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Expertise in Corporate Tax Planning: The Issue Identification Stage

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1. *Introduction*

Corporate tax planning requires tax professionals first to identify tax problems and planning opportunities (issues) for their clients, and then to find ways to solve the problems and address the opportunities. Researchers and practitioners have theorized that expertise[1] in the

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[1] We infer expertise in this study from the level of *performance* in a specific task, here issue identification in tax planning. This inference is consistent with much of the literature on expertise in accounting and other disciplines (e.g., Bonner and Lewis [1990],

issue identification stage of tasks like tax planning is the critical determinant of expertise in the overall task (e.g., see Dawes [1979], Einhorn [1974], and Sommerfeld et al. [1989]). In this study, we examine expertise in issue identification in a corporate tax-planning context. Specifically, we investigate both the relation between knowledge (and general abilities) and performance at corporate tax issue identification, and the relation between knowledge and various instructional and practice experiences, e.g., firm training programs. Ultimately, understanding both of these relations is necessary for improving the performance of tax planners.

This study examines the two relations by measuring instruction, practice, knowledge, ability, and performance in the context of tax issue identification. We use multiple measurement methods to capture different aspects of knowledge. We also extend prior research by measuring multiple dimensions of performance and by hypothesizing different knowledge–performance relations depending on the dimension of performance being measured. Finally, we present an exploratory analysis of how specific instruction and practice variables (e.g., number of corporate tax courses completed) are related to knowledge.

Most previous research has linked general experience either to performance (e.g., Chi, Glaser, and Rees [1982]) or to knowledge (e.g., Weber [1980]). The former approach entangles the two relations which we examine directly, while the latter approach fails to tell us which specific instructional and practice experiences create the knowledge required for expert performance. In auditing, researchers are beginning to examine the link between knowledge and performance. Most of this research is limited to recognition of financial statement errors (e.g., Libby and Frederick [1990]). However, two studies have examined the relation between knowledge and performance in other auditing tasks (Bonner and Lewis [1990] and Choo and Trotman [1991]). These studies obtain differing results, possibly because of differences in the way knowledge was measured.

Because tax planning and, particularly, issue identification differ from auditing tasks in several ways, we are reluctant to accept that the auditing results will generalize to tax planning. First, tax issue identification involves finding *both* problems and opportunities; auditors look only for problems. Second, the tax professional's goal is to solve the problems for the *client*; the auditor's goal is to determine the impact of the problems on the *audit*. Third, and most important, the process of tax issue identification involves *forward* reasoning from "symptoms"

Chi, Glaser, and Farr [1988], and Davis and Solomon [1989]), although many other factors undoubtedly also affect performance, e.g., incentives, time pressure, and illness. In this study, we attempted to control for the effects of time (which was held constant) and some incentives (which were shown to have no significant impact on performance).

(facts) to consequences (tax effects); the auditing process involves *backward* reasoning from "symptoms" (financial indicators and other information) to causes (possible errors). Previous research has shown that forward and backward reasoning are different processes and, thus, require different skills (see, e.g., Waller and Felix [1989]). Finally, results of error frequency studies in auditing are unlikely to generalize to tax because of the specialized nature of error frequency knowledge (Bonner and Pennington [1991]).

Our findings suggest that the relation between knowledge and performance differs depending on whether we use a quantitative definition, a qualitative definition, or a combined quantity–quality definition of performance. Contrary to our expectations, problem-solving ability affects qualitative performance only when knowledge is low. Our results also suggest that university instruction in corporate tax, case-oriented instruction, and experience in corporate tax planning are associated with greater corporate tax and transaction knowledge. We also found that results are not consistent across knowledge measurement methods.

The next section develops the hypotheses to be tested. The third section explicates the methods, including measurement of variables. The fourth section presents the results of hypothesis tests and the exploratory analysis. The last section concludes with a discussion of the results and possibilities for future research.

2. *Literature Review and Hypothesis Development*

2.1 THE IMPORTANCE OF ISSUE IDENTIFICATION

Issue identification is an important requirement of "ill-structured" tasks, which are characterized by unclear means of achieving goals and by the availability of many alternatives (Simon [1960]). In tax planning, the professional must evaluate a client's situation and determine the potential problems and opportunities (issues), ascertain the means available for addressing the issues, and identify alternative actions and their associated costs and benefits. From a *quantity* perspective, performance in tax issue identification might be characterized as identifying many potential tax issues in a set of facts. From a *quality* perspective, performance might be characterized as identifying the issues with the greatest tax savings to the client or identifying the most difficult-to-find issues.[2] Finally, performance could be viewed as some combination of quantity and quality.

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[2] We attempted to measure the tax savings provided by each issue in our task but were unable to achieve sufficient inter-rater reliability for use in our research. This lack of reliability was probably due to the complexity of our instrument and the differing practice experiences of our raters.

In this paper, we measure performance as (1) number of tax issues identified (quantity), (2) an average difficulty-of-identification score (quality), and (3) the product of the number of issues identified and the average difficulty of identification score (quantity × quality). Identification of more difficult-to-find issues can reduce the probability that an issue has been overlooked, while each additional issue identified may lead to a marginal benefit for the client.

2.2 KNOWLEDGE, ABILITY, AND PERFORMANCE IN ILL-STRUCTURED TASKS

Some research has suggested that knowledge and abilities are important determinants of performance in ill-structured tasks (e.g., Lesgold [1984], Simon [1979], and Voss and Post [1988]). We believe this is particularly true for tax planning,[3] because planners must rely on what they already know and the abilities they already have when searching for issues in a client's set of facts and determining (sometimes unique) means for addressing those issues.

Both "technical" knowledge and "functional" knowledge have been found to contribute to performance in a variety of domains. In addition, general problem-solving ability may be related to performance in ill-structured tasks. In this section, we develop hypotheses about the relations of knowledge and ability to the performance quantity dimension and the combined dimension. These hypotheses are based on the results of earlier research that examined general notions of performance. Subsequently, we develop a hypothesis about the relations of knowledge and ability to our quality performance dimension based on literature that has specifically examined qualitative aspects of performance.

