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Audit Education and the Real-Time Economy

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ABSTRACT: The real-time economy (RTE) changes the way accounting information is received, processed, and analyzed. Consequently, it drives demand for auditors who possess enhanced skills and attitudes. Unsurprisingly, the current generation of auditing students expects to be well prepared when entering the profession and facing these new challenges. Auditing educators have the unique opportunity to assume a leading role and empower modern auditors, arming them with the best weapons available to combat error and fraud. This position paper discusses the changing function of the auditing profession, analyzes the advancement of auditing technology featuring continuous auditing and monitoring, and identifies three primary attributes (attitudes, technical competences, and behaviors) that will define the RTE auditor. For each of these attributes, this paper identifies educational media (or instructional tools) that may be incorporated into auditing curricula as a way of introducing and developing these skills.

> In years to come, experts predict, many companies will use information technology to become a "real-time enterprise"—an organization that is able to react instantaneously to changes in its business. And as firms wire themselves up and connect to their business partners, they make the entire economy more and more real-time, slowly but surely creating not so much a "new" but a "now" economy.
>
> —*The Economist* 2002

INTRODUCTION

The real-time economy (RTE) is here. Businesses thrive or fail from one moment to the next, people share information instantaneously, and millions of economic transactions flow from account to account through massive information systems. The "now" economy has forced smartphone-enabled sales forces to endure virtually uninterrupted work hours, and managers to embrace global team-directed efforts. This environment represents a time of great change for financiers, accountants, and auditors. No longer do the old techniques of evaluating business history provide sufficient information to managers and stakeholders; rather, auditors need a powerful set of skills to provide enhanced assurance.

Audit education can lead the way as the audit environment changes. The progressive technological advances that are fundamental to the RTE require auditors to re-think the way they approach an engagement. Audit educators must provide training that is not only sufficient to meet the needs of this new environment, but also empower students to embrace the rapid changes of the

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new economy (Amernic and Craig 2004; Boyce 2004; Howieson 2003). This paper attempts to define and describe the shift needed in auditing education toward the real time economy and continuous auditing.

Throughout this paper, we identify motivating factors, specific skills, and instructional media that relate to three principal attributes of an RTE auditor: *attitudes* refer to a set of views of the world that should be incrementally transmitted to entrants to the audit profession; *behavior* indicates the nature of the interaction between the auditor and clients, regulators, audit teams, and technology; *objective knowledge* includes specific knowledge and skills required to conceptualize, implement, and operate an RTE audit.

This position paper is organized as follows: the second section provides an overview of the RTE and the continuous auditing model. The third section presents the attitudes, behavior, and objective knowledge components found in the RTE auditor skill set. The fourth section contains a sample of relevant instructional media found in accounting education literature. The fifth section summarizes the paper, reviews the strengths and weaknesses of our proposed approach, and suggests additional areas of research.

To aid the reader, the main concepts and elements of this paper are summarized in a knowledge map, presented in Figure 1. The map follows the progression of this paper from left to right and focuses on the auditor attributes in the central column. The left column identifies motivational elements to this paper, the right identifies instructional media, and arrows delineate paths linking motivation and media to skills.

THE REAL-TIME ECONOMY AND CONTINUOUS AUDITING

The RTE adds new requirements for the training of auditors, including ethical attitudes, risk measurement and management competencies as well as the ability to think and make judgments in an unstructured setting. For example, much of the audit burden has shifted from external to internal auditors as a result of Auditing Standard No. 5 (AS5; (PCAOB 2007). Rebalancing allows internal auditors to play a greater role in providing audit evidence. AS No. 5 has been the primary motivator for the audit load rebalancing effort, demonstrated in a recent survey of audit officers (Protiviti 2008). Many leading organizations, anticipating this shift, are adopting technology that allows them to limit their exposure (see Alles et al. 2006). This attitude is quite different from the current ex-post facto audit. This creates an environment that is conducive to the introduction of real-time auditing.

