

**USING ELECTRONIC AUDIT WORKPAPER SYSTEMS IN AUDIT PRACTICE:  
TASK ANALYSIS, LEARNING, AND RESISTANCE**

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**SUMMARY:** While many audit firms have adopted electronic systems for workpaper preparation and review in hopes of improving both efficiency and effectiveness, prior research shows that the expected gains may be difficult to achieve. In order to investigate possible sources of difficulty in full use of these systems in audit practice, this paper identifies individual task components involved in workpaper preparation and review. We assess the relative difficulty of performing the individual component tasks, and examine the “learning curve” by relating difficulty ratings to performance frequency. We also assess which component tasks are more difficult in an electronic versus a paper environment, and measure auditor resistance to the electronic system after one to two years of use. Using survey data from auditors at an international audit firm that recently adopted an electronic workpaper system, we find that tasks involving “navigation” around the electronic system (e.g., agreeing lead sheets with workpapers) are the most difficult for auditors to accomplish. Audit managers and partners express greater difficulty with the electronic system, and report using fewer of the capabilities of the system, relative to staff and seniors. Finally, we present reported incidence of “working around” the system, including behaviors such as creating review notes and storing workpapers outside the system. The difficulties that we document present possible implications for complying with professional standards such as *Auditing Standard No. 3*, on audit documentation. Our results are useful to audit practice in targeting training efforts, and to research in providing topics for study of decision improvement.

**Key Words:** Auditing, Audit Workpapers, Systems Implementation, Technology, Training.

**Data Availability:** Inquiries regarding potential uses of the data may be directed to the contact author.

# **USING ELECTRONIC AUDIT WORKPAPER SYSTEMS IN AUDIT PRACTICE: TASK ANALYSIS, LEARNING, AND RESISTANCE**

## **INTRODUCTION**

This study investigates specific sources of difficulty faced by auditors in preparing and reviewing workpapers using electronic systems. In addition to documenting the component tasks in which greater difficulty occurs, we assess whether difficulty is reduced by greater frequency of practice, and whether the negative association of difficulty with frequency differs among preparers (audit staff and seniors) and reviewers (manager and partners). We further assess reports of “working around” the system after a period of experience with it, which may contribute to inefficiency in system use.

Our analysis is motivated by two trends in the audit industry. First, while some audit firms have shifted from paper to fully electronic environments for audit work systems (Yang 1993; Rothman 1997; McCollum and Salierno 2003), others have adopted partially electronic systems (e.g., simply creating pdf files for storage) or are still considering making this transition. Further, based on our discussions with practicing auditors, there is important variation in the nature and use of electronic audit workpaper systems even at the largest firms, which implies resistance by some auditors to fully incorporating the systems into their everyday audit practice. For example, while some firms require all personnel to use the system, others require only staff and senior auditors to use the system. Some firms allow individual partners to “opt out” of using the system on specific engagements, while others do not. Some firms require that all tasks are completed using the system, while others require only certain tasks to be completed using the system. Some firms require use of the system for electronic storage of documentation, while others allow storage of documentation in both electronic and paper formats. Further, there are often pockets of clients for which electronic systems are not yet appropriately tailored to

industry-specific needs, e.g., governmental and non-profit engagements, so in these industries the traditional paper-based system is still in use. These variances in practice imply that the move toward electronic workpapers in the auditing industry is an ongoing, dynamic process.

The second trend that motivates our analysis is that regulators are currently very interested in auditors' use of electronic audit records for maintenance of engagement documentation (e.g., PCAOB 2004). As our anecdotal evidence suggests, there is considerable variation (even among the largest audit firms) in how such documentation is developed and maintained. While some sources of variation are known because they result from design features, in other cases variation in documentation may occur based on varying system usage. This variation may gain importance due to the PCAOB inspection process and the requirements of *Auditing Standard No. 3*.

While these trends motivate research on electronic audit workpaper systems, there are only a few studies that investigate issues associated with use of such systems. What these studies reveal is that there are potential effectiveness and efficiency difficulties associated with adoption and continuing use of electronic workpaper systems (Bedard et al. 2003; Brazel et al. 2004; Bible et al. 2005; Rosman et al. 2006). These findings are not surprising, given that prior research in the contexts of education and information systems shows that information processing in computerized environments involving hypertext is cognitively demanding because using the technology requires devotion of some portion of short-term memory that would otherwise be used for processing of task information (e.g., Thuring et al. 1995). Further, hypertext environments promote nonlinear (non-sequential) processing, further complicating task performance (e.g., Mills et al. 2002). Due to the increasing use of electronic practice tools in auditing and evidence that auditors might not perform better in electronic environments, further

research is clearly warranted. Specifically, research is needed on the sources of difficulty that auditors are experiencing difficulties with electronic workpaper systems in practice, and the extent to which they are ameliorated by system experience.

To study this issue, we worked with personnel at an international auditing firm that had recently introduced an electronic audit workpaper system in its U.S. practice. This firm was interested in supporting research that could help assess specific areas in which further training and support could be most usefully directed.<sup>1</sup> Working jointly with system developers, we developed a taxonomy of the individual component tasks involved in preparing and reviewing audit workpapers electronically using the firm's system. Using this taxonomy, we surveyed firm personnel with one to two years' experience using the system (having a mean of 28 electronic engagements overall), regarding their perceptions of the difficulty of the component tasks and the frequency with which they accomplish those tasks. Our analyses relate the difficulty of each type of task to performance frequency, to assess the extent to which specific steps are subject to a learning curve effect. We compare which component tasks are relatively more difficult in electronic environments, and assess the extent of specific behaviors that indicate auditors are working around the new system. Contact personnel at 12 U.S. offices of the firm distributed the survey, and we obtained usable responses from 119 audit personnel at all ranks.

