses usually takes a long time and carries the risk that the new course might be canceled if not enough students register, online education platforms can gather large and diverse pools of traditional and emerging courses in a relatively short time and at lower cost and store them online for ad hoc demand. Students who feel the need to acquire new skills not taught by traditional accounting programs often turn to these online education platforms to gain that knowledge. Given the fact that online education platforms can offer not only CPA-oriented courses but also

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<https://cnb.cx/2MyeOXY>). The U.S. Department of Education and Moody's Investors Service also project that the closure rates of small colleges and universities will triple, and mergers will double, in coming years (Hess 2017). The disruption caused by online education comes not just from the technology itself, but mainly from the new business model upon which online education is based (Doug Lederman, "Clay Christensen Sticks with Predictions of Massive College Closures," *Inside Higher Ed*, Apr. 28, 2017, <http://bit.ly/2wsfTpg>). Online education has transformed the knowledge that formerly could only be obtained in the classroom into "bytable" goods that can be transferred through the Internet without time, structure, and geography constraints (Greenstein and Vasarhelyi 2003).

emerging technology courses at a cheaper price, traditional business schools will have to reconsider their competitive strategies. In short, they should focus on cultivating the "accounting plus" skill set. Professors can even make full use of materials already available online by assigning them as required reading, thereby shortening the time spent on those contents and allowing class time to focus on practical training. They should also draw on their research competencies to create new content that is not already available elsewhere.

What's Happening around the World

In general, curricula and methods of education in most countries have not substantially changed, but pressures are increasing, with innovative universities

Exhibit 2
Skill Levels Assessed on Each Section of the CPA Exam

Section	Remembering and Understanding	Application	Analysis	Evaluation
AUD	30-40%	30-40%	15-25%	5-15%
BEC	15-25%	50-60%*	20-30%	-
FAR	10-20%	50-60%	25-35%	-
REG	25-35%	35-45%	25-35%	-

*Includes written communication
Source: *Uniform CPA Examination Blueprints*, 2018

trying to fill the gap. Universities in Asia have tested integrating IT/advanced analytics courses into their accounting programs. Southwestern University of Finance and Economics (SWUFE) in Chengdu, China, for example, is creating an entire undergraduate program oriented around business analytics in accounting. The program emphasizes training in mathematics, statistics, and IT (e.g., data mining, machine learning, database) in addition to the core accounting knowledge. It also includes two innovative courses regarding the use of data analytics to accomplish accounting, auditing, and risk management tasks. Singapore Management University has established the first master's degree in accounting data and analytics in Asia, which helps students to develop expertise in applying data technology to accounting. Similar efforts have also been made by universities in North America and Europe; for example, the University of Waterloo in Canada integrates a basic curriculum of analytics with its undergraduate and graduate offerings, and Queen Mary University in the United

Kingdom teaches undergraduate students how to use mathematics and statistics to discover patterns in finance and accounting domains.

One of the biggest challenges for universities in establishing these interdisciplinary programs is the significant lack of qualified faculty members with a strong background and training in both technology and accounting. Although basic courses, like IT and statistics, can be offered by professors in each discipline, innovative courses that bridge technology and accounting should be taught by faculty with expertise in both domains. The number of doctoral programs that offer such training to their PhD students, however, is limited. Currently, accounting departments (e.g., SWUFE's) try to recruit faculty members with IT or statistics expertise as supplemental instructors; however, more effort still needs to be invested into the development of doctoral programs that equip PhD students with both technology and accounting knowledge.

Digital media made available on the Internet is probably the major equaliz-

er. Rutgers University has placed its entire accounting curriculum for free on Youtube (<http://bit.ly/2MXkVnP>) and on its website (<http://http://raw.rutgers.edu/RADL.html>). The incremental cost of provisioning this is close to zero and the cost for the university to capture the classes is small; on the other hand, the social good can be very large although the learning requires self-discipline and low threshold of frustration as the free education does not provide assistance to resolve questions nor tests to verify learning.

How Should the Profession Adapt?

The automation of repetitive tasks will cause substantial reduction of the workforce needed for traditional assurance work, but it will also lead to an increasing need for employees who possess skills such as IT and data analysis. Consequently, the advent of disruptive technologies is forcing members of the accounting profession to learn new skills, especially IT, statistics, and modeling. To satisfy the constantly changing needs of the workplace, the education model should also be up-to-date.

