

Explaining Differences in Learning Outcomes in Auditing Education - The Importance of Background Factors, Prior Knowledge and Intellectual Skills

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Abstract

In this paper we use a learner perspective on learning outcomes which reflects that some students taking accounting classes are also provided with on-the-job training in accounting firms. Hence knowledge about learning outcomes for different groups of students is essential information for educators as well as the accounting profession. This paper extends prior research on the role of declarative and procedural knowledge in performing auditing tasks. Measuring learning outcomes is a complex matter requiring sensible measures for both declarative knowledge (ability to verbalize pertinent facts or processes) and procedural knowledge (intellectual skills). The performance of 75 graduate accounting students representing both types of schema is examined. The findings suggest that differences in learning outcomes may be attributed to differences in student background and prior knowledge (auditing experience). The findings also suggest that the importance of prior knowledge is mitigated by the intellectual skills required for a particular task.

Keywords: leaning outcomes, auditing, declarative knowledge, procedural knowledge, intellectual skills, measurement, work experience

1. Introduction

The ability to provide sensible measures for learning outcomes in accounting education is under increased scrutiny. In this paper we use a learner perspective in auditing education, which reflects that some students taking accounting classes are also provided with on-the-job training in accounting firms. Hence knowledge about learning outcomes for different groups of students is essential information for educators as well as the accounting profession. Sensible measures are needed by educators in order to (1) chose teaching methods which match prerequisite skills among a heterogeneous student body, (2) assess the need for correcting misconceived knowledge (i.e., cleaning the slate), and (3) be able to set up challenging yet fair exams for the total student body. The assessment of learning outcomes for the purpose of knowledge management plays a major role in accounting firms too. Knowledge transfer among auditors is part of everyday life within most accounting firms. Developing a sound on-the-job training environment is pivotal for recruiting and the design of supervision, and in the end for the expected “success-rate” in retaining (valuable) employees.

Prior research suggests that scripts or schemas are useful when organizing “data in memory” for accounting contexts. I.e., when faced with the knowledge provided in a graduate course the student benefits from prior experiences and stores the important aspects of each new experience in memory in accordance with such schemas. The schemas available for students of graduate auditing courses reflect prior accounting work experience for some students and undergraduate accounting coursework experience for all students.

This paper extends prior research on the role of declarative and procedural knowledge in performing auditing tasks. Measuring learning outcomes is a complex matter which requires sensible measures for both declarative knowledge (ability to verbalize pertinent facts or processes) and procedural knowledge (intellectual skills). The study uses a multitude of measures based on a hierarchical separation of intellectual skills originally suggested by Robert M. Gagné (1984). An instrument was developed to measure differences regarding learning outcomes in the context of an auditing course by posing a broad set of questions which test declarative knowledge and a broad range of intellectual skills from conceptual understanding to the use of higher-order-rules. This paper

presents data based on answers from 75 graduate accounting students representing both types of schema. The study provides evidence which confirms an interrelationship between declarative and procedural knowledge in auditing. The findings suggest that differences in learning outcomes may be attributed to differences in student background and prior knowledge (auditing experience). The findings also suggest that the importance of prior knowledge is mitigated by the intellectual skills required for a particular task.

2. Motivation and Research Question

The ability to provide sensible measures for learning outcomes in accounting education is under increased scrutiny, e.g., Davidson and Baldwin (2005), Duff (2004), Gracia and Jenkins (2003). The growing accounting education research literature suggests that accounting educators around the world share the challenge of preparing students for a working life in accounting firms, Bryan and Smith (1997). At business schools the students have a wide choice of programs, each with an intended specialization in mind. The learning objectives for these graduate students are common, in the sense that students are expected to acquire a certain amount of both theoretical and practice related knowledge during the education. In addition, the overall learning objectives for a specific graduate program must also reflect the nature of that program. Accounting programs will, presumably everywhere, reflect that accounting and auditing are fields generated from a practice-related history, Knechel (2000). The emphasis on facts, definitions and vocabulary in accounting education has always played a major role, e.g. Ingram and Howard (1998), Bonner and Walker (1994).

Desirable skills, such as the ability to recognize previously encountered situations, to apply the appropriate analytical tools available to the domain and to synthesize previous knowledge to come up with solutions to new or complex problems, are often mentioned as explicit learning outcomes of business degree programs. These skills are not less desirable in accounting programs, e.g. Duff (2004), Stone and Shelley (1997). In addition to teaching the “facts of the trade”, one of the educator’s primary tasks may then be described as assisting in the evolution of cognitive skills among graduate students, e.g. The 2000-2001 Auditing Section Education Committee (Johnson et al., 2003). In accounting programs, the intended specialization will thus have to reflect the potential challenges which will face auditors and other accountants in their future work, see Fuller and Kaplan (2004), Nelson et al. (2003), Knechel (2000).

The measurement of student performance is often initiated for control purposes, Gracia and Jenkins (2003), Ingram and Howard (1998). In effect, generic questions of the following nature are raised: what are the consequences for student performance under different programs, under different instructional approaches, under different instructors etc.? The perspective guiding such measurements are that of the educational institution (or the individual educator), whereas the perspective of the students is more rarely chosen, e.g. Krausz et al. (1999), Moses (1987). Krausz et al. (1999) explores the relationship between performance in entry-level graduate accounting coursework and prior accounting work experience and undergraduate accounting coursework experience. As such, the performance is examined from the perspective of the student by taking the student’s background and prior knowledge into account, see also Ferguson et al. (2000), Dorsey et al. (1999), English and Koeppen (1993), Knechel and Snowball (1987). The present study may be seen as a contribution which develops this perspective even further by examining differences in learning outcomes. Hence the research question addressed in this study may be stated as the following:

RQ: What Is the Importance of Background Factors, Prior Knowledge and Intellectual Skills in Explaining Differences in Learning Outcomes in Auditing Education?