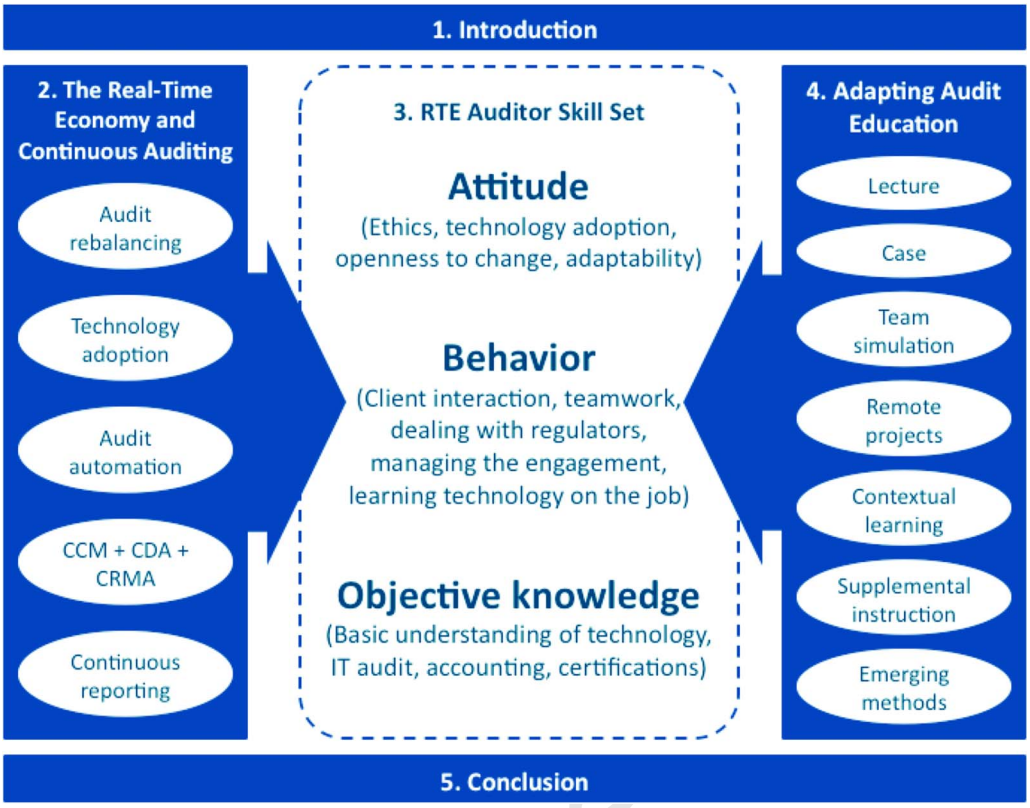
The Nature of the Real-Time Economy (RTE)

The use of internal real-time reporting is substantially increasing. Coming years will see more nimble and adaptive companies integrated into the global economy. The evolution of these technologies and their integration into business will also introduce behavioral effects that may accelerate or delay progress.

In addition to the advent of technology, the RTE can be characterized by a substantive reduction in the delays within and between processes (Vasarhelyi and Alles 2008). This is enabled by the progressive digitization through the application of technology (Vasarhelyi and Greenstein 2003). Digitization further reduces these delays and, when implemented properly, gives the organization competitive advantage (Powell and Dent-Micallef 1997). Additional benefit can be obtained through the acceleration of data transfer, facilitated by XML and XBRL (Bovee et al. 2005).

The assurance function is being automated to gain efficiencies and cope with the changes that occur in the underlying reporting structure. The auditing function has witnessed a similar phenomenon. It took little time from the introduction of PCs for large audit firms to purchase substantial quantities of these devices. They replaced the cumbersome and time-consuming footing, extending, and ticking with data extraction software and user-friendly spreadsheets. While the

FIGURE 1
Knowledge Map



auditors possessed this clear early advantage, such enthusiasm has not carried through to some of the newer auditing tools. The literature attributes this mainly to: 1) the ossifying effect of obsolete and unchanging regulatory statutes, 2) the investment-inhibiting nature of the partnership structure of auditing firms, and 3) the risk averse nature of accountants (Curtis and Payne 2008). Auditing education, responding to the needs of the professional accounting firms, has reacted accordingly.

The contrast between management information systems and traditional auditing tools is notable (Figure 3). While business systems are leveraged for cross-application integration, auditing tools are relegated to data extraction, cumbersome spreadsheets, manual manipulation, and limited automation. Dashboards and executive information systems provision more timely data (e.g., status updates every six hours), but auditors are limited by a statute-driven manual reporting scheme.

Numerous modern companies across various domains have developed a wide array of applications to explore the benefits of the RTE. Use of progressive automation has enabled them to gain competitive advantage and become leaders in their fields. Vasarhelyi (2009) has collected several

of these examples.[1] Many of these strategic applications dramatically changed the nature of the business and forced competitors to copy or perish. Likewise, by embracing automated audit tools, RTE auditors have the potential to change the nature of audit.

Continuous Auditing

If the stakeholders in the RTE environment are to make use of real-time data, then auditors have an obligation to provide assurance for that data as it is issued. Unless RTE auditors understand the technology and environment, they cannot provide relevant services to modern investors and managers. Audit automation facilitates the transition from the traditional audit of historical financial data to auditing of current, real-time financial and nonfinancial information.

Continuous auditing provides assurance on real-time information within an organization (Vasarhelyi and Halper 1991). The CICA/AICPA (1999, xiii) defines continuous audit as "a methodology that enables independent auditors to provide written assurance on a subject matter using a series of auditors' reports issued simultaneously with, or a short period of time after, the occurrence of events underlying the subject matter." These automated tools are used to determine whether a firm's data is adequately maintained and internal controls function properly. Extensive research has been conducted regarding the functionality, challenges, and benefits of continuous auditing in academia,[2] by professional associations (CICA/AICPA 1999; IIA 2005) and public accounting firms (PricewaterhouseCoopers 2002; Searcy et al. 2002).

Continuous auditing has matured from a pilot test at AT&T Bell Laboratories (Vasarhelyi and Halper 1991) to a progressive reality affecting organizational management, and internal and external audit organizations. From large banks to multinational consumer goods firms, the adoption of continuous auditing is driving auditors to reevaluate their functions, tools, processes, and attitudes (Vasarhelyi and Kuenkaikaew 2009). Vasarhelyi and Kuenkaikaew (2009) observe a wide range of audit-like organizations, very slow and heterogeneous adoption of technology, low level of technical competence among auditors, and widely varying methods of audit management. By contrast, empowered internal auditors are adopting technology to monitor their companies' systems, illustrating the changing and dynamic audit climate.