Several studies have shown that performance in ill-structured tasks is related to technical knowledge, which includes the facts, rules, and relationships relevant to a particular domain. In medicine, errors in disease diagnosis are linked to lack of knowledge about symptom–disease relations (e.g., Groen and Patel [1988], Hobus et al. [1987], Johnson [1983], and Kassirer [1989]). Studies of computer programmers (such as Adelson and Soloway [1988], McKendree and Anderson [1987], and Soloway et al. [1982]) find a relation between programming knowledge and programming performance. In auditing, technical knowledge is related to performance in tasks such as hypothesizing financial statement errors (Bonner and Lewis [1990]). Note, however, that a few studies have found no relation between technical knowledge and performance in ill-structured tasks (e.g., Choo and Trotman [1991] and Patel and Groen [1986]). In tax, technical knowledge includes knowl-

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[3] We asked 14 tax practitioners to rate the importance of knowledge and ability for several tax tasks. Results of an F test from a one-way *ANOVA* comparing tax planning to other tasks performed by tax professionals indicate that planning is perceived to require more knowledge ($p < 0.01$) and ability ($p < 0.01$) than tasks such as preparing returns and IRS representation.

edge of the law related to transactions within a tax-relevant domain, which could be entity-based, jurisdiction-based, or industry-based. In corporate tax planning, technical knowledge is defined as corporate tax knowledge. Based on previous research examining the relation between technical knowledge and performance, the following hypothesis is suggested:

*H*1: The extent of corporate tax knowledge possessed by tax practitioners will be positively related to the number of issues identified and to the combined measure of performance.

Functional knowledge about the operations of the entities involved in the task is also important to performance in ill-structured tasks. Medical research has found that knowledge of the functionings of the human body is important to proper diagnosis (see Clancey [1988], Groen and Patel [1988], and Lesgold et al. [1988]). Similarly, program comprehension and design studies suggest that performance in those tasks is related to knowledge of the functionings of the entities for which programming is being done (e.g., Adelson and Soloway [1988] and Jeffries et al. [1981]). In auditing, Bonner and Lewis [1990] found that knowledge of business operations was related to performance in the task of determining a cause for an irregularity. Functional knowledge relevant to identifying corporate tax issues refers to knowledge about the kinds of transactions corporations engage in, the effects of those transactions on the financial situations of the parties involved, and so on. This review of prior research leads to the following hypothesis:

*H*2: The extent of corporate transaction knowledge possessed by tax practitioners will be positively related to the number of issues identified and to the combined measure of performance.

Because ill-structured tasks provide little information to decision makers about issues involved, means of solution, and alternatives available, reasoning may also be an important determinant of performance (Hunter [1986], Lesgold [1984], and Simon [1979]). This would be particularly true in issue identification, as there are no standardized rules for identifying issues. In tax planning, the need for problem-solving abilities may be acute because client situations and the tax law change regularly. Based on these observations, the following hypothesis is proposed:

*H*3: The extent of problem-solving ability possessed by tax practitioners will be positively related to the number of issues identified and to the combined measure of performance.

These hypotheses predict that knowledge and ability have independent positive relations with performance. While there is no literature that explicitly examines the quantitative dimension of performance, earlier research which has specifically addressed qualitative aspects finds a relation between performance in tasks similar to tax planning and the interaction of technical and functional knowledge. An additional finding of these studies is that the interaction reflects an integration of

technical and functional knowledge, i.e., that the information overlaps somehow in memory.

The superior qualitative performance of those with integrated knowledge suggests that experts apply technical knowledge more effectively because they can exploit the specific features of the entity or environment. Those without integrated knowledge must apply their technical knowledge in a more general way which will lead to a solution that may overlook some subtle and possibly more efficient or effective solutions. As an example, consider giving directions with the help of a map. Someone with excellent technical knowledge of map reading but with no functional knowledge of the area can search the map and find a route. But someone with similar technical knowledge of map reading and with functional knowledge of the area can engage in a more effective search for possible routes. Furthermore, the results of the search would be more likely to identify less obvious (viz., difficult-to-identify) but possibly more efficient or effective routes.

The literature supporting these ideas comes from studies of program comprehension and design. Specifically, Pennington [1987*a*; 1987*b*] found the quality of program comprehension was very low in programmers with either low technical or low functional knowledge, but high in those who had both types of knowledge and had integrated the two. Adelson and Soloway [1985] found similar results in a program design task. Given these findings, we expect integrated technical and functional knowledge (implied through an interaction of the two types of knowledge) to be related to the qualitative dimension of expertise in our tax task. The form of the interaction we predict is consistent with that found by Pennington [1987*a*; 1987*b*].

Finally, general problem-solving ability may interact with knowledge to affect the quality dimension of expertise. Absent some minimal level of reasoning ability, some knowledge may be difficult to obtain and any knowledge possessed would have little impact. The observed importance of integrated technical and functional knowledge and its possible interaction with problem-solving ability lead to the prediction of the following relation:

*H*4: There is a positive relation between the interaction of corporate tax knowledge, corporate transaction knowledge, and—where measured—problem-solving ability and the mean difficulty score of issues found.

2.3 THE EFFECTS OF INSTRUCTION AND PRACTICE EXPERIENCES ON KNOWLEDGE

Predominant theories of learning suggest that both instruction and practice lead to knowledge acquisition; see, for example, Anderson [1982; 1987] and Camerer [1981]. Empirical evidence, however, is either lacking or equivocal. Much of the literature examines the relation between knowledge and a general "experience" variable that aggregates several differences in instruction, practice, and feedback. While

this research generally has found some relation between general experience and knowledge (e.g., Frederick [1991], Libby and Frederick [1990], McKeithen et al. [1981], Patel and Groen [1986], and Weber [1980]), the *specific* aspects of the learning environment leading to knowledge acquisition have not been addressed. Second, most studies on the effects of instruction or practice *per se* relate those variables to performance instead of knowledge (e.g., Mandinach and Linn [1987] and Wiedenbeck [1989]), with mixed results. Third, some research suggests that learning from practice in the real world is difficult because of uncertainty in the environment (Brehmer [1980]). Because of the lack of examination of specific relations and inconclusive prior results, we perform only an exploratory analysis of the effects of instruction and practice on knowledge.

3. Research Method

3.1 USE OF MULTIPLE METHODS FOR MEASURING KNOWLEDGE

Mixed results in auditing and other domains with regard to the relations between knowledge and either expertise or instruction and practice may be due to the use of different methods for measuring knowledge. These methods tend to capture different types of knowledge, which may have different relations to expertise or instruction and practice, depending on the task. The characterization of knowledge we refer to is based on its form in memory. A prominent theory of expertise and learning (Anderson [1982; 1987]) characterizes knowledge of a topic (e.g., corporate tax) as being either declarative (factual) or procedural (rules for doing skilled tasks); theory suggests the latter may be somewhat more important to expertise than the former.