The results provide information about the processes of constructing and reviewing audit workpapers using electronic audit workpaper systems. Our taxonomy contains 38 component tasks performed by workpaper preparers (staff and seniors), and 28 component tasks performed by workpaper reviewers (managers and partners), classified into the categories of system security, data input, organization of the file and verification of data, and review. Overall, our results reveal specific tasks that auditors consider relatively difficult in the electronic system

(e.g., ensuring that workpapers are updated for adjusting journal entries and tracing amounts from financial statements to lead sheets, among others), whose common characteristic involves “navigating” around the electronic system. Further, reviewers find the electronic system more difficult to use than preparers.

Regarding the overall learning curve associated with the new system, results show that it takes about five engagements on average before personnel are comfortable using the electronic system, although reviewers report a greater mean and range on this measure. Auditors at all levels report a significant increase in using the full capabilities of the system over time. However, there is evidence of variance in full use of the system, based on responses to questions about behaviors suggestive of “working around” the system (e.g., creating review notes on paper outside of the electronic system). Both preparers and reviewers report reduced incidence of working around the system as they gained familiarity with it, but we still find some reports of these behaviors even after system familiarity is achieved. In sum, our results show improvement in system use with practice. However, we identify specific pockets of difficulty that persist even after considerable system use.

Our results are useful to audit practitioners as they develop new electronic audit workpaper systems, as they revise existing systems, and as they consider how to focus training on areas of greatest difficulty to their professionals. Further, leaders of audit firms may find this research useful as they consider implications of variation in documentation (and related regulatory risk) associated with the challenges of electronic audit workpapers. Our results are also useful for researchers in designing studies about specific features of the audit workpaper preparation and review process, and are useful for educators in preparing students for audit practice. The remainder of this paper is organized as follows. The next section provides a

discussion of the issues concerning using electronic audit workpaper systems. We then discuss our methods and results. Finally, we describe our overall conclusions.

## **USING ELECTRONIC AUDIT WORKPAPER SYSTEMS**

Entities of all types are incorporating electronic technologies with the objective of improving effectiveness and efficiency of business processes (e.g., Bell et al. 2002). However, there are indications that the goal of the “paperless” office is often not completely achieved, and that employees often attempt to circumvent electronic systems by reverting to paper processing. Research in other contexts shows that users bypass newly implemented work systems by reverting to the former system for certain tasks (Chau 1996), by duplicating tasks in both old and new systems (Sellen and Harper 2002), and/or by not using the new system correctly (Markus 1983; Hartwick and Barki 1994). In addition, even when individuals have a strong motivation to appropriately use an electronic system, their success may be limited because of the complexity of the task and associated disorientation within the electronic system (e.g., Nielsen 1990), or because their task knowledge is not well-developed enough to most successfully leverage system features (Mills et al. 2002).

In the case of a fully integrated workplace system, such as those developed by some of the large audit firms, there are a number of potential consequences to reverting to paper for performance of difficult steps in electronic file construction or review. The audit workpaper is a legal document containing evidence supporting the audit opinion. The completed workpaper compiles evidence, which for audits of large companies, is accumulated over a period of time by many individual professionals acting in a hierarchy. Each firm has a defined, complex set of procedures that must be performed in a certain order, aggregated, and reviewed for completeness. Bypassing the system by working off-line can affect efficiency, effectiveness, or

both. Inefficiency could result if tasks are duplicated, while ineffectiveness could result if key workpapers were lost or the file was not constructed correctly so that it could not be easily reviewed. Further, if preparers of the engagement file print out workpapers or lead sheets during the engagement, they will not be using the system linkage and cross-referencing capabilities. Thus, subsequent reviewers of the file will be unable to perform an efficient review. Creating review notes on paper at any point in the team hierarchy will also result in subsequent reviewers being unable to access them from remote locations. Thus, there are potentially important consequences to working around the system by resisting electronic functionalities and reverting to paper processing. In addition to consequences for the engagement itself, in the U.S. the integrity of the workpaper is crucial as a foundation for later inspection by the Public Company Accounting Oversight Board (PCAOB 2004).

Despite the key role of electronic workpaper systems, there is little research on the audit effectiveness and efficiency implications of these systems. While few in number, these studies provide preliminary signals of concern. For instance, Bible et al. (2005) find audit effectiveness decrements resulting from difficulties in navigating around an electronic audit workpaper system. Extending those findings, Rosman et al. (2006) show that auditors' difficulties in electronic environments are associated with system complexity, and that the most successful auditors in the electronic environment adapt to it by limiting the extent of their navigation around the system and instead focus on understanding and remembering the information gained from the system. Further, Brazel et al. (2004) show that, compared to those anticipating face-to-face review, auditors anticipating electronic review are less concerned about audit effectiveness, more likely to be influenced by prior workpapers, and feel less accountable for their work. Further,



Glover et al. (2000) find that many internal auditors report using internally developed software in performing their professional roles, but their satisfaction with these tools varies widely.

While these studies motivate further research on effectiveness and efficiency in electronic versus paper environments, the issue arises as to whether such effects would be limited to new system applications, or whether they would persist following training and/or practice. On the issue of training effects, Bedard et al. (2003) find that face-to-face training prior to implementation improves auditors' perceptions of system quality and intentions toward using a new electronic workpaper system. However, they also find that auditors' perceptions of their own ability to perform audit tasks using the system does not necessarily improve with training. Thus, the little evidence on improvements due to training in this context is mixed. Regarding the effect of practice, we are unaware of any relevant research in the auditing context, thus motivating the current paper.

In order to identify sources of difficulty in accomplishing work within an electronic audit workpaper system, it is important to understand the basic nature of the tasks that auditors complete. However, we are unaware of published academic or practitioner articles describing the exact nature of the tasks that auditors with different work roles accomplish using electronic audit workpaper systems. Gaining this understanding is important from a practical standpoint for guiding implementation and training, but it is also important because performing good research in auditing requires detailed understanding of the component tasks involved (Abdolmohammadi and Usoff 2001; Trotman 2005). Our first set of research questions seeks to provide information in this regard, defining the component tasks and assessing their relative difficulty:

- (1) What component audit tasks are involved in an electronic audit workpaper system for auditors in different workpaper roles?
- (2) How difficult are the component workpaper tasks?