3. Hypotheses

3.1 *The Importance of Background Factors*

In this section, we consider the importance of different factors in the student’s background, which might affect the teaching situation and the precondition for learning. These factors include both controllable and uncontrollable elements. It is possible to imagine a straightforward scenario where all students obtain a theoretical background in order to be prepared for a later practical working experience. Even in this scenario, the student body may not be a homogeneous mass. From the students’ perspective, differences in performance may be caused by differences in the ability to acquire knowledge and/or differences in the ability to reproduce the required knowledge in a test situation. Behind these differences are an endless number of explanatory factors such as: the ability to learn given a particular teaching style, the ability to perform under stress, gender, culture, maturity, personal experiences or simply “having a bad day”, e.g., Duff (2004), Gracia and Jenkins (2003), Byrne et al. (2002), Eide et al. (2001), Wooten (1998). From the educators’ perspective, it is impossible to be conscious about all these factors at the same time (and still make sense) and by the very nature of these factors, it may be impossible to reconcile opposing differences/causes. Regardless of this, some kind of measurement of

student learning is required in most accounting courses, e.g. “any assertion about (teaching) efficiency must include a measurement of a student’s learning achievements”, Adler (1999, 241). Davidson and Baldwin (2005) associate Bloom’s taxonomy to end-of-chapter assignments in order to identify the presence of cognitive skill objectives as prospective learning outcomes. However, their analysis indicates that low-level learning skills are predominant for intermediate accounting textbooks. More attempts have been made to go beyond traditional measuring of student learning, e.g. Curtis and Davis (2003) report on the application of Pathfinder Associative Networks as one potential approach to assess learning outcomes of a deeper kind rather than just monitoring students’ ability to reproduce facts. In testing the student performance, the educator cannot control all these factors, no matter what performance measure he/she chooses, Smith (2004), Harwood and Cohen (1999). Accordingly, it is asserted that some differences in student performance (beside individual differences) would be expected for any accounting course. For example, the history of attendance and the time spent on preparation by students will have an effect on some learning outcomes, but not necessarily all, Gracia and Jenkins (2003). The entry GPA and the type of exam may also affect the learning outcome. These factors are furthermore chosen because they are measurable and because the students are familiar with such questions from regular questionnaires measuring their performance. Hence, the following null hypothesis will be explored (tested) for a particular auditing course:

H1: The learning outcomes of auditing students do not depend on their gender, age, entry GPA, type of admission exam, history of attendance and average amount of preparation for lectures.

3.2 The Importance of Prior Knowledge

The distinction between knowledge acquired at school and knowledge acquired at the workplace is not as clear-cut as indicated in the scenario in the section above. The opportunity to acquire a theoretical foundation in a given field has been the declared “raison d’être” for many business programs. For a number of reasons, however, students do not always comply with this ideal. One of the things that educators must acknowledge is that students taking accounting classes are often provided with on-the-job training in accounting firms, Ferguson et al. (2000), Dorsey et al. (1999), English and Koeppen (1993).

Prior research suggests that auditors depend on procedural knowledge to master different tasks within auditing, e.g. Curtis and Davis (2003), Thibodeau (2003), Bonner and Walker (1994), Bonner (1990). Bédard and Chi (1993) presented a theory of skill acquisition which divides the learning process into two major stages: a declarative stage and a procedural stage, see also Anderson (1995). The declarative knowledge to be learned is knowledge of facts, theories and definitions (from textbooks and journals). Procedural knowledge consists of rules or steps needed for performing skilled tasks. In distinguishing between the two, declarative knowledge is similar to data, and procedural knowledge is similar to processes. As a consequence, declarative knowledge must generally be in place prior to the acquisition of procedural knowledge, so that procedural knowledge can be compiled through interpreting declarative knowledge, Bonner and Walker (1994). Herz and Schultz (1999) describe the theoretical relationship between the two types of learning required: “Declarative learning takes place when descriptions of the steps of a new cognitive task are added to long term memory. As the cognitive task is repeatedly performed, two related processes (proceduralization and composition) convert declarative knowledge to procedural knowledge”, Herz and Schultz (1999).

In auditing, basic declarative knowledge is commonly acquired through formal education, and procedural knowledge is predominately acquired later during the auditor's professional career, e.g., Frederick (1991), Frederick and Libby (1986). An example confirming the relevance of this distinction is the finding by Frederick and Libby (1986), who examined how the auditor's “memory store” interacts with current audit evidence to determine judgment. Thus, they found that experienced auditors had knowledge of the relations between control weaknesses and account errors and knowledge of relations among accounts, whereas inexperienced auditors had only the latter (declarative) knowledge. Nonetheless, a distinction between declarative knowledge acquired in school and procedural knowledge acquired in practice is very crude. First, teaching objectives in accounting courses aim to convey both the declarative and procedural knowledge types. Second, students attending accounting classes may have obtained procedural knowledge from practice and in a sense bring this knowledge into play in the classroom discussions during the semester.

The ability to distinguish between learning outcomes for various groups of students may be seen as important for educators as well as the accounting profession, Gracia and Jenkins (2003), English and Koeppen (1993). Stone and Shelley (1997) compare the effectiveness of a new accounting program to that of a traditional program. The new program emphasizes the acquisition of intellectual skills and the improvement of attitudes without losing traditional accounting declarative knowledge. The change towards the learning objectives in the new program

may be seen as support for the notion that the evolution of cognitive skills among auditing students may lead to accounting expertise, see also Bonner (1999) and Choo and Tan (1995). Bonner (1999) has provided an elaborate framework in her article “Choosing Teaching Methods Based on Learning Objectives: An Integrative Framework”. Since teaching methods vary as to the conditions they can create and different types of learning objectives require different conditions for achievement, the premise of her framework is that the choice of teaching methods should be based primarily on the type of learning objective, Bonner (1999).

Therefore sensible measures for learning outcomes are needed by educators in order to (1) chose teaching methods which match prerequisite skills among a heterogeneous student body, (2) assess the need for correcting misconceived knowledge (i.e., cleaning the slate), and (3) be able to set up challenging yet fair exams for the total student body. The assessment of learning outcomes for the purpose of knowledge management plays a major role in accounting firms too. Knowledge transfer among auditors is part of everyday life within most accounting firms. The development of a sound on-the-job training environment is pivotal in the recruitment and design of supervision and in the end for the expected “success rate” in retaining (valuable) employees.