We attempt to measure both declarative and procedural forms of corporate tax and transaction knowledge using a standard knowledge test, free recall of facts from a case, and cued recall. The knowledge test is similar to those given in school to determine whether students have learned facts, so it is likely to capture more declarative knowledge. Free recall is also likely to capture more declarative knowledge because the case used in the present study contains a set of facts novel to the subjects; the facts people recall reflect their previous declarative knowledge. Finally, the cued recall method we use (thinking aloud about a specific topic) is likely to capture more procedural knowledge because people are not asked to recall specific factual information.

If either declarative or procedural knowledge is relatively more important to performance in a tax issue identification task, the results regarding both the experience, instruction, and knowledge relation and the knowledge–performance relation may differ across these methods. For example, studies which find no relation between knowledge and expertise (e.g., Choo and Trotman [1991] and Patel and Groen [1986])

primarily used free recall of facts from a case; if free recall captures mainly declarative knowledge, the lack of results could be attributable to the greater importance of procedural knowledge for performance in the tasks examined.

3.2 SUBJECTS

The 112 subjects in this study were professionals with a mean of 4.8 years experience in tax practice. Over the past three years in tax practice or time spent working in tax (whichever was less), subjects spent an average of 36% of their time working on corporate tax issues and an average of 16% of their time doing tax planning. Approximately 15% of the subjects were either firm-designated or self-designated corporate tax specialists. Sixty-four of the subjects were attending training classes at the AICPA National Tax Education Program; these subjects were from firms of varying sizes (single-office to national). The remaining 48 subjects were from the local offices of four Big Six firms.

3.3 PROCEDURES

There were 37, 36, and 39 subjects, respectively, randomly assigned to the knowledge test, free recall, and cued recall groups. All subjects completed the same corporate issue identification case. Performance in the case was used to infer expertise. The knowledge test and the free recall groups then completed the knowledge/ability task. The cued recall group completed the knowledge task prior to completing the issue identification case.[4] After completing the case and knowledge/ability task, all subjects provided data about a variety of instruction and practice variables. In each part of the study, a researcher was present to read instructions aloud and answer questions. Subjects were given 35 minutes for the issue identification case and varying amounts of time for the knowledge tasks (determined on the basis of pilot tests), and were not allowed to confer with each other or to use reference materials. In general, subjects used the full amount of time allowed to complete the tasks. Subjects at the National Tax Education Program volunteered to participate in the project outside class hours and were paid a small amount of money. Big Six participants completed the project during a regularly scheduled training session in their offices; their participation was also voluntary but they received no cash payment.[5]

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[4] Results of F tests from a one-way *ANOVA* between the cued recall group and the other groups suggest that differences in administration order in the cued recall task had no statistically reliable effect on performance.

[5] Tests on performance, knowledge, ability, and experience data revealed no significant differences (at $p < 0.10$) based on Big Six versus non-Big Six employment or the existence of cash payments to the National Tax Education group. Data were therefore pooled across subject groups.

3.4 MEASUREMENT OF PERFORMANCE

A corporate tax issue identification case, adapted from the *Price Waterhouse Case Studies in Tax* (Jones [1989]), was used to measure performance. After we added complexity to the case, it was given to three other professors with tax expertise, who identified as many issues as they could; their solutions were used to validate the authors' original solution and to identify any omitted issues. Next, the case was given to the national-level designated corporate tax experts at two Big Six firms who identified a few additional issues. The final case contained 74 possible tax issues.

For the task, subjects were instructed that they had been contacted by potential clients, brothers who were coowners of a medium-sized corporation. The case contained facts and financial statements for the company. Some facts in the case were relevant for identifying tax issues and some provided only superficial information. Subjects were instructed to "identify any potential tax problems or planning ideas suggested by the facts," record their responses, and number each issue identified.

Responses were coded to measure both quantity—the total number of correct issues identified[6]—and quality—an average difficulty of identification rating. Difficulty ratings were obtained from an author, two other tax professors, and the designated corporate tax expert at one Big Six firm in response to a scale anchored with a (1) "very easy to identify" and a (7) "very difficult to identify." The reliability (coefficient alpha) for these difficulty ratings across the four raters of 0.70 satisfies Nunnally's [1978] reliability criterion for newly developed constructs. The mean difficulty rating on each issue across the four judges was used as the difficulty value for coding. The distribution of cases across difficulty scores is exhibited in the "total" column of table 1, panel A. Descriptive statistics for the frequency of issue identification and difficulty ratings are given in panel B.[7] Table 2 presents a description of the most and least often identified issues and the issues with the highest and lowest difficulty scores.

Each subject's answers to the case were coded by an author and by a graduate assistant with considerable tax practice experience. The Kappa coefficient (Cohen [1960]) for inter-rater reliability was 0.79, with overall agreement of 94%. Discrepancies between the raters were resolved with another author serving as arbitrator. Resolved sets of

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[6] While the quantity and combined scores were not adjusted for incorrect issues identified (a measure incorporating efficiency), a review of subjects' transcripts finds almost no incorrect issues. Also, efficiency is indirectly considered in the quantity measure because of the time constraint placed on subjects.

[7] The case, the list of 74 issues, and associated difficulty scores are available on request from the authors.

TABLE 1

Descriptive Statistics and Cross-Tabulation for Tax Issue Difficulty Scores[a] and Number of Times Each Tax Issue from the Planning Case Was Identified

Panel A: Cross-Tabulation of the Difficulty Scores of Tax Issues and Number of Times Tax Issues Were Identified by 112 Tax Professionals

	Number of Times Issue Was Identified by Tax Professionals						
Issue Difficulty Score	0–1	2–5	6–11	12–21	22–37	38–102	Total
≥ 1 and < 2	0	1	0	0	2	5	8
≥ 2 and < 3	1	5	4	0	5	5	20
≥ 3 and < 4	2	1	2	9	3	1	18
≥ 4 and < 5	2	3	6	4	1	0	16
≥ 5 and < 6	6	2	0	2	0	1	11
≥ 6 and < 7	1	0	0	0	0	0	1
Total	12	12	12	15	11	12	74

Panel B: Descriptive Statistics for Number of Times Each Issue was Identified and Issue Difficulty Scores

Variable	Mean	Standard Deviation	Minimum	Maximum
Number of Times Issue Was Identified	19.15	22.61	0.00	102.00
Issue Difficulty Scores	3.47	1.28	1.00	6.50

[a]Tax issue difficulty scores were computed using the mean response from four raters to a seven-point Likert scale where 1 indicated "very easy to identify" and 7 indicated "very difficulty to identify," for each issue in the tax-planning case.

issues were then used to calculate the number of issues identified by each subject and their average difficulty.