- (3) Which component tasks are more difficult in an electronic system compared to a traditional paper audit workpaper system?

The second issue in using electronic audit workpaper systems concerns the transition to those systems. As previously noted, research in other business contexts finds that the full benefit of paperless office systems is often not achieved because employees often work around systems. In the current context, there is evidence of effectiveness problems associated with electronic systems (Bible et al. 2004). However, it may be that repeated performance of workpaper tasks within the context of an auditor's normal practice would resolve this issue over time. To our knowledge, the extent to which difficulties in performing electronic audit workpaper tasks are reduced with practice has not been investigated. We approach this issue by assessing the frequency of performance of component tasks using the electronic workpaper system, and then considering the correlation between difficulty and frequency of task performance. In addition to this analysis, which is aimed at providing insight into the individual aspects of the workflow, we also assess the learning curve associated with performing workpaper tasks on the system by evaluating auditors' comfort using the system. Stated formally, our second set of research questions is:

- (4) How frequently do auditors complete the component workpaper tasks?
- (5) What are the factors affecting auditors' learning to use the new system?

The third broad issue involved in using electronic audit workpaper systems concerns potential auditor resistance. Prior research on technology adoption consistently demonstrates that people of all types and across a multitude of technology-based systems are prone to resisting these systems, despite the best efforts of system designers and administrators (e.g., Sellen and Harper 2002). Therefore, understanding how auditors might try to work around systems, and the

frequency with which they do so, is important. Further, we also address the learning curve in this context by assessing whether these resistance behaviors decline with system experience.

- (6) What is the frequency of possible resistance behaviors that might be expected as auditors adopt an electronic audit workpaper system?
- (7) Does the frequency of those resistance behaviors decline with experience using the system?

## **METHODS**

### **A Description of the Electronic Audit Workpaper System**

The electronic audit workpaper system of the participating audit firm encompasses all phases of the audit process. Auditors begin the process of engagement file construction by gaining access to the system, which is password protected and has file-sharing features that enable remote users to simultaneously access and change the file. Once access is gained to the system, workpaper preparers work with a master file containing generalized procedures that enables the auditors to conduct an effective audit that appropriately controls risks. Workpaper preparers can tailor the file to address specific client risks, including setting the strategy to be used on the engagement and altering the nature, timing, and/or extent of planned audit procedures. Workpaper reviewers can electronically access the file, making changes and electronically inserting review comments.

Once planning is accomplished, auditors use the client-tailored engagement file to perform the engagement. The file contains standard workpaper templates for auditing routine account balances, and auditors use these to update information from prior years. Auditors insert electronic memos into the file in order to document discussions with the client or create short notes about the results of a test or procedure. Copies of related files can be embedded within the master file or an electronic link can be made between files. The system has various

functionalities that assist auditors, including electronic tickmarks, and the generation of a workpaper reference list that documents all tasks accomplished and reviewed, and all tasks for which work still needs to be accomplished. The system uses a cascading windows-type feature that enables auditors to view and copy portions of various files on the computer screen at the same time, and there is an electronic scratch pad for making quick mathematical calculations. The audit firm's decision aids are linked into the system, including the audit sampling tool.

The system automatically records which system user accomplished each audit task, and the time that each task was accomplished. Auditors save electronic copies of the file at least twice daily, and the system saves changes to the file and stores them at a remote site daily. The completed engagement file is electronically archived at a secure, remote location. Finally, the system contains a roll-forward feature that makes it possible to create a new engagement file while maintaining the tailoring performed in the prior year.

### **Procedures and Sample**

With the assistance of system developers and other personnel at the participating international audit firm, we developed a survey instrument to assess auditors' perceptions of the relative difficulty of the component tasks of preparing and reviewing electronic workpapers, and the relative frequency of use. The instrument also captures self-reports of behaviors inconsistent with the goal of electronic processing and storage of audit information (i.e., resisting the system by "working around" it). The instrument was distributed by contact personnel at 12 offices of the firm. Valid responses were obtained from 119 professionals in those offices, a response rate of about 70 percent. Of the respondents, 24 are audit staff, 45 are seniors, 27 are managers, and 23 are partners.<sup>2</sup> Respondents had experience using the electronic system for one or two years. The mean number of engagements using the system is 23 for preparers, and 36 for reviewers.

## **Variable Measurement and Testing**

We designed the survey instrument to assess the relative frequency and difficulty of using all component tasks of an audit using an electronic workpaper system. To address RQ1 (identifying task components), we worked with system developers to provide precise steps involved in constructing and reviewing workpapers on this system. These tasks are shown in Table 1. While the existing literature provides examples of various audit tasks (e.g., Abdolmohammadi 1999, Rich et al. 1997), these general taxonomies do not specifically relate to the component steps used within this particular system. Thus, we relied on developers of this system, who best understood the steps involved in task completion. For purposes of analysis, we categorized the component tasks according to major phases of the preparation or review process.

### **INSERT TABLE 1 ABOUT HERE**

To address RQ2 and RQ4, participants assessed relative difficulty and frequency, respectively, for each component task relevant to their workpaper role. For some component tasks, there is an equivalent audit task in a paper-based system (e.g., creating review notes), and for those tasks participants also made frequency and difficulty assessments relative to the paper environment.<sup>3</sup> We compare the task difficulty ratings between electronic and paper environments to address RQ3.

To address learning effects (RQ5), we: (1) examine the correlation between task difficulty and task frequency, (2) measure the number of engagements auditors complete before feeling comfortable using the electronic system, and (3) evaluate self-reports on the extent to which auditors use the full capabilities of the electronic system (both on the first few engagements and after gaining familiarity with the system). To evaluate resistance to the new system, we worked with system developers to identify behaviors consistent with “working

around” the system (RQ6). We asked auditors to indicate the extent that they engaged in those behaviors on the first few engagements using the new system and after gaining familiarity with the system, in order to measure whether such behaviors decline with system experience (RQ7).