Prior research suggests that auditors acquire knowledge through experience and develop a knowledge structure, e.g. Dorsey et al. (1999), Bonner et al. (1997), Christ (1993), Bonner and Pennington (1991), Bonner and Walker (1994). Prior research also suggests that scripts or schemas are useful when organizing “data in memory” for accounting contexts, e.g., Choo (1996), Choo and Trotman (1991), Birnberg and Shields (1984). I.e. when faced with the knowledge provided in a graduate course, the students learn from their prior experiences and store the important aspects of each experience in memory in accordance with such schemas. The schemas available for students of graduate auditing course reflect prior accounting work experience for some students and undergraduate accounting coursework experience for all students. E.g. Ingram and Howard (1998) reported that conceptual knowledge is taught and measured as a highly prioritized part of most undergraduate courses in accounting. Because prior research suggests that prior knowledge is important for how new knowledge is acquired and organized, measuring learning outcomes have to take into account that such schemas play a major role. In the study by Krausz et al. (1999), the hypothesized relationship between performance in entry-level graduate accounting coursework and prior accounting work experience was supported, Krausz et al. (1999).

Two sets of students are identified in this paper. One student group has prior and/or current working experience within accounting firms and is identified as having an “auditing experience” schema. The other student group has no working experience within accounting firms, but may have other related working experience. However, the students possess solely a theoretical background for organizing knowledge learned in the auditing course. As a residual, the second student group is identified as having a “no auditing experience” schema. Even though both groups will share the content of the educational background, an experience effect may not only cause a difference in what they know, but also in how new knowledge is acquired and organized.

Hence, an instrument was constructed to measure the learning outcome for the two student groups by testing a range of declarative and procedural knowledge. It may be asserted that the available knowledge schema for students with or without auditing experience will not affect the learning outcomes for declarative knowledge. The educator’s perspective would be that the students face the same curriculum and attend the same lectures, so no difference in performance is expected. However, prior knowledge may inhibit students with working experience in reproducing declarative knowledge. As stated by Herz and Schultz (1999): “Gauging declarative knowledge relies on one’s ability to verbalize pertinent facts or processes; measuring procedural knowledge is more subtle as it relies on “automatic” linkages to performance that gradually deny access to declarative knowledge. This distinction limits experienced auditors’ ability to demonstrate their knowledge via ordinary recall or recognition measures commonly used in accounting studies”.

While the latter may be true, this phenomenon may not hold in the specific context. Hence, an assertion about learning outcomes for declarative knowledge when comparing students with and without auditing experience is stated as the following null-form hypothesis:

H2: There is no difference between students with and without auditing working experience regarding learning outcome for declarative knowledge.

The importance of prior knowledge when performing auditing tasks suggests that students with auditing experience would be expected to have an advantage when answering questions on procedural knowledge. The null hypothesis is stated in the following form:

H3: There is no difference between students with or without auditing working experience regarding learning outcomes on procedural knowledge.

Hypotheses 2 and 3 will be explored (tested) for a particular auditing course as will be described later.

3.3 The Importance of Intellectual Skills

Within accounting, intellectual skills include the ability to differentiate and integrate alternative problem perspectives, the ability to identify accounting-related information resources, the ability to structure problem solutions, and written communication skills, Knechel (2000), Stone and Shelley (1997). In the work initiated by Robert M. Gagné, the conceptual understanding of intellectual skills may be equated with procedural knowledge. “Intellectual skills” are seen as separate from motor skills, and verbal (declarative) knowledge, see Gagné (1984), and Gagné and Medsker (1996). In his work, Gagné advocates the use of a categorical approach to understand and measure learning outcome. When it comes to a subdivision of intellectual skills, Gagné offers a conceptual hierarchy of increasing complexity. Hence, a need for more sophisticated measures when dealing with learning outcome in regard to procedural knowledge is identified. In the context of this paper, the conceptualization of different intellectual skills has been used as a foundation for developing an instrument, see subsection 4.2. The intention has been to develop an instrument which can test whether it makes sense to subdivide learning outcome with regard to procedural knowledge.

Because of the need for prerequisite skills in performing well on procedural knowledge, a difference is expected between the two groups of students, i.e. the assertion behind hypothesis 3. However, since a certain amount of intellectual skills is expected to translate into the answers in both groups, it is difficult to predict the level of complexity at which this change will take place. In dealing with the framework of teaching methods, Bonner (1999) states that: “To acquire intellectual skills, students should have some framework before practicing (experiencing) with examples. This idea is consistent with previous arguments describing the benefits of providing a framework through lecturing,” Bonner (1999).

The importance of prior knowledge in performing auditing tasks suggests that students with auditing experience are expected to have an advantage when answering questions on procedural knowledge. However, some extent of procedural knowledge is expected to be acquired by the “no auditing experience” students, see also Lehman and Norman (2006). Using the expected direction of this relationship, the following hypothesis will be explored (by one-sided tests) for a particular auditing course:

H4: The higher degree of intellectual skill required for learning outcome, students with auditing working experience will perform better than students without auditing working experience.

4. Methodology

4.1 Study Design and Subjects

A total of 75 students completed the questionnaires distributed to two similar auditing classes (34 students in the first class and 41 in the second). The questionnaires contained 21 main questions with different levels of complexity ranging from multiple-choice to open-ended questions.

The questionnaires were distributed without any notice in mid-semester at the end of a teaching session in the auditing course given by the same lecturer. Hence the students were unprepared for the task and the test is consequently approaching active knowledge. Before handing out the questionnaires the students were briefly motivated and instructed (three to four minutes). Participation was voluntarily and all the students participated in second class, while three students of the first class chose not to participate. The time allowed to answer the questionnaire was 40 minutes.

The students attend a two year full time or three to five year part time graduate education in “accounting and auditing”, CMA in Denmark. The graduate exam makes up the theoretical part of the auditors' qualification as state authorized public accountant (certified public accountants). In order to become state authorized public accountant the graduates will need at least three further years of auditing experience after graduation before they can attempt the final practical exam to become a state authorized public accountant.

As mentioned earlier Krausz et al. (1999) explored the relationship between prior accounting work experience and undergraduate accounting course work experience. We have extended the amount of descriptive background information even more. The background information relates to: (1) Working experience: Current or previous auditing experience or other work experience including job title and domain and task-specific information -job description, (2) Academic qualification to enter the graduate education CMA including the type of education BSc or HD (Higher Diploma), average grade, graduation year and place of education, (3) Study related information including whether they are full time or part time students, number of semesters followed in auditing, previously failed exam in auditing, preparation time relative to class lectures and attendance in class (percentage), and (4)

General data: Time used to complete the questionnaire, gender, address in form of current zip code, birthday and year, and student-ID (voluntary).