3.5 MEASUREMENT OF TAX AND TRANSACTIONAL KNOWLEDGE AND PROBLEM-SOLVING ABILITY

3.5.1. Knowledge and Ability Test. The first group of 37 subjects completed the case, then took a test to measure corporate tax and transactional knowledge and problem-solving ability.[8] Recall that we expect this test to measure mostly *declarative* knowledge. Subjects were instructed to answer the questions to the best of their ability and were given approximately 45 minutes to complete the test. A research assistant graded the knowledge test and totaled scores. Questions within each section of the test were equally weighted.[9]

Corporate tax questions were collected from the Uniform CPA Examination and from one of the authors. The 23 questions (with 48

[8] Based on a pretest given to undergraduate tax students and Ph.D. students with tax experience, we made several changes to the instrument. We were unable to validate the test with tax professionals; however, our ex post reliability coefficients are reasonable.

[9] This knowledge test is available from the authors upon request.

TABLE 2

Most and Least Identified Issues and Issues with Highest and Lowest Difficulty Scores

Panel A: Most and Least Often Identified Issues

Issue Description	Frequency of Identification	Difficulty Score
Most Often Identified:		
Fifty percent ownership causes each brother to be related to the corporation under §318.	102	2.75
An individual's passive activity loss carryover is not usable until there is passive activity income or a disposition of the activity. Passive activity income should be sought.	87	1.25
Loan should bear the AFR interest rate to avoid §7872 problems.	87	1.75
Least Often Identified:		
A policy to distinguish between §162 supplies expense and spare parts inventory is desirable.	0	3.00
There is potential loss of S Corporation election if the §1375 tax is imposed for three years in a row.	0	5.5
If the subcontracting entity has any qualified real estate construction contracts, it needs to consider the method of accounting for the contracts.	0	5.33

Panel B: Issues with Highest and Lowest Difficulty Scores

Issue Description	Frequency of Identification	Difficulty Score
Lowest Difficulty Scores:		
A capital loss carryover available to an individual in the case is usable at the rate of $3,000 per year unless he can generate some capital gain to offset the loss.	72	1
An individual's passive activity loss carryover is not usable until there is passive activity income or a disposition of the activity. Passive activity income should be sought.	87	1.25
In the formation of a new corporation, property transfers are tax free if the requirements of §351 are met.	4	1.33
Highest Difficulty Scores:		
If the corporation is involved in manufacturing, it may need to evaluate its exposure to the ozone depleting chemicals tax under §4681.	1	6.5
For a §355 split-up, there must be a corporate business purpose.	1	5.75
Debt financing on a stock portfolio can cause a limitation on the dividends received deduction under §246A.	2	5.75

possible answers) covered a variety of topics including tax treatment of transactions such as redemptions and distributions, calculation of corporate taxable income, and the subject matter of well-known court cases addressing corporate tax issues. Reliability (coefficient alpha) for corporate tax knowledge, after dropping three questions, was 0.68.

Corporate transaction questions were developed by an author from articles in the financial press, the *Journal of Accountancy*, and the *Journal of Taxation*. Topics covered by these 18 questions included various forms of mergers and reorganizations, financial transactions such as interest-rate swaps, and stock transactions of various sorts. The reliability coefficient for this set of questions was 0.75 (none of the questions was dropped).

Finally, nine problem-solving ability questions, a subset of those used by Bonner and Lewis [1990], came from the 1987–4 Graduate Record Examination. Although these questions were from a well-tested source, we calculated a reliability coefficient because we used a small subset.[10] The coefficient, after dropping one question, was 0.63.

All correlations between independent variables were significantly less than one, and ranged from 0.357 for tax knowledge and general problem-solving ability to 0.619 for transaction knowledge and general problem-solving ability. This represents evidence of discriminant validity (see Anderson and Gerbing [1988] and Bagozzi and Phillips [1982]).

3.5.2. Free Recall. The second group of 36 subjects first completed the issue identification case, then spent approximately 20 minutes on a distractor task to clear short-term memory before recalling facts from the case. The distractor task required subjects to make judgments about debt and equity and to list relevant features; the debt-equity issue did not arise in the case.

In recalling facts, subjects were asked to:

> List all the facts you can remember about the Central Colorado Leasing and Sales case that you completed a few minutes ago. You should write down all the facts that you can remember, listing one fact per number on the following pages of this booklet. Even if you have doubts about the completeness or importance of your statements, you should include them in the list below.

These instructions are similar to those used by Libby and Trotman [1990]. Subjects were given approximately 15 minutes to complete their free recall. This measure is expected to capture primarily declarative knowledge related to the contents of the case.

Individual facts in the case were listed prior to running the study by one author and validated by a second author and by two corporate tax academics who did not work on the project. Next, one author coded

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[10] Time constraints necessitated reducing the length of one part of the knowledge test. Since we were primarily concerned with the effects of tax and transactional knowledge in this first study, we reduced the length of the problem-solving section.

the facts as surface (not pertaining to any tax issues in the case) or structural (relevant for at least one issue). These surface/structure codings were also done independently by a tax professor at another institution. The Kappa coefficient for inter-rater agreement was 0.79, with overall agreement of 90%. Disagreements were resolved with a second author serving as arbitrator.

The discrete facts were used as a solution key for subjects' written recalls by one author and a graduate assistant with extensive tax experience, who acted as independent coders. The Kappa coefficient for coding reliability was 0.79, with overall agreement of 97%. Discrepancies in coding were again resolved with a second author serving as arbitrator. Since the facts in the case related to both tax laws and transactions, structural facts recalled is a joint measure of tax and transactional knowledge stored in long-term memory, as the distractor task prevented rehearsal of the case in short-term memory. The number of surface facts recalled, as expected, had no effect on performance.

3.5.3. Cued Recall. The third group of 39 subjects first thought aloud in response to the following statement: "Please think carefully and name as many corporate transactions as you can. Please be as specific as you possibly can." They were given up to 15 minutes to think aloud, then went on to complete the issue identification case. Their statements were recorded on tape. This task, expected to measure primarily procedural knowledge, was given to subjects prior to the case so that they could not recall transactions unfamiliar to them prior to completing the case. For the first group of subjects (the knowledge test group), there was no information in the case related to the test. The free recall subjects clearly had to complete the case first to recall facts from the case.