## **RESULTS**

### **Defining the Component Tasks and Assessing Task Difficulty**

Table 1 reports results relating to our first four research questions.<sup>4</sup> Regarding RQ1, the major tasks that auditors complete in electronic audit workpaper systems include security, data input, organization/verification, and review (see Table 1 for specific tasks within each of these categories). RQ2 concerns the difficulty of various component workpaper tasks. Panel A shows variation in difficulty ratings among these major task categories, revealing that the relatively more difficult tasks for preparers in the electronic system involve data input and organization/verification. There is also considerable variation in difficulty within the task categories.<sup>5</sup> For instance, almost 40 percent of preparers indicate difficulty in annotating and completing scanned workpapers electronically (i.e., a response of “Difficult” or “Very Difficult”). Other component tasks with high percentages of difficulty ratings within the data input category include creating scanned documents (28.1 percent), importing client information from external databases (18.8 percent), and refreshing workpapers after AJE’s are booked (16.7 percent). The most difficult component tasks in organization/verification include ensuring that workpapers are updated for adjusting journal entries (22.7 percent) and agreeing lead sheets to workpapers (14.7 percent). All of these tasks are crucial to constructing and maintaining accurate and complete workpapers.

For reviewers, Panel B of Table 1 shows that organization/verification and review tasks are rated as more difficult overall than security tasks. The most difficult organization/verification

tasks for reviewers include ensuring that workpapers are updated for AJE's (46.9 percent) and finding workpapers/memos (32.7 percent). Some of the review tasks causing the most difficulty include determining that workpapers or memos have been prepared for all significant balances appearing on the lead sheets (48 percent), tracing amounts from the financial statements to the lead sheets and workpapers (44 percent), determining which workpapers are key (36.7 percent), ensuring that the workpapers agree to lead sheets (32.7 percent), and ensuring that workpapers have been properly cross-referenced to supporting documents (30.6 percent).<sup>6</sup>

The evidence in Table 1 yields several insights. First, while many tasks are relatively easy, the proportion of auditors indicating difficulty with some component tasks is fairly high, even after fairly extensive electronic experience. This is despite a very well-designed system, thorough training, and continued assistance to engagement personnel by the development team. Second, there is considerable variance in difficulty ratings of component tasks within the input and organization/verification task categories for preparers, and within the organization/verification and review categories for reviewers. This suggests that it is not the activity that is being performed, but some aspect of performing it electronically, that is causing the problem. Third, reviewers' responses indicate greater difficulty on most dimensions than preparers' responses. Thus, although reviewers perform their tasks on more engagements than preparers (a mean number of electronic engagements of 36 versus 23 for preparers), they continue to have difficulty with some aspects of the task, perhaps leading to inefficiency.<sup>7</sup>

Table 2 reports results of RQ3, which concerns identifying tasks that are more difficult in an electronic system compared to a traditional paper audit workpaper system. For preparers, some of the tasks whose difficulty increases the most in the shift to an electronic workpaper environment include: agreeing lead sheets to workpapers, agreeing workpapers to lead sheets and

supporting documents, and tracing amounts from the financial statements to the lead sheets and workpapers. For reviewers, some tasks whose difficulty increases the most in the shift to an electronic workpaper environment include tracing an amount from the financial statements to the lead sheets and workpapers, determining that workpapers/memos have been prepared for all significant balances appearing on the lead sheets, and ensuring that workpapers agree to lead sheets. Taken together, these results imply that the electronic environment seems to present important difficulties to both preparers and reviewers in navigating around the electronic file. It is also interesting to note that reviewers' mean difference in difficulty between paper and electronic environments is much higher than that of preparers', providing further evidence that the shift toward an electronic environment is more challenging for reviewers.

#### **INSERT TABLE 2 ABOUT HERE**

#### **Transition and Learning Issues**

Our second set of findings addresses transition and learning issues. RQ4 concerns the relative frequency with which component tasks are performed. Table 1 Panel A shows that more frequent tasks for preparers include signing onto the electronic workpaper system, inserting Excel and Word workpapers, and creating memos. Panel B shows that more frequent tasks for reviewers include signing off workpapers and memos as reviewed, reviewing Excel and Word workpapers on screen, and reviewing memos on screen.

Table 3 reports results addressing RQ5, which concerns the factors that affect auditors' learning to use the new electronic audit workpaper system. The first way we investigate this issue is by considering the correlation between the task performance frequency and perceived task difficulty. We find that for workpaper preparers, the overall correlation between difficulty and frequency is significantly negative, as is the correlation between difficulty and frequency on



the ten most difficult tasks, which implies that performing a task more frequently reduces task difficulty for these auditors. In contrast, there is the correlations for reviewers are not significant, implying that “learning by doing” is not effective in reducing task difficulty for managers and partners. This implies that managers and partners require more intensive training and assistance in order to become comfortable using the system. When we analyze the association of difficulty and frequency by task category, we find that for preparers, organization/verification is the only task category for which there is not a significant negative correlation, suggesting a learning curve effect. For reviewers, the only task category in which difficulty declines with frequent performance is file security. These findings reinforce the organization/verification tasks as a key source of difficulty in preparing and reviewing electronic workpapers.