Table 1 provides an overview of the composition of the subjects. Panel A holds a cross-tabulation of the subjects according to gender, age group and entry exam. Of the 75 subjects 51 were male and 24 were female. No variations associated with gender were identified. The ages varied from 23 years to 34 years, with an average of 25.9 years. By subdividing the subjects in the age groups in Table 1, Panel A, it is possible to show that the subjects with a HD entry exam are typically older than the subject with the BSc entry exam (Note 1).

Table 1. Cross-tabulation of subject characteristics

Panel A. Gender, age group and entry exam

Exam	Gender	Age group			Total
		age below 26	26 to 30	age above 30	
BSc.	Female	10	3	1	14
	Male	17	10	0	27
	Total	27	13	1	41
HD	Female	4	6	0	10
	Male	6	15	3	24
	Total	10	21	3	34

Panel B. Auditing experience, work experience and full or part time students

		Work experience		Total
		no	yes	
Part time student	Audit experience		2	2
	No audit experience		36	26
	Total		38	38
Full time student	Audit experience	29	4	33
	No audit experience	0	4	4
	Total	29	8	37

In Table 1, Panel B, the cross-tabulation of subjects suggests three different ways to examine the potential for work experience effects. First, the subjects may be divided in two equally sized groups based on whether they consider themselves part time or full time students. Second, based on general work experience 46 of the 75 subjects (61%) had prior experience. Third, based on auditing work experience 40 of the 75 subjects (53%) had prior experience. Given the three possibilities, it follows naturally to examine the importance of prior knowledge in relation to audit matters based on the latter subdivision of the students.

The auditing work experience ranged from two to 183 months with an average above five years (67.9 months). One student whose job title suggested current auditing experience was dropped from the experience sub-sample as it was revealed that he only had one month of auditing experience. Further cross-tabulations (not shown here) suggest that the group of students without any auditing experience is essentially students with a BSc. degree. The group of students with auditing experience typically work and attend the graduate CMA education programme at the same time. For most the entry exam is an HD, but a few hold BSc degrees.

4.2 The Instrument

The need for an elaborate measurement (instrument) of both declarative and procedural knowledge was identified in sections 2 and 3. It is always a challenge to develop an appropriate instrument for measuring learning objectives, i.e.: “classifying learning objectives into types is not a trivial task” (Bonner, 1999). The design was based on the classification of knowledge and learning of Gagné and Medsker (1996) i.e. verbal knowledge also called declarative knowledge and intellectual skills also called procedural knowledge. The hierarchy of the procedural knowledge is: a) discrimination, b) concepts, c) simple rules and d) high order rules (Gagné & Medsker, 1996).

The instrument included 21 main questions with different levels of complexity, and many had supplementary questions. Ten of the 21 main questions are classified as declarative, while the remaining 11 main questions are

classified as procedural. The way the questions were constructed allowed up to 36 correct answers on declarative knowledge and 31 correct answers on procedural knowledge. The latter are subdivided in accordance with the learning hierarchy, i.e. three are classified as “concepts”, four as “simple rules”, and four are classified as “high order rules”. At an early state the questionnaire was verified by a group of audit practitioners and experienced lecturers and validation tests were run on older students who had completed the auditing exam. Relevant comments were incorporated into the final questionnaire.

In order to classify the questions, we used some rather rigid rules. For declarative knowledge we based our composition of the questions mainly on the following proposition: The outcome of declarative knowledge is that a person is capable of stating or giving the name, fact, or idea – usually in the form of a proposition – and does not require the information to be applied or transferred to novel situations. The primary challenge for verbal information learning is retention and retrieval – recognition or recall – not transfer, see Gagné and Medsker (1996, 82-83).

In other words, the questions should be asked in such a way that it is possible to answer only by recall or by recognition (maybe aided by other facts). In order to illustrate we provide two examples from the questionnaire:

Question 4. Who is responsible for the financial reporting of a public/ private company? 1) The management, 2) The supervisory board, 3) Both the management and supervisory board, 4) The auditor, 5) Both the management and the auditor, 6) Both the auditor and the supervisory board, 7) The management, the supervisory board and the auditor, 8) Don't know.

Question 8. In auditing, a distinction is made between 8 types of evidence and 3 levels of persuasiveness. List the remaining 6 types of evidence after “Inquiry” and “Internal documentation”. List the relevant level(s) of persuasiveness for each type of evidence.

The two questions provide examples of how the students are subjected to tasks requiring recognition and recall respectively. Question 4 is a multiple choice question, and requires that the student *recognize* facts given several choices of wrong, partly wrong or correct answers. It is not necessarily easier than to recall, because when the learner is asked to recognize a particular fact, the more paths which lead to other facts, the slower the response (Gagné & Medsker, 1996). Question 8 requires that the student should *recall* the remaining types of audit evidence. They are aided by two examples of evidence. In doing so we enhance the possibility of recalling the facts, because when the learner must recall facts rather than simply recognize them, a greater number of paths to other facts appear to have the effect of enhancing retention (Gagné & Medsker, 1996).

The classification rules used for procedural knowledge follow the subdivision of skills in discrimination, concepts, simple rules and higher order rules respectively. Even though we were apprehensive about the first type of skill, we constructed one question related to discrimination, but the question was excluded from the analyses because afterwards we recognized that the question could be fully answered based on common knowledge. Besides, discrimination among physical phenomena is not used very often in a classroom where auditing is taught (Bonner, 1999, 16).

In determining the concepts we based the construction of the questions mainly on the following proposition: Concepts must be learned by use of language and require a verbal definition. Definitions are statements that express rules for classification, and *contain essential features and functions* of the object or relation being defined and are abstract rules for classification of objects and events. When defined concepts have been acquired, the outcome should be that the persons are able *to use the definition to classify* objects or relations (Gagné and Medsker, 1996, 61-62).

There are three questions related to the concepts. The following example is provided:

Question 12. Please classify the following into audit evidence and/or an audit procedure: 1) reconciliation, 2) scanning, 3) confirmation, 4) trace, 5) compare and 6) inquiries.

The question requires that the students understand what audit evidence and audit procedures are, that is knowledge they have acquired declaratively. As opposed to the declarative questions, the question requires that the students are able to make a *distinction* between audit procedures and audit evidence, and are able to use the definitions in stead of just stating the facts.

In determining the simple rules questions we primarily based the device of the questions on the following proposition: A rule may be a particular kind of a defined concept and is typically composed of several concepts. Learning a rule becomes a matter of learning the correct relationships among them. The outcome is the ability to *demonstrate* or *apply* the rules, not to state them (Gagné & Medsker, 1996).