The taped recalls were transcribed by a graduate assistant, broken down by meaningful phrases (Ericsson and Simon [1984]), typed, and proofread. Each phrase was coded by one author and a graduate assistant (with an advanced law degree in tax and extensive experience in tax practice) as a corporate transaction, a tax-related intrusion, i.e., a phrase with some relation to tax law or issues, or a nontax intrusion. The Kappa coefficient for reliability on these codings was 0.68, with overall agreement of 80%. Again, discrepancies were resolved in the presence of a second author. The correlation between corporate transactions and tax-related intrusions was –0.295, indicating discriminant validity. Nontax intrusions were excluded from subsequent analysis.

Both the number of transactions and the number of tax intrusions served as the measures of knowledge. Tax intrusions are a measure of tax knowledge because the process of recalling transactions is likely to trigger in memory tax concepts associated with the transactions (Anderson [1990]). The greater the tax knowledge stored along with transactions in memory, the more likely it is that such knowledge will be recalled and intrude on the transactions listing. In other words, the

tax intrusions probably occurred because subjects were beginning to or already had integrated their tax and transactional knowledge (all but one subject had these intrusions).

3.6 MEASUREMENT OF INSTRUCTION AND PRACTICE VARIABLES

Using a questionnaire given to subjects after completing the case and knowledge task, we asked subjects to report the following information: number of university and continuing education courses on corporate tax, percentage of instruction that was case-oriented rather than rule-oriented, number of college degrees possessed, and whether any of the degrees were in tax or law.[11] Case-oriented instruction was included as a variable because of its specific emphasis on issue identification. We did not ask about instruction on corporate tax issue identification because we thought subjects would have difficulty recalling contents of specific courses. Because instruction in corporate tax necessarily requires the discussion of corporate transactions, we did not ask subjects specific questions about instruction on corporate transactions.

For general experience, subjects reported their titles and number of years as a tax professional in public accounting. For specialized experiences, we asked subjects to report the percentages of time spent in the past three years doing corporate tax work and tax planning, and whether they were currently designated or informal corporate specialists.[12] Again, we did not measure specific experiences with corporate transactions because tax planning is largely composed of transaction structuring. Finally, we used title to proxy for the extent of time doing reviews, since firms indicated to us that managers and partners normally review tax research.

Because we know little about the constructs of "practice" and "instruction," we subjected a correlation matrix of the standardized measures above to an exploratory factor analysis (see Kim and Mueller [1983] and Nunnally [1978]). Using the Kaiser Image Analysis method of extraction with varimax rotation (Kaiser [1963]), we found six factors accounted for most of the variance in the 11 measured variables. The factors, factor loadings, and their proportionate contribution to explained variance are presented in table 3. The reliability of the fac-

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[11] One free recall subject did not complete the questionnaire. Accordingly, she was dropped from all analyses involving instruction and practice variables, which resulted in a sample size of 111 subjects overall and 35 subjects in the free recall group.

[12] The notion of corporate specialization is very broad and could include specialization in issues faced by small and closely-held corporations as well as specialization in other areas such as mergers and acquisitions. However, as there is significant overlap across these areas and the corporate specialists in the present study were drawn primarily from small and medium-sized regional and national practices, their specializations are likely to be consistent with our case, which related to a closely-held business.

tors ranged from approximately 0.65 to 0.98, with all but factor 6 possessing reliabilities above 0.70. Factor scores were computed to form the independent variables used in the exploratory analysis of the relations between instruction and practice and knowledge.[13]

4. *Hypothesis Tests and Exploratory Analyses*

Table 4 presents descriptive statistics for the performance, knowledge, and ability variables for each task in the study and maximum possible scores where applicable. Table 5 presents descriptive statistics for the practice and instruction variables used in the exploratory analysis.

4.1 RELATIONS OF KNOWLEDGE AND ABILITY TO PERFORMANCE

The knowledge test was used to test hypotheses 1 through 4 regarding the positive relations of tax knowledge, transactional knowledge, general problem-solving ability, and the interaction of the three to the two measures of performance. Using normalized values, i.e., the difference between observed and mean values divided by standard deviation, we regressed the quantity and quality measures of performance on the three scores from the knowledge test.[14] The results of the regressions are shown in table 6, panel A. Also shown is the result of a regression of the product of quantity and quality measures on the knowledge test scores, using fractile scores for all variables. With number of issues as the dependent measure, the model finds only tax knowledge to be positively related to performance ($t = 2.15$, $p < 0.05$). The strength of the effect is indexed by the difference in squared multiple correlations for the main effects model (0.28) and a reduced model where tax knowledge is omitted (0.18). Thus, the tax knowledge effect accounts for approximately 10% of the variance in quantitative performance. A further test of hypotheses 1 through 3 is provided by the regression employing the product of quantity and quality measures as the dependent variable. Again, our results indicate that only tax knowledge is positively related to performance ($t = 3.48$, $p < 0.05$), accounting for 24% of the variance in combined performance.

With average difficulty scores as the dependent variable, the only variable related to performance is the three-way interaction among tax knowledge, transactional knowledge, and problem-solving ability ($t = 1.34$, $p < 0.10$). Based on squared multiple correlations in the full model and a reduced effects model, the interaction explains 6% of the variance in the dependent variable. To examine the nature of the

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[13] An alternative approach, using a simple sum of the standardized scores of variables with loadings greater than 0.40 for each factor, yielded results almost identical to the analysis reported herein. For a discussion of the use of factor scores versus factor-related scores, see Kim and Mueller [1983, pp. 70–72].

[14] Except as indicated, for all regressions reported, our specification tests indicated all assumptions required for *OLS* were met.

TABLE 3

Factor Analysis of Instruction and Practice Variables from Postexperimental Questionnaire for 111 Tax Professionals

Instruction and Practice Variables	Factor Loadings					
	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
Tax Experience (Years)	**0.94**	0.07	0.12	−0.39	0.00	0.01
Performs Reviews	**0.91**	−0.07	−0.10	0.09	−0.07	0.02
Title in Firm	**0.88**	0.02	0.12	0.16	0.07	0.12
Number of Nonuniversity Corporate Tax Classes	**0.59**	−0.22	−0.12	0.08	0.13	**0.62**
Number of College Degrees	0.06	**0.86**	−0.04	0.04	0.23	0.00
Number of University Corporate Tax Classes	−0.02	**0.47**	0.15	−0.09	0.14	**0.79**
Tax or Law Degree	−0.10	**0.86**	0.05	−0.03	−0.23	0.20
Amount of Case-Based Instruction (in %)	0.03	−0.01	**0.85**	−0.08	0.18	0.05
Tax-Planning Work (in % of time spent)	0.26	0.17	**0.46**	**0.57**	−0.09	**0.47**
Corporate Specialist	0.08	−0.04	−0.13	**0.88**	0.21	−0.07
Corporate Work (in % of time spent)	0.00	0.04	0.19	0.19	**0.91**	0.12
Proportionate Variance Contribution	0.31	0.19	0.12	0.13	0.11	0.14
Factor Designations	Time in Tax Practice	University Instruction	Case-Based Instruction	Corporate Tax-Planning Experience	Corporate Client Base	Corporate Tax Instruction

Note: Only boldfaced loadings were used when constructing factor-related scores for instruction and practice factor variables.