### **INSERT TABLE 3 ABOUT HERE**

We also address transition and learning effects by considering the number of engagements auditors completed before feeling comfortable using the electronic system. Based on the results reported above, we expected that reviewers might require more engagements to move up the learning curve. The results in Table 3 Panel B are consistent with this expectation. Preparers’ require an average of 4.63 engagements (with a range of 1-12) to become comfortable with the new system, while reviewers’ require 6.30 engagements (with a range of 1-40). Finally, we investigate the extent to which auditors report using the full capabilities of the electronic system on their first few engagements and after they became familiar with the system (Table 3 Panel C). Means for both preparers and reviewers indicate that auditors generally do not use the full capabilities of the electronic system, even after they are familiar with it (e.g., means of 3.70 and 3.38 for preparers and reviewers, respectively where a three indicates that they sometimes use the system’s full capabilities and a four indicates that they frequently use its’ full

capabilities). However, both workpaper preparers and reviewers report significant improvement in using the system's full capabilities once they get used to the system, indicating that practice does improve system acceptance.<sup>8</sup>

### **Resistance Issues**

Our third set of results concerns resistance issues. RQ6 concerns the frequency of possible resistance or “work-around” behaviors that system developers identified as having potentially negative consequences for efficiency and/or effectiveness. Results presented in Table 4 show that on average, preparers report moderate levels of working around the system, with means representing incidence of these behaviors between “infrequent” and “sometimes”. The most common behavior in working around the system on the first few engagements is storing or maintaining workpapers on paper instead of in electronic form. The most common behavior after getting used to the system is printing out lead sheets and cross-referencing them to the financial statements and audit workpapers rather than doing so electronically. However, in each case, practice with the system significantly reduced the incidence of working around the system. Regarding reviewers' work-around behaviors, the results show that reviewers also report moderate incidence of working around the system on the first few engagements. With the exception of terminating the engagement, the means represent an incidence of these behaviors between “infrequent” and “sometimes”. On the first few engagements, the mean response to the question regarding printing out workpapers so that they can be reviewed is 2.98, and the mean for creating review notes on paper is 2.52. As with preparers, practice significantly reduced the incidence of both behaviors.

**INSERT TABLE 4 ABOUT HERE**

### **CONCLUSIONS**

This paper describes component tasks involved in preparing and reviewing audit workpapers using a fully integrated electronic audit workpaper system, investigating relative difficulty and frequency of performance of these components, the learning curve for electronic workpaper systems, and reporting ways in which auditors try to work around the system while learning. Our findings provide considerable information about the processes of constructing and reviewing audit workpapers in electronic environments.<sup>9</sup>

Our first set of results relates to task difficulty. We identify 38 tasks performed by workpaper preparers (seniors and staff), and 28 tasks performed by workpaper reviewers (managers and partners) within electronic workpaper systems. We classify these into the categories of system security, data input (setting up the engagement file), organization of the file and verification of data, and review. Our analysis shows that reviewers consider working with the electronic system to be more difficult than do preparers. The results also reveal that the tasks that seem most difficult for both preparers and reviewers involve navigating around the electronic system. For example, almost half of preparers report difficulty completing tasks such as tracing amounts from the financial statements to lead sheets/workpapers, determining that workpapers/memos have been prepared for all significant account balances, and ensuring that workpapers are updated for adjusting journal entries. Further, when auditors compared the difficulty of tasks in electronic and paper environments, the results also reveal that “navigation” tasks are particularly difficult. Our finding of persistent navigation difficulties, even after one to two years of using a system carefully designed to assist file construction and review, reinforces the results of Bible et al. (2005) on navigation problems in electronic audit workpaper systems. Therefore, system design, implementation, and training need to be especially targeted toward addressing this difficulty.

Our second set of results relates to transition and learning effects. When we correlate task difficulty and frequency ratings, we find that completing tasks more frequently within the electronic system is helpful in reducing task difficulty for workpaper preparers, but not for reviewers. Since preparers spend more time actually using the workpapers in their job role (Rich et al. 1997), it may be that while frequency improves difficulty perceptions for these auditors, this relationship takes longer to develop for reviewers because they simply spend less time on task. Regarding the overall learning curve associated with the new system, results show that it takes preparers between four and five engagements before feeling comfortable using the new system, whereas it takes reviewers between six and seven engagements. Auditors also report a significant increase in using the full capabilities of the system once they become familiar with it. Once familiarity is gained, preparers indicate greater use of the system's full capabilities than reviewers. These findings suggest that training using highly realistic cases is important, and that oversight or peer review may be appropriate to ensure quality on engagements when teams transition to a new electronic system.

Our third set of findings concerns resistance issues. While the use of self-reports to capture these behaviors might under-represent their incidence, we find that personnel at all levels report some behaviors indicating "working around" the system (e.g., creating review notes on paper outside of the electronic system or storing documentation in a paper binder instead of on the electronic system). Both preparers and reviewers report reduced incidence of working around the system as they gained familiarity with it, but we still find reports of such behavior by some auditors even after they have gained significant familiarity with the system. This variation in how audit evidence is documented is important because it may result in difficulties in later retrieving evidence for internal quality control and for PCAOB inspection teams. The possibility

of subsequent documentation problems has greater import under *Auditing Standard No. 3* than under previous auditing standards. Audit firms currently using electronic audit workpaper systems, and those transitioning to such systems, should be aware of these findings and should make efforts to ensure that auditor resistance does not result in failure to comply with professional standards.

For researchers, our results motivate emerging research on the audit effectiveness/efficiency implications that may be associated with electronic audit workpaper systems. Bible et al. (2005) summarize this literature by noting that prior research has not demonstrated that electronic environments facilitate information processing (e.g., Dillon 1996). To the contrary, findings of studies within and outside of auditing are consistent in showing performance problems associated with the cognitive load involved in navigating around electronic environments, causing disorientation (e.g., McDonald and Stevenson 1996). While Bible et al. demonstrate performance decrements associated with electronic environments, Rosman et al. (2006) find that specific decision processes overcome this difficulty. Further, studies outside of auditing such as Mills et al. (2002) show that greater domain knowledge is associated with better ability to navigate through a hypertext environment. Complementing these studies, we show that difficulties with performing some audit tasks on a new system decline with practice, but do not disappear completely. From an audit effectiveness perspective, future research could investigate individual auditor characteristics that influence task difficulty, and how task difficulty perceptions subsequently affect individual auditor decision-making (e.g., during the workpaper review process). In addition, research could investigate the extent to which avoiding electronic workpaper systems by “working around” them affects auditor decision-making and the required documentation of audit evidence, and whether these behaviors persist in

mature systems. From an efficiency perspective, studies could investigate the cost-benefit tradeoffs associated with the shift to electronic audit workpaper systems, and how the learning curve on the new systems affects audit efficiency. Studies comparing training methods might also be directed toward auditing students, as effective preparation before entering the workplace will ease the transition for students and reduce cost to firms once they are employed.