Continuous auditing includes three primary components (Figure 2). Continuous controls monitoring (CCM) consists of a set of procedures used for monitoring internal controls. Continuous data assurance (CDA) verifies the integrity of data flowing through the information systems. Continuous Risk Monitoring and Assessment (CRMA) is used to dynamically measure risk and provide input for audit planning.

While continuous monitoring of access controls and authorizations is well developed in computer security applications (Jajodia et al. 1997), monitoring enterprise system configuration and business process settings remains an emerging area of development. Implementation strategies for CCM, CDA, and CRMA require skills that will be developed by the RTE auditor.

Continuous Controls Monitoring

COSO (2009) defines CCM as the "periodic evaluation and testing of controls by internal audit." CCM has the ability to "enhance the efficiency and effectiveness of the whole internal control system" (COSO 2009) by determining whether errors exist and helping internal auditors and managers resolve controls weaknesses before they perpetuate into larger problems. In recent years, the push for CCM implementation at some firms has originated from management and internal audit requirements, rather than from external audit firms (Brown et al. 2007; COSO 2009).

[1] See: http://raw.rutgers.edu/RTEexamples.
[2] See Brown et al. (2007) for an extensive literature review on the subject of continuous auditing.

FIGURE 2
Components of Continuous Auditing

Firms that implement CCM are likely to build on the expertise of seasoned auditors who understand the controls framework and how the firm operates (Vasarhelyi and Alles 2008; Teeter et al. 2009). This expertise aids the conversion of manual control assessment to automated platforms and provides validation of the effectiveness of the implemented controls. 21st century auditors need to understand the concepts being shared by seasoned auditors and help incorporate them into the RTE environment.

Examples of CCM include procedures for continuously monitoring:

- User access control and user account authorizations;
- System controls configuration; and
- Settings and workflows related to business processes.

Auditors implementing and performing CCM will have to be highly sensitive to the control environment, be able to talk to the client professionally about controls and their weaknesses, understand the intricacies of the effects of overlapping controls, be able to work with clients to define rules that emulate requirements of the IT audit, and possess other related skills.

Continuous Data Assurance

Continuous auditing depends on accurate data, such as personnel information and financial transaction figures, flowing through information systems. Continuous data assurance evaluates the integrity of the financial and nonfinancial transactions to ensure that errors in the data are minimized. Valid data translates into valid information upon which management and auditors can base valid decisions (Vasarhelyi and Halper 1991; Alles et al. 2006; Elliot 2002). AQ: #1

Examples of CDA include procedures for verifying:

- Underlying master data;
- Transactional data flows; and

- Key process metrics using analytics (including continuity equations).

Auditors performing CDA will have to have improved process design and implementation skills, possess a better understanding of statistics, be able to communicate with the client requesting data verification instances (e.g., positives—false and true—data verification), and be very sensitive to the nature of errors and potential fraud. While auditors today have a certain degree of data extraction skills, auditors (internal and external) will have to be very knowledgeable about drawing data from ERPs, flat files, data flows, and data warehouses. Given the frequency of data extraction, reliance on IT experts to draw this data for the auditor is not feasible.

Continuous Risk Monitoring and Assessment

Risk assessment procedures have been an integral part of the traditional audit for many decades. Companies have a portfolio of risk containing risk elements, such as management risk and audit risk. Management risk influences audit risk and the weighting of these risks fluctuates in response to changing business conditions. The audit planning process encompasses the assessment of auditor perceptions and an allocation of audit resources to high-risk areas.

While there are many forms of guidance in the literature and statutes, this process is still vague and *ad hoc*; audit firms have their own systematized approaches but are heavily reliant on unstructured assessments and judgment. Internal audit departments generally will perform annual audit plans and similar risk assessment. They will determine the change in audit risk as it relates to the greater management risk portfolio. The allocation of audit resources will tend to respond to corporate contingencies and often bend to pragmatic issues such as availability of data, political environment, and management concerns (Vasarhelyi and Kuenkaikaew 2009). Often the internal audit planning processes will be analogous to those of the large audit firms:

- Divide the audit risk frame into manageable parts;
- Understand the basic profile of risk of each of the parts;
- Work on proposing joint risk profiles; and
- Create scenarios.

CRMA takes the COSO (2009) monitoring framework a step further. It includes processes that:

- Measure risk factors on a continuing basis;
- Integrate different risk scenarios into some quantitative framework; and
- Provide inputs for audit planning.

Auditors performing CRMA will have to be very well versed in enterprise risk management principles and audit risk assessment practices included in the COSO (2009) framework. They will need an openness to change during to react to the risk environment. The audit plan and procedures as well as the weighting of audit evidence will have to be rebalanced. Therefore, auditors will need to re-parameterize monitoring procedures during the audit.

Continuous Reporting

Continuous reporting is the release of financial and nonfinancial information on a near real-time basis (Hunton et al. 2004; Gal 2008). It reduces the delay inherent in traditional reporting and provides a more accurate picture of a firm's financial position. The adoption of XBRL by companies for both external and internal reporting makes consolidation and release of this information more feasible (Murthy and Groomer 2004). RTE auditors work with client information and will require new specialized tools to aid in this enhanced disclosure.