TABLE 4

Descriptive Statistics for Expertise and Knowledge/Ability Variables for 112 Tax Professionals

Panel A: Knowledge and Ability Variables from the Knowledge Test, Free Recall Task, and Cued Recall Task

Knowledge and Ability Variables	*n*	Mean	Standard Deviation	Min.	Max.	Maximum Possible
Tax Knowledge Score	37	26.47	4.58	18.00	37.00	48.00
Transaction Knowledge Score	37	5.71	2.82	0.00	10.50	18.00
General Problem-Solving Score	37	4.28	1.98	0.00	7.00	8.00
Number of Structure Facts Recalled	36	27.62	12.89	4.00	52.00	127.00
Number of Transactions Recalled	39	18.38	11.60	0.00	47.00	NA
Number of Tax Intrusions Recalled	39	11.19	13.00	0.00	61.00	NA

Panel B: Expertise Variables from the Issue Identification Case (by Group and Overall)

Expertise Variables	*n*	Mean	Standard Deviation	Min.	Max.	Maximum Possible
Number of Issues Identified:						
Knowledge Test Group	37	12.06	3.82	6.00	19.00	74.00
Free Recall Group	36	12.43	5.48	4.00	27.00	74.00
Cued Recall Group	39	13.65	5.52	4.00	31.00	74.00
All Groups Combined	112	12.60	5.00	4.00	31.00	74.00
Mean Difficulty of Issues Identified:						
Knowledge Test Group	37	2.54	0.25	2.06	3.17	NA
Free Recall Group	36	2.68	0.41	1.83	3.68	NA
Cued Recall Group	39	2.75	0.30	2.07	3.38	NA
All Groups Combined	112	2.65	0.33	1.83	3.68	NA
Combined Performance:[a]						
Knowledge Test Group	37	0.21	0.19	0.00	0.71	1.00
Free Recall Group	36	0.19	0.17	0.00	0.76	1.00
Cued Recall Group	39	0.20	0.15	0.00	0.71	1.00
All Groups Combined	112	0.20	0.17	0.00	0.76	1.00

[a]The combined performance expertise variable is the product of the number of tax issues identified and the mean difficulty of issues identified, each standardized to the (0, 1) interval using fractiles.

TABLE 5

Self-Reported Instruction and Experience Variables for 111 Tax Professionals

Panel A: Descriptive Statistics for Instruction Variables, by Group and Overall

Variable	Group	*n*	Mean/ Percentage	Standard Deviation	Minimum	Maximum
Number of University Corporate Tax Classes	Knowledge Test Group	37	1.52	1.25	0.00	6.00
	Free Recall Group	35	1.56	1.02	0.00	5.00
	Cued Recall Group	39	1.22	1.16	0.00	5.00
	All Groups Combined	111	1.44	1.15	0.00	6.00
Number of Nonuniversity Corporate Tax Classes	Knowledge Test Group	37	8.30	9.41	0.00	40.00
	Free Recall Group	35	4.52	6.12	0.00	30.00
	Cued Recall Group	39	5.92	7.43	0.00	30.00
	All Groups Combined	111	6.23	7.84	0.00	40.00
Amount of Case-Based Instruction (%)	Knowledge Test Group	37	28.31	26.52	0.00	75.00
	Free Recall Group	35	24.21	25.33	0.00	100.00
	Cued Recall Group	39	26.05	26.61	0.00	90.00
	All Groups Combined	111	26.24	26.00	0.00	100.00
Number of College Degrees	Knowledge Test Group	37	1.38	0.55	1.00	3.00
	Free Recall Group	35	1.49	0.57	1.00	3.00
	Cued Recall Group	39	1.46	0.60	1.00	3.00
	All Groups Combined	111	1.44	0.32	1.00	3.00
Percentage Holding a Tax or Law Degree	Knowledge Test Group	37	11			
	Free Recall Group	35	14			
	Cued Recall Group	39	21			
	All Groups Combined	111	15			

Panel B: Descriptive Statistics for Practice Variables, by Group and Overall

Variable	Group	n	Mean/ Percentage	Standard Deviation	Minimum	Maximum
Tax Experience (in years)	Knowledge Test Group	37	6.57	6.82	0.50	33.00
	Free Recall Group	35	4.00	3.47	0.50	13.00
	Cued Recall Group	39	4.24	3.74	0.50	15.00
	All Groups Combined	111	4.97	2.18	0.50	33.00
Corporate Tax Work (in % of time spent)	Knowledge Test Group	37	41.35	22.29	5.00	80.00
	Free Recall Group	35	31.62	21.73	0.00	90.00
	Cued Recall Group	39	35.64	22.55	0.00	100.00
	All Groups Combined	111	36.32	22.36	0.00	100.00
Tax-Planning Work (in % of time spent)	Knowledge Test Group	37	22.23	29.55	0.00	100.00
	Free Recall Group	35	12.07	15.50	0.00	90.00
	Cued Recall Group	39	13.90	16.34	0.00	70.00
	All Groups Combined	111	16.16	21.81	0.00	100.00
Percentage of Sample Who Are Corporate Tax Specialists	Knowledge Test Group	37	27			
	Free Recall Group	35	3			
	Cued Recall Group	39	18			
	All Groups Combined	111	16			

Panel C: Title in Firm Frequencies, by Group and Overall

Group	Staff	Senior	Manager	Partner	Missing	Total
Knowledge Test Group	8	11	6	12	0	37
Free Recall Group	11	8	11	3	2	35
Cued Recall Group	11	15	6	5	2	39
All Groups Combined	30	34	23	20	4	111

TABLE 6

Regressions of Performance Measures from the Issue Identification Case on Knowledge and Problem-Solving Ability Variables from the Knowledge Test, Free Recall Task, and Cued Recall Task