There are four questions related to simple rules. The following example is provided:

Question 15. State the type of audit evidence which is ideally the strongest for ascertaining existence of inventory.

It is a necessity in order to answer the question that the students are able to recall the (declarative) knowledge about audit evidence and audit objectives, and have basic knowledge of inventory. Besides, it requires that they are able to choose not only audit evidence, but also the most reliable evidence related to a specific audit objective, i.e. the correct relationship among them (concepts). Furthermore, they must relate them to a specific item in the financial statements in order to reach a proper audit solution to the problem.

In determining the **high order rules** questions we primarily based the device of the questions on the following proposition: The outcome of learning high order rules is that one can generate a new rule by combining old rules and use the new rule to perform a task (Bonner, 17), Gagné and Medsker (1996).

There are four questions related to high order rules. The following example is provided:

Question 19. Could it be relevant to send positive direct confirmations to accounts payable creditors, yes or no? Please explain your reasons shortly.

It is very common and almost a must to confirm the existence of receivables by use of positive confirmations. It is not that common to use the same procedure for accounts payable. The problem solving requires that the student knows the accommodation of confirmations – the rules – and is able to make an abstraction to accounts payable and explain the conditions under which it will be desirable to use confirmations as an instrument in auditing accounts payable.

The classification of the questions was contemplated as part of the overall verification of the instrument by independent audit practitioners and experienced lecturers. Ex post, a comparison of answers related to our classification of declarative and procedures knowledge was made using paired samples tests. Across all subjects this test indicated a highly significant difference with regard to the relative number of correct answers between declarative knowledge and procedural knowledge respectively. More results related to the paired samples tests are presented in further detail in section 5 below (see table 6 specifically).

5. Results and Analyses

5.1 The Interrelationship between Declarative and Procedural Knowledge

The first issue we examine is the possible relationship between declarative and procedural knowledge. As stated in section 4, the subjects were prompted for answers in a number of questions belonging to different categories. The preliminary analyses are based on operational measures for learning outcomes in terms of two relative measures. In the following, the relative measures are termed “accuracy” and “extent” respectively.

An example of the measures for an individual subject is provided here. For the part gauging declarative knowledge, subject no. 7 had 22 correct answers, answered 30 questions out of 36, i.e., giving a *measure for knowledge accuracy* of 0.73 (22/30) and a *measure for knowledge extent* of 0.61 (22/36). For the other part gauging procedural knowledge, subject no. 7 had 26 correct answers, answered 30 questions out of 31. That is, a *measure for knowledge accuracy* of 0.87 (26/30) and *knowledge extent* of 0.84 (26/31).

Table 2. The Relationship between declarative and procedural knowledge (pearson correlations, n=75)

	Accuracy, declarative knowledge	Extent, declarative knowledge	Accuracy, procedural knowledge	Extent, procedural knowledge
Accuracy, declarative knowledge	1			
Extent, declarative knowledge	0.686**	1		
Accuracy, procedural knowledge	0.255*	0.390**	1	
Extent, procedural knowledge	0.184	0.580**	0.751**	1

Note: ** Significant at 0.01; * Significant at 0.05

The relationship between declarative and procedural knowledge is examined by looking at Pearson correlation coefficients calculated on the basis of the answers from the 75 students. In table 2 the correlation coefficients are

presented for knowledge accuracy and knowledge extent for both types of knowledge. The findings suggest a positive relationship between all four measures.

First, it is evident that there is a positive relationship between declarative and procedural knowledge. The correlation coefficient between the accuracy measure of declarative and procedural is 0.255 (significant at the 5% level) and between the knowledge extent measure of declarative and procedural the coefficient is 0.580 (significant at the 1% level).

Second, the evidence suggests that only one of the two measures for each type of knowledge is necessary in order to gauge the the students' knowledge in this task. In effect, when the measures for declarative knowledge are compared, it is clear that the accuracy and extent measures are correlated (0.686, which is significant at the 1% level). A comparison of the measures for procedural knowledge gives a correlation between the accuracy and extent measures of 0.751 (significant at the 1% level).

Third, even the cross-correlations suggest a positive relationship. In effect, if students provide accurate answers regarding procedural knowledge, the chance is that they will also score high on the declarative extent measure. The corresponding correlation is 0.390 (which is significant at the 1% level). It is not surprising that the lowest level of correlation is 0.184 (not significant at the 5% level), which is the cross-correlation coefficient between accuracy for declarative knowledge and the extent of procedural knowledge.

These initial results suggest that the strict distinction between declarative and procedural knowledge seen in a number of studies should be handled carefully. As noted in several studies, a positive relationship between the two types of knowledge should be expected, e.g. Herz and Schultz (1999), Stone and Shelley (1997), Bonner and Walker (1994). In effect, this may have considerable implications and should be taken into account when interpreting the knowledge differences as a result of different teaching styles, experience levels, familiarity with specific audit domains etc. In addition, it makes sense to continue the analyses below based solely on the extent measure as the performance measure for learning outcomes.

5.2 Examination of the Importance of Background Factors

In this section, we provide evidence of the importance of background factors for learning outcomes. In the context of this paper, we examine whether the learning outcomes of the 75 auditing students depend on such factors as gender, age, entry GPA, type of admission exam, history of attendance and average amount of preparation for lectures.

In table 3 the relationships between background factors and the overall performance measure is presented in the form of correlation coefficients. The overall performance measure is the learning outcome measured as the extent of correct answers to all the questions in the instrument. Three of the factors have significant correlations with the overall performance measure, namely: entry exam, entry GPA and auditing experience. However, entry exam and auditing experience are highly correlated. In effect, most students with work experience have HD degrees and this provides a tie to the matter being measured (audit knowledge). Auditing experience (suggesting prior knowledge) is treated as a separate factor in the following sub-section, hence entry GPA stands out as the only remaining background factor with significant impact on the learning outcome. This factor could be seen as a broad indicator for intellectual capacity as measured for prior scholastic performances, i.e., prior performances as a good indicator for the present capabilities. The correlations also indicate that the entry GPA is not driven by the type of entry exam. This suggests that we are dealing with two independent factors. It should also be noted that average preparation does not influence the learning outcome. According to the correlation coefficients presented in table 3, this could be due to a significantly lower level of preparation among students with audit experience (and HD entry exam). This suggests a need to disseminate the findings in relation to the experience factor (see subsection 5.3).