In addition to the above research implications, our findings also contribute to audit practice and education. For audit practice, the results provide insight on implementation of electronic audit workpaper systems, including information about the tasks completed within the system and auditors' perceptions of the difficulty of those tasks and auditors' reports on how frequently they use those features of the system. This information should be useful to other audit firms as they design and update their own electronic audit workpaper systems. Further, the results provide evidence on the transition and learning issues associated with the adoption of an electronic audit workpaper system, and provide evidence on the existence and nature of auditor behaviors associated with resisting the new system. Understanding these features should assist system developers and audit firm personnel as they consider potential implementation costs and training needs associated with new electronic audit workpaper systems. We are unaware of any other study that provides evidence on these issues that is derived from the real audit practice environment. In addition, educators will find these results useful to share with students in their descriptions of current practices in audit evidence documentation.

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**TABLE 1**  
**Relative Difficulty and Frequency of Using Audit Tasks in an Electronic Workpaper System**

**Panel A. Preparers**

	<i><b>DIFFICULTY</b></i>		<i><b>FREQUENCY</b></i>
	<i><b>Mean (s.d.)</b></i>	<i><b>Percent rating as difficult</b></i>	<i><b>Mean (s.d.)</b></i>
<i><b>Security Tasks</b></i>			
Manage the security of the file	1.9 (1.0)	4.1	3.3 (1.5)
Check in files	1.8 (1.0)	9.1	4.3 (1.1)
Backup files to external media (to a CD)	1.8 (1.0)	7.6	3.6 (1.4)
Distribute checked out files	1.8 (0.9)	6.1	4.2 (1.2)
Create checked out files	1.7 (0.9)	4.5	4.3 (1.1)
Ensure the appropriate use of signatures by team member who did the work	1.7 (0.8)	4.6	4.2 (1.0)
Backup files to the network	1.5 (0.7)	1.5	3.7 (1.3)
Sign into Electronic Audit System file	1.0 (0.2)	0	4.9 (0.2)
<i>Average of Security Tasks:</i>	<b>1.6 (0.5)</b>		<b>4.1 (0.7)</b>
<i><b>Input Tasks</b></i>			
Annotate and complete scanned workpapers electronically	3.0 (1.5)	39.7	2.5 (1.5)
Create scanned documents	2.6 (1.5)	28.1	2.4 (1.5)
Import client and engagement information from separate databases	2.2 (1.2)	18.8	1.6 (1.2)
Insert scanned documents	2.0 (1.3)	13.6	2.8 (1.5)
Refresh workpapers inserted in Electronic Audit System file after AJE's booked	2.0 (1.3)	16.7	4.7 (0.6)
Use tickmarks	1.7 (1.0)	7.3	4.5 (0.9)
Annotate and complete Excel and Word workpapers electronically	1.6 (0.9)	2.9	4.7 (0.6)
Insert financial statement workpapers	1.4 (0.7)	3.0	4.6 (0.7)
Create Excel and Word workpapers	1.4 (0.8)	1.5	3.9 (1.6)
Insert Excel and Word workpapers	1.3 (0.6)	1.5	4.9 (0.3)
Create memos	1.1 (0.4)	1.5	4.9 (0.4)
<i>Average of Input Tasks:</i>	<b>1.9 (0.6)</b>		<b>3.7 (0.5)</b>

**Notes to Table:** Task difficulty is measured on a scale of 1 (very easy) to 5 (very difficult). Task frequency is measured on a scale of 1 (very rarely) to 5 (very often). In addition to means and standard deviations, the table reports the percent of auditors indicating the task is relatively difficult (i.e., a difficulty rating of 4 or 5).

**TABLE 1 (continued)**  
**Relative Difficulty and Frequency of Using Audit Tasks in an**  
**Electronic Workpaper System**

**Panel A. Preparers (continued)**

	<i>DIFFICULTY</i>		<i>FREQUENCY</i>
	<i>Mean (s.d.)</i>	<i>Percent rating as difficult</i>	<i>Mean (s.d.)</i>
<b><i>Organization/Verification Tasks</i></b>			
Ensure that workpapers are updated for AJE's	2.5 (1.2)	22.7	4.4 (0.8)
Find workpapers and memos	2.4 (1.1)	13.2	4.6 (0.8)
Agree lead sheets to workpapers	2.1 (1.1)	14.7	4.6 (0.7)
Trace an amount from the financial statements to the lead sheets and workpapers	2.1 (1.0)	8.8	4.4 (1.0)
Cross-reference workpapers to supporting documents, lead sheets and financial statements	2.1 (1.0)	8.8	4.4 (1.0)
Cross-reference workpapers to lead sheets and supporting documents	2.0 (1.0)	10.3	4.3 (1.0)
Agree workpapers to lead sheets and supporting documents	2.0 (1.0)	5.9	4.6 (0.6)
Determine which review notes have not been cleared	1.7 (0.8)	1.5	4.1 (1.2)
Determine which procedures have not been completed	1.7 (0.8)	1.5	4.3 (0.9)
Determine which review notes have not been closed	1.6 (0.8)	1.5	4.0 (1.2)
Determine which workpapers/memos have not been reviewed	1.6 (0.8)	2.9	4.2 (1.0)
Determine which workpapers/memos have not been signed off	1.6 (0.8)	2.9	4.3 (1.0)
Sign off workpapers and memos	1.2 (0.7)	2.9	4.9 (0.2)
<i>All Organization/Verification Tasks:</i>	<b>1.9 (0.7)</b>		<b>4.4 (0.6)</b>
<b><i>Review Tasks</i></b>			
Review Excel workpapers on screen	2.1 (1.1)	14.9	4.4 (1.1)
Review Word workpapers on screen	1.7 (0.9)	7.5	4.4 (1.1)
Close review notes	1.4 (0.7)	1.5	4.0 (1.3)
Create review notes	1.4 (0.6)	0	4.1 (1.2)
Review memos on screen	1.3 (0.7)	1.5	4.4 (1.0)
Respond to review notes	1.3 (0.6)	0	4.4 (1.0)
<i>All Review Tasks:</i>	<b>1.6 (0.6)</b>		<b>4.3 (0.9)</b>