Panel A: Regressions for 37 Tax Professionals in the Knowledge Test Group

	Coefficients (t statistics) for Regression Models, by Performance Measure		
Knowledge and Problem-Solving Ability Variable	Number of Issues	Difficulty Score	Combined Performance
Tax Knowledge (tax)	0.38	0.30	0.44
	(2.15)**	(1.30)	(3.48)**
Transactional Knowledge (tran)	0.24	-0.18	0.05
	(1.14)	(-0.70)	(0.39)
Problem-Solving Ability (gps)	-0.05	-0.25	-0.01
	(0.19)	(-0.85)	(0.12)
tax * tran		0.36	
		(1.11)	
tax * gps		-0.28	
		(-1.06)	
tran * gps		-0.19	
		(-0.84)	
tax * tran * gps		0.33	
		(1.34)*	
R^2	0.28	0.22	0.32

Panel B: Regressions for 36 Tax Professionals in the Free Recall Group

	Coefficients (t statistics) for Regression Models, by Performance Measure		
Knowledge Variable	Number of Issues	Difficulty Score	Combined Performance
Structural Facts Recalled	-0.31	0.16	0.04
	(-0.33)	(2.45)**	(0.37)
R^2	0.00	0.15	0.00

Panel C: Regressions for 39 Tax Professionals in the Cued Recall Group

	Coefficients (t statistics) for Regression Models, by Performance Measure		
Knowledge Variable	Number of Issues	Difficulty Score	Combined Performance
Tax Intrusions (ti)	0.18	0.68	0.23
	(1.04)	(3.66)**	(1.93)*
Transactions Recalled (tran)	0.17	0.31	0.20
	(0.95)	(2.04)*	(1.94)*
tran * ti		0.51	
		(2.72)*	
R^2	0.04	0.32	0.10

* = $p < 0.10$.
** = $p < 0.05$.
All regressions displayed in the above tables use normalized (z) scores for all variables except for the combined performance regressions, which use fractile scores.

interaction, product term analysis (see Jaccard, Turrisi, and Wan [1990]) was employed.[15] This analysis calculates the effect of one independent variable on the dependent variable at a given level of the other two independent variables. Results indicate that tax knowledge has a positive effect ($t = 2.06$, $p < 0.10$, using a Bonferroni-corrected alpha) on qualitative performance only at high levels (i.e., one standard deviation above the mean) of general problem-solving ability and transactional knowledge. Furthermore, general problem-solving ability has a positive effect ($t = 2.33$, $p < 0.10$, with a Bonferonni-corrected alpha) on qualitative performance only at low levels (one standard deviation below the mean) of tax and transactional knowledge. Transactional knowledge was not observed to have an effect at any level of general problem-solving ability and tax knowledge.

Thus, for the number of issues identified and the combined measure, tax knowledge has an average positive relation with performance, which supports hypothesis 1. No main effect for transactional knowledge or for problem-solving ability is found, which fails to support hypotheses 2 and 3. In contrast, for average difficulty scores, the three-way interaction hypothesized by *H*4 is the only variable related to performance. The form of the interaction suggests that problem-solving ability helps performance only at low levels of knowledge. Consistent with the notion of integrated knowledge underlying hypothesis 4, additional tax knowledge is helpful at higher levels of transactional knowledge and ability.

A joint test of hypotheses 1 and 2 was provided using normalized data gathered in the free recall task. For this test, we regressed performance, using normalized (fractile score) variables for the quantity and quality (combined) analyses on the normalized number (fractile score) of structural facts recalled (a measure of corporate tax and transactional knowledge together). As can be seen in table 6, panel B, with number of issues or combined measure as the dependent variable, the number of structural facts recalled was not related to performance ($F = 0.11$, and $F = 0.14$, respectively), which fails to support hypotheses 1 and 2. However, when the difficulty score is used as the dependent variable, the number of structural facts is significantly related to performance ($F = 6.00$, $p < 0.05$), which indirectly provides support for hypothesis 4 (since both types of knowledge are included in the structural facts measure).

The think-aloud responses to the cued recall question provided additional tests of hypotheses 1, 2, and 4. We regressed performance

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[15] Product–term analysis specifies the nature of bilinear interaction effects by assuming fixed values for all but one independent variable in a full effects model. Other variables are typically set at three values: one standard deviation below the mean, the mean, and one standard deviation above the mean. The slope of the resulting linear equation is then subjected to a statistical test.

measures on the number of correct corporate transactions recalled (a measure of transactional knowledge), the number of tax intrusions (a measure of tax knowledge), and their interaction. Again, all variables were normalized for quantity and quality regressions, while fractile scores were used in the combined performance regression. With number of issues (quantity) as the performance measure, results in table 6, panel C show that neither variable is related to performance. However, the combined score indicates that both tax and transactional knowledge are significantly related to performance ($t = 1.93$, $p < 0.10$, and $t = 1.94$, $p < 0.10$, respectively), and each explains 5% of the variance.

With the difficulty score as a performance measure, the predicted interaction is related to performance ($t = 2.72$, $p < 0.05$) and explains 18% of the variance.[16] The results of a product term analysis to investigate the nature of the interaction show no significant effect for transactions recalled on the difficulty score at a low tax intrusion value. However, at medium and high values of tax intrusions, an increasingly significant positive effect is observed, using a Bonferroni-corrected alpha ($t = 2.04$, $p < 0.10$; and $t = 3.31$, $p < 0.05$, respectively).

Thus, all three hypotheses are at least partially supported with cued recall measures of knowledge. The combined measure of performance was related to both tax and transactional knowledge, and the difficulty performance measure was related to the interaction of tax and transactional knowledge. Finally, the form of the interaction suggests that additional transactional knowledge aids performance once there is a medium amount of tax knowledge, consistent with earlier research.

Our results regarding the link between knowledge and performance provide some limited evidence of a main effect of tax knowledge on the number of issues identified and main effects for both tax and transactional knowledge on combined performance. These results differ across knowledge measurement methods, probably because the knowledge test and free recall methods tend to reflect declarative knowledge while the cued recall method reflects procedural knowledge. Also, the free recall knowledge measure reflected both tax and transactional knowledge. The lack of results in the free recall task probably reflects two factors: (1) transactional information dominated tax information in the case, and (2) the recall measure is a narrower measure of knowledge than that from the knowledge test. Based on the first factor, these results would be consistent with the finding from the other two methods that transactional knowledge is not related to the number of issues identified. Problem-solving ability also appears not to play a role. Thus, declarative tax knowledge appears to be an important factor allowing tax professionals to identify a large number of tax issues.

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[16] The regression using the average difficulty score contained a violation of the homoscedasticity assumption, so the results reported are from a regression using White's [1980] heteroscedastistic-consistent standard errors.