Continuous reporting will pose additional challenges for auditors. Continuous measurement is necessary for a continuous audit. The monitoring approach will further differentiate, integrate, and change the roles of management, internal and external audit, and other audit-like functions (Vasar-

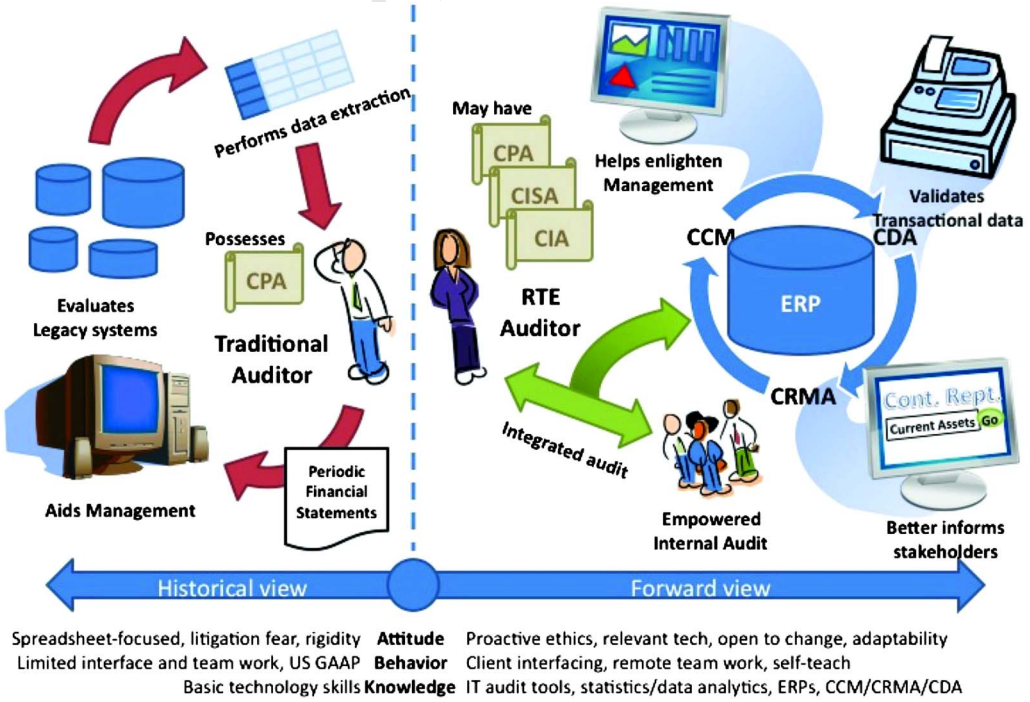
helyi and Kuenkaikaew 2009).[3] The set of skills developed for this environment will bring an attitude of preference for online monitoring rather than archival analysis, the ability to make rapid decisions based on feedback from these systems, and improved statistical competence.

THE RTE AUDITOR SKILL SET

Auditors need to possess skills that will help them meet the demands of the real-time economy and continuous auditing (Zhao et al. 2004). Attitudes and contextual knowledge will help them understand the technology they will be expected to use as they conduct their audits. The auditor's ability to work effectively in a team and enhance an integrated audit is reflected in the behavior the auditor demonstrates. The left area of Figure 3 illustrates dynamics facing the traditional auditor, and the right area outlines some of the tools and resources available in the RTE.

The traditional auditor focuses on a firm's history. Armed with a Certified Public Accountant (CPA) credential, he works to extract sample data from legacy and heterogeneous information systems. In the technology realm, he uses spreadsheets, basic sampling, and analytical techniques. The outcome of his work is a certification of the financial statements prepared by management.

FIGURE 3
The Real-Time Audit Environment



[3] Vasarhelyi and Kuenkaikaew (2009) found that major organizations have several overlapping and conflicting internal audit-like functions such as fraud, internal control, internal audit, Basel II, etc. They predict that eventually these functions will be rationalized and substantially integrated.

Much of what he does is delegated by the audit manager with minimal interaction with internal auditors. The constant concern about litigation keeps him risk averse and understandably resistant to change. All of the work is performed several months after the occurrence of relevant events. As a result, any material errors or instances of fraud that have occurred in that past period have had time to propagate and create additional difficulty for his team.

The RTE auditor, on the other hand, is ready to work with current information. Past data can certainly help model the future, but her forward-looking view allows her to react to problems as they occur and work with management to solve them. She may possess other certifications in addition to a CPA license. She realizes that events occur in real time, so she is proactive in treating new forms of ethical dilemmas, open to change, and always searching for tools that will help her client remain a going concern. Working alongside an empowered internal audit team, she coordinates, delegates, and evaluates the integrated information systems that ingest millions of transactions, ensure that management knows that controls are working, and give stakeholders an accurate picture of the client's standing. In order to conceptualize, implement, and operate these systems, the RTE auditor understands the technology and statistics that provide a continuous audit and assurance of the system. Spreadsheets become one of many tools that she uses. Finally, she has the ability to work remotely and find solutions to problems if she is unsure in a situation. The RTE auditor's skill set is the key to her success. The attitude, behavior, and objective knowledge differentiate her from the traditional auditor.