**TABLE 1 (continued)**  
**Relative Difficulty and Frequency of Using Audit Tasks in an Electronic Workpaper System**

**Panel B. Reviewers**

	<i><b>DIFFICULTY</b></i>		<i><b>FREQUENCY</b></i>
	<i><b>Mean (s.d.)</b></i>	<i><b>Percent rating as difficult</b></i>	<i><b>Mean (s.d.)</b></i>
<i><b>Security Tasks</b></i>			
Manage the security of the file	2.3 (1.0)	10.2	2.9 (1.3)
Ensure the appropriate use of signatures by the engagement team member who did the work	1.9 (1.0)	6.3	4.0 (1.2)
Sign into Electronic Audit System file	1.2 (0.5)	2.0	4.7 (0.6)
<i>Average of Security Tasks:</i>	<b>1.8 (0.6)</b>		<b>3.9 (0.7)</b>
<i><b>Organization/Verification Tasks</b></i>			
Ensure that workpapers are updated for AJE's	3.3 (1.2)	46.9	3.8 (1.4)
Find workpapers/memos	3.0 (1.1)	32.7	4.5 (0.7)
Sign off workpapers/memos as reviewed	1.6 (1.0)	10.0	4.8 (0.5)
Determine which workpapers/memos have not been reviewed	1.6 (0.8)	4.1	4.6 (0.6)
Determine which review notes have not been closed	1.5 (0.8)	2.0	4.3 (1.1)
<i>Average of Organization/Verification Tasks:</i>	<b>2.2 (0.7)</b>		<b>4.4 (0.6)</b>
<i><b>Review Tasks</b></i>			
Trace an amount from the financial statements to the lead sheets and workpapers	3.3 (1.1)	44.0	3.9 (1.1)
Determine that workpapers or memos have been prepared for all significant balances appearing on the lead sheets	3.2 (1.3)	48.0	4.3 (0.9)
Ensure that the workpapers have been properly cross-referenced to supporting documents, lead sheets and financial statements	3.0 (1.0)	30.6	3.6 (1.2)
Ensure that workpapers agree to lead sheets	2.9 (1.2)	32.7	4.0 (1.1)
Determine which workpapers are key	2.8 (1.2)	36.7	3.5(1.2)
Review Excel workpapers on screen	2.7 (1.1)	24.5	4.8 (0.5)
Review scanned documents on screen	2.6 (1.3)	27.1	3.1 (1.6)
During fieldwork, determine what changes were made to audit procedures approved at the planning stage	2.5 (1.0)	18.4	2.6 (1.0)

**TABLE 1 (continued)**  
**Relative Difficulty and Frequency of Using Audit Tasks in an  
Electronic Workpaper System**

**Panel B. Reviewers (continued)**

	<i><b>DIFFICULTY</b></i>		<i><b>FREQUENCY</b></i>
	<i><b>Mean (s.d.)</b></i>	<i><b>Percent rating as difficult</b></i>	<i><b>Mean (s.d.)</b></i>
<i><b>Review Tasks (continued)</b></i>			
Trace an amount from a workpaper to a supporting document	2.5 (1.0)	14.0	3.9 (1.3)
Indicate that you as reviewer have agreed an amount to a lead sheet or supporting document	2.4 (1.3)	18.4	3.3 (1.6)
Insert the reviewer's tickmarks into a workpaper	2.2 (1.3)	18.4	3.1 (1.7)
At the planning stage, determine what tailoring changes were made to the audit procedures	2.1 (1.0)	12.0	4.1 (1.1)
Send a file that you have worked on to another engagement team member	1.9 (1.1)	10.2	4.3 (1.2)
Review Word workpapers on screen	1.7 (0.8)	2.0	4.8 (0.5)
Ensure that all review notes have been properly cleared	1.7 (0.9)	4.1	4.4 (1.0)
Create review notes	1.6 (0.9)	8.2	4.4 (1.3)
Indicate that an engagement team member's response to a review note is not adequate	1.4 (0.8)	4.2	3.3 (1.4)
Delete review notes from the engagement file at the end of the engagement	1.3 (0.6)	0	4.1 (1.3)
Review memos on screen	1.3 (0.6)	0	4.9 (0.4)
Close review notes	1.3 (0.7)	2.1	4.4 (1.2)
<i>Average of Review Tasks:</i>	<b>2.2 (0.6)</b>		<b>3.9 (0.7)</b>

**TABLE 2**  
**Description of Tasks That Are More Difficult in an Electronic Environment**

<u><i>Task Description</i></u>	<u><i>Mean Difference in Difficulty Between Paper and Electronic Environments</i></u>	<u><i>Std. Dev.</i></u>	<u><i>Matched- pairs t</i></u>
<b>RESULTS FOR PREPARERS:</b>			
Agree lead sheets to workpapers	-0.77	1.198	4.955***
Agree workpapers to lead sheets and supporting documents	-0.65	1.022	4.925***
Trace an amount from the financial statements to the lead sheets and workpapers	-0.55	1.126	3.782***
Cross-reference workpapers to supporting documents, lead sheets and financial statements	-0.49	1.250	2.812***
Find workpapers and memos	-0.44	1.406	2.434**
<b>RESULTS FOR REVIEWERS:</b>			
Trace an amount from the financial statements to the lead sheets and workpapers	-1.774	1.376	-8.356***
Determine that workpapers or memos have been prepared for all significant balances appearing on the lead sheets	-1.583	1.718	-5.974***
Ensure that workpapers agree to lead sheets	-1.441	1.353	-6.898***
Ensure that workpapers are updated for AJE's	-1.131	1.348	-5.436***
Ensure that the workpapers have been properly cross-referenced to supporting documents, lead sheets and financial statements	-1.107	1.267	-5.665***
Trace an amount from a workpaper to a supporting document	-0.881	1.131	-5.050***
Find workpapers/memos	-0.833	1.509	-3.579***
Indicate that you as reviewer have agreed an amount to a lead sheet or supporting document	-0.762	1.590	-3.106***