In contrast, the results regarding the relation between knowledge and the average difficulty-of-identification score (performance quality) are consistent across methods. All three methods showed that the interaction of tax and transactional knowledge and, where measured, problem-solving ability is important to the quality of performance. These results suggest that, in order to identify difficult issues, tax professionals must integrate their tax and transactional knowledge. The convergence across methods suggests that both declarative and procedural knowledge may be relevant to identifying difficult issues.

4.2 EXPLORATORY ANALYSIS OF RELATIONS BETWEEN INSTRUCTION AND PRACTICE AND KNOWLEDGE

To investigate the effects of instruction and practice on knowledge, we regressed the various knowledge measures presented earlier on the factor analytic instruction and practice variables. Because there is no theory suggesting *which* instruction and practice variables should be related to knowledge, a stepwise regression procedure was used with entry and exit criteria set at $p < 0.10$. The results of the regressions are summarized in table 7.

For the knowledge test group, we regressed corporate tax knowledge, corporate transaction knowledge, and their interaction on the six instruction and practice variables. Results, shown in table 7, suggest that university instruction affects the extent of transactional knowledge ($t = 1.80$, $p < 0.10$) and that case-based instruction affects the interaction of tax and transactional knowledge ($t = 2.21$, $p < 0.05$). These results also provide support for our contention that our knowledge test measured mostly declarative knowledge.

For the free recall group, we regressed number of structural tax facts (*tax and transactional knowledge together*) on the six factor analytic variables. University instruction is positively related to the number of structural facts recalled ($t = 3.19$, $p < 0.01$). The negative relation ($t = -1.73$, $p < 0.10$) observed between case-based instruction and the number of structural facts recalled defies explanation. The relation of instruction to structural facts recalled is again consistent with the notion that our free recall task measured mainly declarative knowledge.

Finally, for the cued recall group, we regressed transactional knowledge, tax knowledge, and their interaction on the factor analytic variables. As shown in table 7, corporate tax-planning experience is positively related to tax knowledge ($t = 2.73$, $p < 0.05$) and negatively related to transactional knowledge ($t = -1.79$, $p < 0.10$). One explanation for this result is that the corporate specialists tended to dwell on tax *consequences*, so they had less time to mention actual *transactions*. Time in tax practice was positively related to the interaction of transactions and tax intrusions ($t = 2.09$, $p < 0.05$), suggesting that some aspects of instruction or practice not captured by the other five factors and not specifically measured in the present study led to greater integration of

TABLE 7

Summary of Results of Exploratory Stepwise Regression of Knowledge Variables from Knowledge Test, Free Recall Task, and Cued Recall Task onto Instruction and Practice Factor Score Variables

Dependent (Knowledge) Variable, by Group	F Statistic	R^2	Entered Instruction and Practice Factor Score Variables	t Statistics
Knowledge Test Group (37 Tax Professionals):				
Tax Knowledge (tax)	—	—	None	—
Transactional Knowledge (tran)	3.23	0.09	University Instruction	1.80
tax × tran	4.88*	0.14	Case-Based Instruction	2.21*
Free Recall Group (35 Tax Professionals):				
Structure Facts Recalled	5.59*	0.27	University Instruction	3.19**
			Case-Based Instruction	−1.73
Cued Recall Group (39 Tax Professionals):				
Transactions Recalled (tran)	3.19	0.09	Corporate Tax Planning	−1.79
Tax Intrusions (ti)	7.44*	0.19	Corporate Tax Planning	2.73*
tran * ti	4.36*	0.12	Time in Tax Practice	2.09*

* = $p < 0.05$.
** = $p < 0.01$.
In all of the stepwise regressions reported above, the entry/exit criterion was set at $p < 0.10$.

tax and transactional knowledge. We suggested earlier that our cued recall task should measure more procedural knowledge, which theory suggests is acquired through practice. The results here support this idea.

Overall, the results indicate that university instruction leads to an increase in declarative transactional and tax knowledge, and that corporate tax-planning experience is associated with additional procedural tax knowledge. In addition, integrated tax and transactional knowledge is related to case-based instruction and to some general experiences. These results provide some evidence that knowledge measurement methods may capture different types of knowledge (declarative vs. procedural) and that different factors (instruction vs. practice) create different types of knowledge.

5. *Discussion*

Existing research on the relations between knowledge and either expertise or instruction and practice has found mixed results, possibly because of differences in the methods used to measure knowledge. This study extends previous research by directly examining, in a tax context, the two relations using multiple methods to measure knowledge. An additional contribution of this study is its examination of

different dimensions of expert performance and differential findings regarding the link between knowledge and performance.

Our results indicate that declarative tax knowledge is related to the number of tax issues identified (quantity performance), while procedural tax knowledge, transactional knowledge, and ability appear not to be important. In contrast, both declarative and procedural tax knowledge and procedural transactional knowledge affect combined (quantity * quality) performance. When an average difficulty-of-identification score (performance quality) is used to infer expertise, integrated tax and transactional knowledge seem to be required for good performance. For low levels of tax knowledge, general problem-solving ability was associated with better performance. Further, both declarative and procedural knowledge may be important for identifying difficult-to-find issues, based on the convergence of results across knowledge measurement methods. Although we have not directly examined the form of tax professionals' knowledge, these results suggest that a knowledge base with integrated tax and transactional knowledge would be beneficial to the quality of tax issue identification.

With regard to the link between instruction and practice variables and knowledge, results suggest that university instruction creates declarative transactional knowledge and that case-based instruction may assist in integrating declarative tax and transactional knowledge. Procedural tax and transactional knowledge are at least partially acquired by corporate tax-planning experience and integrated through some general experiences or instruction. These results are consistent with learning theories which suggest that instruction creates declarative knowledge and that practice creates procedural knowledge. Also, they provide support for the contentions that our knowledge test and free recall methods captured mostly declarative knowledge, whereas our cued recall method captured mostly procedural knowledge.

Our finding that integrated tax and transactional knowledge may be important to high-quality tax planning is consistent with concerns evidenced by recent changes in tax education (tax courses organized by transactions). Future research should investigate further the nature of this integrated knowledge and seek to provide more detail about why it affects issue identification. This study also provides initial evidence regarding how knowledge is acquired in practice. Further research should be conducted to determine whether current practice includes the *best* ways of imparting that knowledge.

More generally, our results suggest that researchers who undertake investigations of the link from knowledge to performance or other variables (such as instruction or practice) should consider whether declarative or procedural knowledge is likely to be more important and choose a measurement method accordingly. Also, researchers should bear in mind that performance may have many different dimensions—each requiring

different skills—depending on the task. Finally, research on the link between instruction and practice experiences and knowledge is not well developed; accounting researchers have much to contribute in that area.

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