Attitudes

Attitudes drive the dynamic transition from traditional auditing to an RTE paradigm. Many of these attitudes are developed long before a student enters an accounting program. However, exposure to the issues facing the RTE, such as technology adoption and change management, should enable students to refine these skills and anticipate the situations they may encounter.

Ethics

While there is open debate over whether ethics can be taught (Leung and Cooper 1994), accounting education has witnessed a remarkable incorporation of ethical discussion into classroom protocol. The RTE introduces new ethical quandaries related to information provisioning, the automation of entire sub-processes, the global nature of business activities, and the emerging use of technology in the workplace.[4]

Technology Adoption

The development and application of technology within business requires auditors to have an attitude of constant technology discovery. Greenstein-Prosch et al. (2008, 45) state "[a]uditors would normally be expected to have higher knowledge than the average accountant since they must audit the work of many different clients with diverse information systems." They find that auditors are already well versed in e-commerce, general office automation, and some audit automation. We assert that RTE auditors must be able to evaluate technology and match capabilities and features to the needs of the audit.

Openness toward Change

Change in technology, social trends, business processes, accounting standards, and accountant behavior is a part of life. As the audit requirements change, the RTE auditor must possess an attitude that allows her to respond. This skill increases the effectiveness of the audit. Auditors need

[4] For a well-documented list of resources for ethics in accounting, see the work of Thomas (2004).

to possess the ability to adjust their behavior in the RTE. The same adaptability is required for progressively dynamic standards, business activities, and, most of all, changes in risk profile.

Behavior

The RTE will require many changes in the behavior of the auditor. These changes can be facilitated and encouraged by audit educators. The primary focus should be on encouraging students to foster an attitude of lifelong learning. They should understand what the RTE is and how it will affect their function as auditors.

Client Interaction

Future engagements will typically involve substantially more remote interaction and data transfer with less face-to-face interaction. Educators will need to define and demonstrate the balance between a need for audit deterrence, a decreasing auditor presence in the facility, constant auditor-client interface, and an increased "audit by exception" approach. As remote audits become increasingly common, auditing students will also need to learn how to deal with clients and team members when they are far apart and unable to meet in person.

Working with a Team

As is the case in many other business processes, virtual teams will turn from the exception to the norm, aiming to explore and exploit niche competencies, diverse geographic locations, uncoordinated and often unpredictable audit actions and plans (Blackburn et al. 2003). Audit educators must emphasize the importance of proper virtual teamwork, discussing the attributes of a successful virtual team as distinct from a group operating in physical proximity to one another.

Dealing with Standard Setting Entities and Regulators

To meet the needs of RTE participants, there will be an increased set of regulations. Consequently, auditors will be required to interface with government entities and standard setters on a more frequent basis. The relationship between auditors and standard setters will eventually entail a wide range of knowledge management and information provisioning tools. For example, the SEC has been provisioning an XBRL instance reader during the deployment of the rule in the U.S. Educators must account for this eventuality by both familiarizing students with the most up-to-date standards-retrieval methodologies available and empowering them to discover future tools later on in their careers.

Managing the Engagement

Audit educators must anticipate and address the challenges posed by the virtual team, the auditor's virtual presence over a virtually uninterrupted time frame, and the existence of a wide gamut of bespoke audit tools. Furthermore, as most audit entities will have engagement management tools that are complex and often not tailored for one particular auditor, company, or client, the educator's inclusion of training for any engagement management software[5] would represent a tremendous benefit to students.

Learning Technology on the Job

Due to the rapid and constant changing of technology and standards, educators will need to focus more of their time on imparting an understanding of key underlying accounting concepts. The minutiae of standards and procedures are already extensively embedded in ERPs. Students should know where to efficiently locate auditing and accounting standards on the Internet and

[5] For example, Thomson provides online training for and a free trial of its Engagement CS software at http://cs.thomsonreuters.com/engagement.

through various other sources, and how to extract information in order to formulate integrative knowledge from these sources. By gaining this core competency, students will ideally possess enough basic accounting understanding to knowledgeably search for information, but they will not be overloaded by an overabundance of detail. Their integrative knowledge will combine basic and acquired information to formulate an integration of accounting rules, audit evidence, and relevant business facts on which to base judgment.

Objective Knowledge

Audit education must ensure that students understand the key concepts underpinning modern accounting software (Greenstein-Prosch et al. 2008). While they need not be IT professionals, students should have an understanding that reaches beyond the level of office software. They need to understand what the "black box" is doing to produce the evidence they will evaluate and the analytics being used in common algorithms. For example, many CCM procedures are rule-based. Appreciating how key performance indicators are monitored provides insight into how controls function.

Basic Understanding of Technology

Interacting with corporate IT requires a set of skills that goes far beyond basic PC competences, similar to attitudes toward technology adoption and an individual's ability to change. Advancing beyond this basic level will require accounting educators to foster an understanding of essential principles in hardware, software, and business applications.