The correlation between background factors and the overall performance measure might be mitigated by the type of knowledge required (Note 2). Hence t-tests for independent samples have been carried out to test for possible factors that can explain differences in measured learning outcomes (i.e. H1). The results are presented as two regression analyses with the extent of declarative knowledge and the extent of procedural knowledge as the respective dependent variables. The results for the explanatory models are based on the six background factors identified above and they are presented in table 4.

Table 3. Relationships between background factors and overall performance measure (pearson correlations, n=75)

	Gender	Age	Entry exam	Entry GPA	Average preparation	Class attendance	Auditing experience	Extent, all questions
Gender	1							
Age	0.134	1						
Entry exam	0.051	0.316**	1					
Entry GPA	-0.097	-0.274*	-0.072	1				
Average preparation	0.139	-0.166	-0.541**	-0.004	1			
Class attendance	-0.177	-0.180	-0.227	0.005	0.229*	1		
Auditing experience	-0.069	0.251*	0.852**	0.061	-0.415**	-0.176	1	
Extent, all questions	-0.061	0.189	0.506**	0.307**	-0.147	0.000	0.575**	1

Note: ** Significant at 0.01; * Significant at 0.05

Table 4. Explaining learning outcomes by background factors

	Declarative knowledge		Procedural knowledge	
	t	p	t	p
Constant	-1.120	0.267	-0.193	0.848
Gender	0.173	0.863	-2.071	0.042
Age	1.437	0.156	1.227	0.224
Entry GPA	3.101	0.003	3.367	0.000
Average preparation	1.619	0.110	1.438	0.155
Class attendance	1.103	0.274	0.609	0.545
Entry exam	3.960	0.000	5.456	0.000

According to the results presented in Table 4, the combination of predictors could explain the *learning outcomes for declarative knowledge* (R squared 0.302, not shown in table). The result is mainly carried by the two factors identified in the correlation matrix (entry GPA and entry exam) and both are significant at the 1% level.

It is evident that the student class attendance during the semester and the average time the students use for preparation before lectures are un-important factors. An explanatory effect for the class attendance and preparation before lectures are implied in the traditional way of teaching, i.e. students need to be well prepared and attend the lectures in order to learn. However, the lacking effects could probably be explained by homogeneity among the students as regards these factors in combination with the nature of the instrument, which aims at measuring available knowledge in an unprepared situation. An explanation for the lack of impact from the class attendance factor could be low variation between subjects (88% of the subjects attend more than 70% of the lectures). It is noticeable that the average amount of preparation for classes does not affect the students' ability to reproduce learning outcomes regarding the part of the questionnaire that requires declarative knowledge. Further subdivision of the model does suggest higher impact from preparation for students with no auditing experience (findings not shown).

The combination of predictors can also manage to explain the *learning outcomes for procedural knowledge* (R squared 0.445, not shown in table). This result is carried by three factors. In addition to the entry GPA and entry exam reported above, the gender is a significant predictor at the 5% level. The gender effect suggests that female students perform better on procedural tasks, while there is no gender effect on declarative tasks. Descriptive statistics (not shown) suggest that slightly more female students have auditing experience and that their entry GPA is slightly higher, but neither these nor any of the other background factors demonstrate significant correlations with the female factor.

The graduate CMA program only accepts students with a GPA grade above average. Still, differences in entry GPA also make a difference in the ability to reproduce procedural knowledge. In effect, students who have previously produced high scores on exams, perform better not only on declarative tasks but also on the procedural tasks in the questionnaire. Keeping in mind that the HD-students typically have auditing experience,

the second predictor (entry exam) probably points to an impact from prior knowledge on audit matters rather than the type of exam in itself.

5.3 Examination of the Importance of Prior Knowledge

In this section, the importance of the availability of an auditing experience schema is examined. It may be asserted that the available knowledge schema for students with or without auditing experience will not make a difference for learning outcomes on *declarative knowledge*. The educator's perspective would often be that the students are faced with the same curriculum and attend the same lectures, so no difference in performance is expected. This was the basis of H2, i.e, the hypothesis that "there is no difference between students with or without auditing working experience regarding learning outcome for declarative knowledge".

The 75 students are divided into two groups, namely 35 students without auditing experience and 40 students with such experience. The descriptive measures in panel A of table 5 indicate that students with auditing experience perform much better than students without auditing experience. The average score for the extent of declarative knowledge is 60% for students with auditing experience as compared to 48% for students without auditing experience.

The average measure for all students was 55%. The relatively "low" performance level reflects the difficulty of the tasks and probably also that the test was unprepared. However, the students did acknowledge their own limitations evidenced by the number of unanswered questions. This is confirmed by the result of analyses based on the other measure termed "accuracy" (results not shown). The majority of the students do not engage in guessing games when they do not know the answer to a question regarding declarative knowledge. It is noteworthy, that this is true of the students with the auditing experience schema too. Furthermore, the possibility that prior knowledge may inhibit students with working experience in reproducing declarative knowledge is not confirmed in the context of this study.

Table 5. Explaining learning outcomes by auditing experience schema

Panel A. Descriptives

		n	mean	std. Dev.	95%CI	
					LL	UL
Extent, declarative knowledge	No experience	35	0.479	0.146	0.429	0.530
	Experience	40	0.602	0.123	0.563	0.642
	Total	75	0.545	0.147	0.511	0.579
Extent, procedural knowledge	No experience	35	0.509	0.135	0.462	0.555
	Experience	40	0.695	0.107	0.661	0.729
	Total	75	0.608	0.152	0.573	0.643

Panel B. ANOVA

		SS	df	MS	F	p
Extent, declarative knowledge	Between groups	0.281	1	0.281	15.558	0.000
	Within groups	1.319	73	0.018		
	Total	1.600	74			
Extent, procedural knowledge	Between groups	0.649	1	0.649	44.432	0.000
	Within groups	1.066	73	0.015		
	Total	1.714	74			

The result of an ANOVA based on these groups is presented in panel B of table 5. The students with auditing experience schema perform better than the students without experience, when performance is measured by the extent of declarative knowledge. In effect, H2 is rejected by the result of the ANOVA showing an F-value of 15.558 (significant at the 1% level). The declarative knowledge conveyed in the auditing course is adopted to a lesser extent by students whose knowledge base is solely theoretical than by students with prior audit experience.