Exhibit 3
Skill Levels Required by CPA Exam

Skill levels	
↑ Evaluation	The examination or assessment of problems and use of judgement to draw conclusions.
Analysis	The examination and study of the interrelationships of separate areas in order to identify causes and find evidence to support inferences.
Application	The use or demonstration of knowledge, concepts, or techniques.
Remembering and Understanding	The perception and comprehension of the significance of an area, utilizing knowledge gained.

Source: *Uniform CPA Examination Blueprints*, 2018

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Exhibit 4
Accounting Plus Skills Framework

Analytic Skills	Personal Skills	Mindsets	Accounting/Audit Knowledge	AI/Disruption Understanding
ERP systems	Personal agility and resilience	Global	FASB standards	Robotic process automation
Programming logic	Client connection and communication	Questioning and challenging	GASB standards	Intelligent process automation
Data visualization	Likeability	Business acumen	PCAOB, ASB, IAASB standards	Watson, deep learning methodology
Analytic modeling	Presentable		Specialized industry understanding	Cognitive computing tools
Extract, transform and load (ETL) tools	Political correctness		Understanding of markets and investor needs	Blockchain and smart contracts
Text mining	Leadership		Measuring and understanding cybercurrencies	Effect of cybercurrencies on the environment
Audit software			Understanding of SOC certificates	Cybersecurity
Legacy systems				

Source: *The Future of Audit: Preparing Students to Succeed*, Ernst & Young whitepaper, 2018.
ERP=enterprise resource planning
SOC=service organization controls

Both the AICPA, which develops the Uniform CPA Exam, and accounting educators should focus more on higher-level skills, especially analytical, critical, and innovative thinking skills, and decrease the emphasis on memorization and the mechanical application of rules. The AICPA should also consider increasing the content of IT, cybersecurity, and data analytics within the exam. Business school accounting programs are encouraged to open new courses related to IT and data analytics to diversify the course pool. Alternatively, accounting educators may also feel it useful to blend big data analytics and IT into existing traditional accounting courses such as financial accounting, managerial accounting, auditing, and taxation. This requires

accounting educators to change their mindset and expand their skill sets; while this may take time, PhD students who possess these new skills may help facilitate the change.

Traditional business schools should also explore new teaching models, such as online teaching, course modularization, or a hybrid of online and physical teaching. Business schools can also consider offering special certifications for new course modules, such as cybersecurity and audit data analytics. Classes can be taped and stored online for the purpose of review and reuse. Educators should also encourage a philosophy of lifelong learning and teach students to learn new things and adapt to the changing environment, cultivating accountants who are prepared for the future. □

Entering a Cambrian Moment

The *Economist* listed the elements of what it called a “Cambrian moment” (named after the “Cambrian explosion” of life on Earth approximately 541 million years ago) in digital technology (“A Cambrian Moment,” Jan. 18, 2014, <http://bit.ly/2LuA2R9>) as—

- easy-to-learn programming frameworks applicable to computer code and modules to implement and change accounting standards;
- services for finding audit and accounting services;
- sharing code from different firms and vendors and instructional providers;
- “application programming interfaces” (APIs), that is, digital plugs that are multiplying rapidly and provide some of the services and education that were exclusive from traditional providers;
- services that can host startups’ offerings (e.g., Amazon’s cloud computing), which have not yet evolved in accounting/audit domain;
- electronic distribution and marketing of all of the above; and
- the Internet itself, which is now fast, universal, and wireless.

Taking these elements together in the accounting, auditing, and instructional domains suggests that substantive change is in the process of happening, creating an environment very different from what universities and firm training have been providing.

Chanyuan (Abigail) Zhang is a PhD student in the department of accounting and information systems at Rutgers University, Newark, N.J. Jun Dai, PhD, is an assistant professor at Southwestern University of Finance and Economics, Chengdu, China. Miklos A. Vasarhelyi, PhD, is the KPMG Distinguished Professor of Accounting Information Systems and director of the Rutgers Accounting Research Center and Continuous Auditing and Reporting Lab at Rutgers University. He is a member of The CPA Journal Editorial Advisory Board.

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