IT Audit

There is virtually no limit to the power, speed, or granularity of future audit technology. In tandem with the need to ensure understanding of basic IT principles, audit educators must familiarize their students with audit automation tools and more advanced software aimed at data extraction, manipulation, control evaluation, sampling, exception reporting, separation of duties, fraud detection, etc. Specially designed continuous audit software will become a critical part of the day-to-day lives of auditors; it is the job of the educator to prepare them for it today.

Accounting and Auditing Knowledge

Anticipating the coming confluence of IFRS GAAP and U.S. GAAP (Thomas 2009), accounting education in the RTE will be forced to deemphasize factual details and emphasize the ability to intelligently seek details in databases and knowledge bases that have only recently become available.

Certifications

While the CPA certification remains dominant, the broader set of career paths available to accounting professionals is increasing the value and visibility of alternative certifications (Charron and Lowe 2009). Rather than focusing entirely on the CPA exam, students should be shown alternatives and complementary certifications that may more accurately match their interests and competences. Examples include:

- Certified Information Systems Auditor (CISA), given by ISACA;
- Certified Internal Auditor (CIA), given by IIA;
- Certified Fraud Examiner (CFE), given by ACFE; and
- Certified Information Technology Professional (CITP), given by the AICPA to qualifying CPAs.

ADAPTING AUDIT EDUCATION

Accountants and auditors need to be equipped with a sufficient understanding of how changes will affect their work. The traditional accounting education model tends to rely on knowledge of accounting concepts and rules (Figure 3, left side). Audit education must shift students' focus onto attitudes, behavior, and objective knowledge. Putting these three dynamics at the core of an audit education program will prove immensely beneficial to the RTE auditor.

Just as the RTE will force managers and auditors to re-consider current practice (Stewart 2000), it will also require a substantial rethinking of educational objectives and processes. Undergraduate audit education has adapted, to a certain degree, with the introduction of additional offerings such as second audit and forensic courses, increased emphasis on IT audit, adoption of cases, and substantial inclusion of vendor-provided teaching materials. However, any further steps taken by audit educators to foster improved attitudes toward lifelong learning of IT will immensely benefit students.

Audit educators are a critical link between today's auditing students and tomorrow's technology-laden auditing environment (Auditing Section Education Committee American Accounting Association 2003). Because new technologies are driven by the state of the art, it is imperative to teach future auditors these skills while they are still young, as younger people have been found to be most likely to adopt new technology (Morris et al. 2005). Educators owe it to their students to present the approaching 'real world' with as much accuracy and candor as possible. These emerging ranks of new auditors, armed with the right tools and competency in their usage, will be the ones to simultaneously handle and drive the change within their audit firms.

The attributes we advocate in this position paper will ideally be taught primarily in undergraduate auditing courses and fraud courses, as well as their graduate level equivalents. They should not, however, be omitted from other introductory and intermediate courses, as these courses form the foundation upon which auditors base their expertise. Some of the more technical attributes may be supplemented by additional courses in subjects such as statistics and management information systems.

Educating the RTE Auditor

Students should understand what goes into CDA, CCM, and CRMA, and how it will affect their future audit engagements. CA instruction can open students' minds to business process automation. Students can practice using analytical and statistical tools, such as ACL or SAS, and lecture time should be dedicated to explaining the mechanics behind the analytics being performed. The instructor can then link engagement steps to audit objectives and help students adjust their plans as evidence from the continuous audit is introduced.

Educating Attitudes

The attitudes adopted by auditors in relation to ethics, technology adoption, change, and adaptability are currently based upon a static paradigm. Moving from traditional, detached views of technology to a more open and proactive view requires a shift that can be addressed using many existing forms of instructional media. In Table 1, we link those media to changing attitudes and show how to address these changes.

Educating Behavior

The way auditors react is as important as their *a priori* attitude. In shifting from traditional auditor behavior to skills required in the RTE, identifying sources of information and conducting additional team simulations will help students determine correct responses, interact with different

TABLE 1
Teaching Attitudes in the RTE

Skill	Traditional Approach	RTE Approach	Sample Instructional Media
Ethics	A segmented approach to ethical behavior.	A proactive integrative attitude towards ethical behavior and consideration for new dilemmas related to the RTE.	Case/Simulation: Use cases tied to team simulation, with additional ethical ambiguity.
Technology adoption	Spreadsheet-based approach.	Constant search for new relevant technologies.	Context: Identify resources for students to explore. Remote: Assign projects that require an online/remote component.
Openness toward change	Change limited by regulation and litigation considerations.	Openness to change.	Simulation: Run team simulations incorporating cost/benefit analysis and examples of successful implementation.
	Substantial conformity to rigid audit and accounting standards.	Adaptability—risk-based assurance and principle-based accounting.	Lecture: Expand the discussion of risk and IFRS.

personalities, and determine where to find answers to open questions. Table 2 provides guidelines for instruction based on these changes.

Educating Objective Knowledge—Accounting and Technology

Objective accounting knowledge can aid students in identifying how to use emerging tools to perform more efficient and effective audits for their clients. Table 3 links a series of changed knowledge base needs of the auditor to a more modern knowledge set. These needs are segmented based on the usage and context of basic IT and other wider learning needs.