In the hypothesis section (3.2), it was stressed that a difference would be more likely for *procedural knowledge*. That is, the importance of prior knowledge when performing auditing tasks suggests that students with auditing experience would be expected to have an advantage when answering questions on procedural knowledge. Table

5 also presents evidence about this contention tested in the null-hypothesis form. As suggested by other studies, e.g. Frederick (1991), Frederick and Libby (1986), we also find a significant difference in the extent of procedural knowledge at the 1% significance level and an F-value of 44.432. That is, when faced with the questions regarding procedural knowledge, students with the auditing experience schema perform better (average 70%) than students with a purely theoretical schema (average 51%).

The effect of prior knowledge is further amplified by the results of the paired samples tests presented in table 6. Earlier the result of paired samples tests across all subjects has been mentioned. When subdivided into the two groups, the paired samples test for students with auditing experience confirms the difference in performance with regard to the declarative and procedural tasks respectively (significant at the 1% level). The students with auditing experience actually perform better on procedural tasks (proportion of correct answers). In contrast, the students without auditing experience perform equally well in relation to the two types of knowledge, i.e., the non-significant result of the paired samples test for this group.

Table 6. Differences between learning outcomes related to declarative and procedural knowledge

		Paired Differences				
		Mean	Std. Dev.	t	df	p
Pair 1, All subjects	Extent, declarative knowledge - Extent, procedural knowledge	-0.063	0.137	-4.001	74	0.000
Pair 1, Auditing experience	Extent, declarative knowledge - Extent, procedural knowledge	-0.093	0.128	-4.615	39	0.000
Pair 1, No auditing experience	Extent, declarative knowledge - Extent, procedural knowledge	-0.029	0.142	-1.228	34	0.228

Rejecting H3 for the extent measure suggests that students adopt the procedural knowledge conveyed in the auditing course better if they have prior practical experience from auditing. As a consequence, the educators have to make sure that the examination based on the auditing coursework is “fair”. The type of questions classified here as requiring procedural knowledge may be considered as parallel as the learning outcomes at the upper end of Bloom’s taxonomy, see Davidson and Baldwin (2005). In effect, a fair exam should reflect the differences in prior knowledge in order to provide equal opportunities for all students.

5.4 The Hierarchy of Procedural Knowledge

The evidence presented in section 5.3 confirms that students with auditing experience schema are expected to have an advantage when answering questions on procedural knowledge. However, some amount of procedural knowledge is expected to be acquired by the students without auditing experience. The questions regarding procedural knowledge are subdivided according to the hierarchy of intellectual skills identified earlier. In effect, the 31 possible answers related to procedural knowledge are classified accordingly – with 15 on “concepts”, 6 on “simple order rules” and 10 on “higher order rules”. As in the previous sections, the relative measure for extent of knowledge is calculated and finally the two student groups are compared. This subdivision allows us to address H4, namely “the higher degree of intellectual skill required for learning outcomes, students with auditing working experience will perform better than students without auditing working experience”.

Table 7. The effect of auditing experience on extent of learning outcomes for increasing intellectual skills

Panel A. Descriptives

		n	mean	std. Dev.	95%CI	
					LL	UL
Extent, concepts	No experience	35	0.705	0.147	0.654	0.755
	Experience	40	0.702	0.142	0.656	0.747
	Total	75	0.703	0.143	0.670	0.736
Extent, simpel rules	No experience	35	0.467	0.252	0.380	0.553
	Experience	40	0.754	0.189	0.694	0.815
	Total	75	0.620	0.262	0.560	0.680
Extent, higher order rules	No experience	35	0.240	0.177	0.179	0.301
	Experience	40	0.650	0.223	0.579	0.721
	Total	75	0.459	0.288	0.392	0.525

Panel B. ANOVA

		SS	df	MS	F	p
Extent, concepts	Between groups	0.000	1	0.000	0.009	0.926
	Within groups	1.514	73	0.021		
	Total	1.514	74			
Extent, simpel rules	Between groups	1.543	1	1.543	31.784	0.000
	Within groups	3.544	73	0.049		
	Total	5.087	74			
Extent, higher order rules	Between groups	3.138	1	3.138	76.253	0.000
	Within groups	3.004	73	0.041		
	Total	6.142	74			

The results presented in tables 7 and 8 reflect the hierarchical view of the difficulty of the questions, i.e. the need for increased intellectual skills as termed by Gagné (1984). The ANOVA results in table 7, panel B provide evidence of the effect of auditing experience on the extent measure for learning outcomes for the different types of procedural knowledge. The order and size of the F-values for the comparison of the two student groups suggest that *H4 is confirmed*, i.e. concepts ($F=0.009$) < simple order rules ($F=31.784$) < higher order rules ($F=76.253$). This confirms that the higher degree of intellectual skills required, the larger difference in performance is observed in favor of the students with auditing experience.

An indication of the need for increasing intellectual skills is available in Table 7, i.e. by comparing the average measure for extent of knowledge for each of the three categories. For students without auditing experience, the extent of knowledge decreases from 70.5% on “concept” questions to 46.7% on “simple order rules” and further to 24% for “higher order rules”. The levels of extent are somewhat higher for students with auditing experience, i.e. 70.2% on concepts, 75.4% on simple rules and 65% on higher order rules.

The ANOVA-tests for the categories of procedural knowledge suggest a more complex picture than indicated in the previous section (when examining H3). In effect, the evidence suggests that there is absolutely no difference between the two groups of students in relation to the simplest form of intellectual skills, namely the concept category, but the difference between the groups is distinct for simple rules and for high order rules. One way to interpret these findings is that it is possible to acquire procedural knowledge only to a certain degree by attending auditing courses without prerequisite knowledge from auditing practice. In addition, the findings suggest that when it comes to procedural knowledge of high complexity, there is no substitute for knowledge acquired through working experience in auditing in order to increase the performance.

While H4 is confirmed, the differences in learning outcomes suggests that the Gagné categories for *increasing* intellectual skills are better fitted for students without auditing experience. Paired sample tests were used to examine differences between each type of learning outcome, see table 8.