**TABLE 3**  
**Factors Affecting Auditors' Learning on New Electronic Audit Workpaper Systems**

**Panel A. Pearson Correlation (1-tailed p) Between Difficulty/Frequency by Task Category**

	<i><b>PREPARERS</b></i>	<i><b>REVIEWERS</b></i>
<i><b>Overall</b></i>	-0.376***	-0.065
<i><b>Top Ten Most Difficult Tasks</b></i>	-0.286***	0.028
<i><b>Security Tasks</b></i>	-0.422***	-0.248**
<i><b>Input Tasks</b></i>	-0.668***	n/a
<i><b>Organization/Verification Tasks</b></i>	-0.144	0.027
<i><b>Review Tasks</b></i>	-0.184*	-0.129

**Panel B. The Learning Curve: Number of Engagements Completed Before Feeling Comfortable Using the Electronic System**

	<u><i><b>Range</b></i></u>	<u><i><b>Mean (s.d.)</b></i></u>	<u><i><b>t-test between ranks</b></i></u>
Preparers	1-12	4.63 (2.44)	1.587*
Reviewers	1-40	6.30 (8.09)	

**Panel C. The Learning Curve: Self-Reports on Using the Full Capabilities of the Electronic System**

	<u><i><b>Mean (first few engagements)</b></i></u>	<u><i><b>Mean (after gaining familiarity)</b></i></u>	<u><i><b>Mean Difference</b></i></u>	<u><i><b>t-test</b></i></u>
Preparers	2.57	3.70	1.13	11.973***
Reviewers	2.40	3.38	0.98	9.705***
<i><b>t-test between ranks:</b></i>	1.009	2.161**		

**Notes to the table:** The following symbols indicate significant effects: \* = < 0.10; \*\* = < 0.05; \*\*\* = < 0.01. Panel C data represent auditors' responses to the question: "How often do you believe you were using the full capabilities of the system (on the first few engagements, and after you got used to using the system)?" The response scale is: 1 = Never, 2 = Infrequently, 3 = Sometimes, 4 = Frequently, 5 = Always.

**TABLE 4**  
**Frequency of Work-Around Behaviors and Experience-Related Differences**

	<i><u>Mean on first few engagements</u></i>	<i><u>Mean after getting used to the system</u></i>	<i><u>Mean difference</u></i>	<i><u>Matched-pairs t-test</u></i>
<b>RESULTS FOR PREPARERS:</b>				
How often did you print out workpapers so that they can be annotated and completed?	2.75	1.97	0.78	10.079***
How often did you store or maintain workpapers in a paper binder?	3.01	2.28	0.74	8.880***
How often did you print out lead sheets and cross-reference them to financial statements and audit workpapers?	2.90	2.43	0.46	5.357***
How often did you create review notes on a piece of paper as opposed to within the electronic system?	2.42	2.04	0.38	4.176***
How often did you suggest to manager or partner that the electronic engagement should be terminated so that it can be completed using a paper binder?	1.62	1.26	0.36	3.832***
<b>RESULTS FOR REVIEWERS:</b>				
How often did you print out workpapers so that they can be reviewed?	2.98	2.18	0.80	7.483***
How often did you create review notes on a piece of paper as opposed to within the electronic system?	2.52	2.10	0.42	5.168***
How often did you terminate the electronic engagement and require that it be completed using a paper binder?	1.04	1.02	0.02	1.000

**Notes to Table:** The response scale for questions in this table is: 1 = Never, 2 = Infrequently, 3 = Sometimes, 4 = Frequently, 5 = Always.

## ENDNOTES

<sup>1</sup> The participating audit firm wishes to remain anonymous.

<sup>2</sup> Personnel of the firm providing data informed us that audit staff and seniors are primarily responsible for preparing the audit workpapers within the new system, so we refer to these individuals collectively as “preparers”. Audit managers and partners are responsible for reviewing completed audit workpapers within the new system, so we refer to these individuals collectively as “reviewers”.

<sup>3</sup> In the current study, this comparison is facilitated because the firm did not implement any change in the underlying audit process and the objectives of that process during the period in which the system was introduced.

<sup>4</sup> In the table, the component tasks are ordered in decreasing mean difficulty ratings by major task category: system security, data input, organization/verification, and review.

<sup>5</sup> Because we collected data from offices that had been using the electronic system for either one or two years, we examined whether difficulty or frequency ratings differed between these groups of offices. Results of independent samples t-tests on difficulty and frequency ratings for preparers and reviews show that the ratings do not differ between groups.

<sup>6</sup> We tested whether the ordering of task difficulty ratings is sensitive to scaling each participant’s difficulty score by their individual average difficulty assessment across all tasks in the electronic system. The results of this test are consistent with our reported results.

<sup>7</sup> While we document the greater difficulty experienced by reviewers, we are not able to pinpoint the precise source of the difference, as preparers and reviewers differ on several dimensions including: generation/age differences, extent of prior experience performing audits on paper systems, and the nature of the task performed.



<sup>8</sup> We acknowledge that this result could be due to a demand effect in the survey instrument. For example, auditors may have felt that the “right answer” was to report greater system use with practice.

<sup>9</sup> Our conclusions are limited to reflect information about the electronic workpaper tasks within one audit firm’s new system. While we believe our taxonomy of component tasks to be generalizeable, findings on relative difficulty and frequency of component tasks may vary in different systems. Therefore, additional evidence from other audit firms and across various types of electronic audit workpaper systems would be useful in further describing contemporary audit practice.