Instructional Media

An instructional medium is defined here as any method or tool designed to facilitate learning and instruction to satisfy a set of learning objectives. Lectures, cases, software instruction, software exercises, classroom presentations, projects, group assignments, and other tools can be used independently or aggregated as instructional media. To help educators in developing students' RTE skills, we have gathered some examples from the literature and our own experience. This section will link the new auditor skill set to a series of instructional media.

While these media are extensively discussed in the literature, they are only beneficial if they are adopted, fundamentally altering the traditional stand-and-deliver approach. It is not enough to give lip service to a new technique; the educator must understand and appreciate the reasoning behind the technique in order to use it effectively. For example, our own anecdotal evidence suggests that students arbitrarily assigned case studies feel there is not sufficient time and discussion dedicated to maneuvering the details of the case. Students perceive poorly used media and learning aids as a waste of time (Jones and Wright 2010). Thoughtful and deliberate inclusion of the media discussed in this section is intended to provide value to an auditing course.

TABLE 2
Modifying Behavior in the RTE

Skill	Traditional Approach	RTE Approach	Sample Instructional Media
Client interaction	Face-to-face interaction	Traditional client interaction with remote/distance coordination	Simulation: Audit simulation teamwork with role-playing of both auditor and client; have teams perform the simulation using online conferencing tools.
Teamwork	On-site teams	Remote team management	Remote: Require distance interaction for the audit team in the case above.
Managing the engagement	Predetermined audit plan	Dynamic engagement	Lecture: Identify steps of an engagement with tight linkage to audit objectives. Context: Introduce evidence that forces teams to make adjustments to original audit plan.
	Sequential audits	Simultaneous remote engagements	Simulation/remote: Run an auditor/client team simulation with remote participation feature.
	Focus on U.S. GAAP	Wider consideration of business process measurement	Case: Introduce an international case with cross-nation consolidation
Learning technology on the job	Extensive focused training	Ability to self-teach new technology tools	Context: Show students where tutorials and help can be found; Do not provide detailed instructions.

The media include lectures, cases, team simulation, remote projects, contextual learning resources, supplemental instruction, and emerging methods. While we attempt to identify use of these tools to enhance the RTE auditor instruction, this list is by no means intended to be comprehensive or exhaustive.

Lecture

Lectures remain central to the current learning process, but there remains ample opportunity to tweak them for the RTE skill set. Through exposure to lecture-enhancing tools, such as tablet PCs and real-time classroom response systems, students are more likely to get accustomed to new uses of technology and experience the process of technology adoption firsthand.

Using lectures simply to explain how technology works or provide a hands-off demonstration may not be sufficient for students to gain confidence with these tools. Altering the traditional lecture format to include more hands-on experience may spark a student's intellectual curiosity and problem solving skills in a controlled environment. Guest speakers, discussions, and other

TABLE 3
Focusing on Objective Knowledge

Skill	Traditional Approach	RTE Approach	Sample Instructional Media
Basic knowledge of technology	Introduction to technology	Fundamental understanding of the concepts and methodologies of IT	Lecture/exercise: Enhanced traditional approach with hands-on component
IT audit	Basic IT audit	Greater focus on IT audit	Lecture: More thorough discussion of IT audit tools. Exercise: Include IT audit software assignments
Technological audit tools	Limited mention of audit-specific software tools	Automated work papers	Exercise: Cloud computing exercise to manage auditor/audit client simulation
		Performance of data extraction	Exercise: ACL/IDEA utilization assignments
		Use of statistical analytical tools	Lecture: Identify statistical methods to be used and provide exercises with a focus on the usage of advanced analytics; Basic overview of a statistical package like SAS or SPSS
		Understanding of ERPs	Lecture: Discuss cases on ERP usage, as well as the basics of ERP
		Understanding of mid-level accounting packages	Exercise/case: Bookkeeping assignment using an accounting package (e.g., QuickBooks) and an audit case around it.
Accounting and audit knowledge	Memorization of essential accounting and auditing facts	Wider knowledge set aimed at improving search and information acquisition skills	Context/case: Discuss auditing cases and have students hunt for specific procedures or standards.
Certification	Primary focus on passing the CPA exam	Passing a variety of professional certification exams; Ability to find information in online and offline sources; Knowledge of existing sources; Ability to extract/find information and form a story.	Supplemental: Emphasis on broad basic knowledge … reliance on "test prep courses" Exercise: Series of practical exercises of rapid information search and contextual reporting

426 complementary elements can help students focus on experiencing an active dialog. As an example, 426
427 Radtke (2004) shares a model for transforming a lecture into an ethical conversation with students, 427
428 incorporating instruction, discussion, and group simulation. 428

Case

Case studies present the real-world experiences of companies. Used properly, they help readers identify factors that lead to success or failure. The use of cases in accounting curricula is well documented in the literature, with examples of cases touching on integrated audit (Gelinas et al. 2008), team management (McConnell and Sasse 1999), and other audit-related themes. Textbooks are lined with cases that present real-world examples in an effort to provoke student thought.

For the future RTE auditor, cases containing more challenging ethical ambiguity can lead to deeper discussion and reflection and enhance ethical training. Additional cases on ERP use and consolidation with international financial reporting standards can help students hone more specialized and relevant skills.