Table 8. Paired samples test, differences between learning outcomes for increasing intellectual skills

		Paired Differences				
		Mean	Std. Dev.	t	df	p
Pair 1, All subjects	Extent, Concepts - Extent, simple rules	0.083	0.292	2.467	74.	0.016
Pair 2, All subjects	Extent, Concepts - Extent, high order rules	0.244	0.313	6.773	74.	0.000
Pair 3, All subjects	Extent, simple rules - Extent, high order rules	0.161	0.240	5.829	74.	0.000
Pair 1, Auditing experience	Extent, Concepts - Extent, simple rules	-0.052	0.259	-1.282	39.	0.207
Pair 2, Auditing experience	Extent, Concepts - Extent, high order rules	0.052	0.268	1.218	39.	0.231
Pair 3, Auditing experience	Extent, simple rules - Extent, high order rules	0.104	0.245	2.687	39.	0.011
Pair 1, No auditing experience	Extent, Concepts - Extent, simple rules	0.238	0.249	5.655	34.	0.000
Pair 2, No auditing experience	Extent, Concepts - Extent, high order rules	0.465	0.191	14.424	34.	0.000
Pair 3, No auditing experience	Extent, simple rules - Extent, high order rules	0.227	0.219	6.132	34.	0.000

For students without auditing experience, all the paired samples tests for differences between the extent measures were highly significant, that is a t-value of 5.655 for the difference between “concepts” and “simple order rules”, a t-value of 6.132 for the difference between “simple order rules” and “higher order rules”, and for the two types of intellectual skills farthest apart, a t-value of 14.424. This confirms the directional order of the intellectual skills as measured by the learning outcomes in accordance with the predetermined categories. This is also confirmed by the performance measured across all subjects as a total, however, the directional order does not hold for the group of students with auditing experience.

In general, the students with auditing experience knowledge schema perform well on all the procedural tasks, and even better on procedural tasks than on declarative tasks. The paired samples tests show that the learning outcomes measured are similar for concepts and simple rules, and for concepts and higher order rules (non-significant differences). Significant differences are found between measures for the extent of simple order and higher order rules. Hence, this finding suggests a directional order of the intellectual skills required, but not as pronounced as for the students without auditing experience. The outcome representing the students with auditing experience indicates that these students perform slightly better on simple order tasks than on concepts, but according to the paired sample tests the difference is not significant. For clarification, we have also examined the data-set with respect to a number of different ex-post classifications of the learning outcomes. One finding is that when concepts and simple rules are treated as one category and compared with higher order rules, paired samples tests confirm a significant difference for students with auditing experience in line with the directional order of the intellectual skills (not shown in table).

6. Conclusions, Limitations and Implications

The evidence presented in this paper contributes to findings in prior studies in the areas of auditing education and audit practice. The contention of this study has been that sensible measures are needed by educators in order to (1) chose teaching methods which match the prerequisite skills among a heterogeneous student body, (2) assess the need for correcting misconceived knowledge (i.e. cleaning the slate), and (3) be able to set up challenging yet fair exams for the total student body. The findings suggest that differences in learning outcomes are attributed to differences in student background (entry GPA) and prior knowledge (auditing experience). This is consistent with prior studies on accounting education, e.g. Ferguson et al. (2000), Krausz et al. (1999), Dorsey et al. (1999), English and Koeppen (1993), Knechel and Snowball (1987).

This study contributes to a more detailed understanding of differences in learning outcomes by relating these to distinct knowledge categories. The student mass as a whole possesses both declarative and procedural knowledge. In general, the students with auditing experience knowledge schema perform even better on procedural tasks than on declarative tasks. This is consistent with prior studies on audit practice, e.g. Frederick

(1991), Frederick and Libby (1986). However, the possibility that prior knowledge inhibits students with auditing experience in reproducing declarative knowledge is not confirmed in the context of this study. The students without auditing experience perform equally well on tasks requiring declarative and procedural knowledge, but with an adverse relationship between performance and the (increased) intellectual skills required as related to the procedural tasks.

The findings also suggest that the importance of prior knowledge is mitigated by the intellectual skills required for a particular task. In effect, the findings suggest that there is absolutely no difference between the two groups of students in relation to the simplest form of intellectual skills, namely the concept category, but the difference between the groups is distinct for simple rules and even more distinct for high order rules. This confirms the proposition by Gagné (1984) with regard to the need for increasing intellectual skills across different categories of procedural knowledge. In the context of this study, the distinction between the three categories of intellectual skills is actually better fitted for students without auditing experience. Significant differences are only found between learning outcomes related to simple order and higher order rules for students with auditing experience. One way to interpret these findings is that it is possible to acquire procedural knowledge only to a certain degree by attending auditing courses without prerequisite knowledge from auditing practice. When it comes to procedural knowledge of high complexity, there is no substitute for knowledge acquired through working experience in auditing in order to increase the performance.

In assessing the strength of our conclusions care must be taken to some important limitations of the study. Firstly, the size of the data set (number of subjects) should always be considered. Secondly, the findings are interpreted in light of a specific context: student performance in a particular auditing course, responses to a particular instrument, and outcome measures based on a limited number of questions. Thirdly, the construction and classification of questions related to the learning hierarchy is inherently an ambiguous task – no matter how rigid the rules for classification are interpreted. The validation procedures considered in designing the instrument and the ex post validation tests conducted, however, increase our confidence in the results presented.

The study has a number of possible implications for education and practice. Implications for education are related to the planning and conduct of audit courses and to tests and final exams based on the auditing course work. Consequently, a fair exam should reflect the difference between the students in order to provide an equal opportunity to perform well for all students. The implications for auditing practice may relate to the recruitment and design of the on job training in order to increase the “success rate” in retaining recruited employees who have a purely “theoretical” background.

Our study has extended prior studies of the importance of the student’s prior experience. We find that there is much more to do with respect to that issue in future research. Other important issues are the pitfalls of constructing a reliable instrument and the relationship between specific procedural skills and performance given different levels of task-complexity. As such, our findings provide support in favor of the idea of using multiple measures when studying the evolution of cognitive skills among graduate students in auditing.

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Notes

Note 1. The BSc (in Economics and Business Administration) is a three years full time education and a more general and broad economic education than the HD (Higher Diploma). The HD is a part time education with two years of general economics and two years in accounting, tax and other disciplines related to accounting. The education corresponds almost to a three year full time education, but is more interrelated with accounting than the BSc education. The students with a HD background typically work for accounting firms when they attend the CMA graduate education on part time.

Note 2. A paired sample test across all subjects indicates a highly significant difference between the learning outcomes measured with respect to declarative and procedural knowledge respectively (see table 6).

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