Team Simulation and Exercises

In team simulation, students assume roles of professionals and deal with real-world situations. Examples of simulation use in teaching concepts from sampling to audit risk are prevalent in the literature (Gelinas et al. 2008; Green and Calderon 2005; Springer and Borthick 2004; Hiltner 1983). Green and Calderon (2005) show that a student's level of learning and satisfaction increase with simulation use.

Several approaches to team development are also present in the literature (McConnell and Sasse 1999). Bryant and Albring (2006) conduct an extensive review of psychology and organizational behavior literature to provide guidance on team building in an accounting environment.

Team simulation helps auditing students develop client-interfacing skills, particularly when dealing with the remote audit. One approach we have attempted divides students into auditor/auditor client teams and presents challenges that these two groups face, including time and management constraints. In this example, teams are assigned to participate as both auditors of one team and audit client of another. Throughout the simulation, planning, working papers, etc. can be maintained on a collaboration website (such as Google Sites) to incorporate a remote/cloud element (see remote projects) into the scenario. Additionally, teams work through the cost/benefit analysis of implementing different forms of audit automation.

Remote Projects

Increasingly, audit teams conduct remote audit engagements and access electronic work papers through an online portal provided by their firm. Cloud computing, which enables data storage and access over the Internet or a virtual private network, is becoming more and more relevant as business processes and workflows gravitate toward online storage. Exposing students to online tools, such as Adobe ConnectNow (http://connectnow.acrobat.com) for web conferencing and Google Sites (http://sites.google.com) for collaborative wikis may prove valuable for them as they begin their careers. Many of these services are available for students to use free of charge.

Contextual Learning

Contextual learning is a valuable skill that allows students to identify resources used to help them solve problems. Understanding how standards and procedures work and knowing where to locate their definitions and interpretation are vital to the contextual learning paradigm. This is particularly important in the advent of international standards integration.

Understanding the tools that aid contextual learning is one of the key behavioral skills that accounting students should possess. As accounting education moves away from a primarily memorization-based scheme, knowing where to find supplemental information on accounting rules (e.g., online databases, expertise of seasoned auditors, and personal libraries) becomes a vital tool for students. Knowing how to search is as important as knowing where to look. Brief instruction in this area can go a long way to help students be effective auditors.

Assignments can couple contextual learning with an emphasis on specialization to enhance team simulations. As they work in teams, students are assigned specialties and then refer to each other when issues arise. Some courses have benefited from accounting "treasure hunts." In this exercise, students are provided only limited information to solve a problem. In lieu of full disclosure, a list of resources is provided where answers can be found.

Supplemental Instruction

As we move away from a CPA-centric curriculum, greater reliance will be placed on certification test prep courses (e.g., Becker, Kaplan, etc.). Jones and Fields (2001) suggest that supplemental instruction effectively increases academic performance. As more students move to these supplemental instructional resources, the audit educator's syllabus can be diversified into more engaging instruction and conceptual learning.

Emerging Methods

New methods of conveying knowledge and identifying resources are continually being discussed and implemented. Additional work should be done to determine instructional media that can be used to better convey the concepts outlined in this paper. Ideally, audit educators will spearhead this movement, sharing new ideas and methodologies to help one another prepare auditing students for the environment that awaits them in the real world.

CONCLUSION

The arrival of the RTE represents a major tipping point for the auditing profession, one that cannot be ignored. Audit education must catch up with the progress being made in the rest of the business world in order to maintain relevance. The change we advocate is neither revolutionary nor impossible, but rather evolutionary and necessary. By taking proactive steps, today's university instructors can train tomorrow's auditors not only to be aware of the state of the art, but also to be able to take advantage of further progression of the field.

We contribute to the literature by linking the RTE environment to specific auditor skills. We further provide value by proposing educational media that can be integrated into the traditional educational context and provide opportunities for students to acquire these skills. While none of the media are new, the context is unique and provides accounting academics with a framework to creatively train future professionals and a basis for future empirical pedagogical research.

While the discussion in this paper is focused primarily on the RTE's impact on auditor training, this issue cannot be separated from current standard setting practices and other extrinsic factors. For example, in the United States, individual state societies determine educational requirements for accountants, and these requirements may not fully incorporate RTE concepts. The reality is that students come to the educational environment to acquire employment, which is universally contingent on professional certification. Without a dramatic shift in the focus of these certifications, the educational approach may not be perceived as value adding and will create a clear double bind.

Predicting the direction of future technology is a task fraught with difficulties (Christensen 1997). Disruptive events, such as the emergence of the Internet, have substantially changed audit practice and consequently education needs. The ability of future auditors to apply their newfound skills and knowledge is based upon the reaction time of audit firms and standard setters. Once again, the closed loop between auditing education and audit practice necessitates a proactive approach from both sides.

Finally this position paper is forward-looking and incorporates a vision of what audit education can become, not a description of current practice. This paper is mainly normative and based in internal logic and experiential evidence. There is a tremendous and as yet unfilled need for

serious empirical research on audit education and consequent auditor career development, including attitudes, technical competences, behavioral skills, and career paths. The educational media discussed in this paper are educational tools used over the years, following what we feel is a natural succession from current trends. Objective assessment and long term career monitoring and tracking (cf. Schein 1971) are needed to guide the profession to a more RTE-relevant set of procedures.

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