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A Comparative Analysis and Evaluation of Knowledge Structures between Expert Novice and Struggling Novice Accounting Students

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A COMPARATIVE ANALYSIS AND EVALUATION OF KNOWLEDGE STRUCTURES BETWEEN EXPERT NOVICE AND STRUGGLING NOVICE ACCOUNTING STUDENTS

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TABLE OF CONTENTS

Page

LIST OF TABLES v

LIST OF FIGURES vii

LIST OF ILLUSTRATIONS viii

CHAPTER

I. INTRODUCTION 1

II. REVIEW OF THE LITERATURE 5

III. METHOD 21

Hypotheses 21

Participants 22

Instrumentation 24

Design 28

IV. RESULTS 29

Results Related to Testing Null Hypothesis One . . . 29

Results Related to Testing Null Hypothesis Two . . . 35

Results Related to Testing Null Hypothesis Three . . 36

Results Related to Testing Null Hypothesis Four . . . 43

Results Related to Testing Null Hypothesis Five . . . 45

Results Related to Testing Null Hypothesis Six . . . 51

Results Related to Testing Null Hypothesis Seven . . . 56

V. DISCUSSION 57

Discussion Related to Null Hypothesis One . . . 58

Discussion Related to Null Hypothesis Two . . . 60

Discussion Related to Null Hypothesis Three . . . 62

Discussion Related to Null Hypothesis Four . . . 64

Discussion Related to Null Hypothesis Five . . . 77
Discussion Related to Null Hypothesis Six . . . 80
Discussion Related to Null Hypothesis Seven . . . 82
Summary, Limitations and Suggestions for Further Research . 83
APPENDICES
Appendix A - Student Baseline Inventory Survey . . . 89
Appendix B Student Learning/Studying Survey . . . 91
REFERENCES 93
VITA 98

LIST OF TABLES

Table		Page
1.	Point total after first three quizzes and the first exam	23
2.	Means, Standard Deviations, and Sample Sizes of Test Achievement Scores Across Struggling Novice and Expert Novice Groups	27
3.	Tests Results for Between and Within Subject Effects	30
4.	Test Scores, Means, Standard Deviations, and Sample Sizes of Test Achievement Scores Across Struggling Novice and Expert Novice Groups	32
5.	Table of Deviation Performance Based Measures for Expert Novices	35
6.	Table of Deviation Performance Based Measures for Struggling Novices	36
7.	Detailed Content Analysis of Student Study Sheets for Test 2	38
8.	Detailed Content Analysis of Student Study Sheets for Test 3	40
9.	Breakdown of Criteria for selecting Study Sheet Contents	43
10.	Breakdown of Responses to How Studied	46
11.	Reported Reading/Studying Techniques of Expert and Struggling Novices	47
12	Reported average times spent on the various components of study/learning activities for the Struggling Novice.	48
13.	Correlations for the Struggling Novice group	49

14. Reported average times spent on the various components of study/learning activities for the Expert Novice. 50

15. Correlations for the Expert Novice group 51

LIST OF FIGURES

Figure Page

1. Average Differences for the two groups across phases of the study 31

LIST OF ILLUSTRATIONS

Illustration		Page
1.	Expert Novice Study Sheet 1	66
2.	Struggling Novice Study Sheet 1	67
3.	Struggling Novice Study Sheet 2	69
4.	Struggling Novice Study Sheet 3	71
5.	Expert Novice Study Sheet 2	72
6.	Expert Novice Study Sheet 3	74
7.	Expert Novice Study Sheet 4	76

CHAPTER I

INTRODUCTION

Two accounting students sit side-by-side. Each has a similar aptitude, spends about the same amount of time studying, and the prior classes taken by each student is approximately the same. The first student consistently masters the material and earns high A's while the second student tenaciously struggles to make C's. The "A" student is what John Bruer, in his book "Schools for Thought", would term an expert novice. In Bruer's theory, an expert novice is someone who can take his/her prior knowledge and "stretch it to pose and answer novel problems" (p. 74). They are individuals who learn new domains more quickly than other novices. Is this due simply to higher I. Q. or the utilization of learning and metacognitive strategies or even some other factors? What are these successful expert novices doing that is critically different than the struggling novices? More importantly, based on insights from what the expert novice is doing, can we teach the struggling novice to become an expert novice and ultimately an expert? A number of cognitive scientists seem to think so (Glaser, 1984; Smith & Good, 1984; Bruer, 1993; Ericsson & Charness, 1994). A growing body of research in cognitive science is supporting the theory that the critical factor in developing expertise is the manner in which facts are integrated and differentiated into one's knowledge base (Bedard & Chi, 1992). Glaser (1984) theorizes that organizational knowledge structures enable the acquisition and preservation of facts. The command of a large amount of specific information and

the ability to retrieve it is derived from this organization. This concept draws from a schema theory of knowledge which is the basis of this research project.

Rather than just assuming that instructors present the information effectively, or that the textbook is well written and that failure to learn the material is the student's fault, educational researchers are systematically exploring and critically analyzing how the successful student is representing and learning the material. It may be discovered that the expert novice is learning the material in spite of the lectures and textbook presentations. Cognitive scientists theorize that the expert novice is cognitively representing, organizing and processing the information more efficiently and effectively than the struggling student. These cognitive representations and processing strategies may not only be teachable to the struggling student, but they also may serve as the basis for how the material should be organized and presented by the instructor. These outcomes and insights are the goal of this research project.

Among the highest goals of teaching is to provide students with the necessary knowledge and abilities to enable them to transfer these skills to novel situations. As educators, we would like to think that we can teach the student principles and general problem-solving skills that they might be able to use in a variety of complex real-life situations. There is a long ongoing debate within psychology as to whether this type of transfer is teachable. Transfer in its simplest sense may be defined as the degree to which behavior will be repeated in a new situation (Detterman, 1993). Detterman identifies different degrees of transfer. He distinguishes between near and far transfer. Near transfer is applying what was previously learned and applying it to the same or very similar situation. Far transfer occurs when previously learned information and principles can be applied in very different and complex situations. This type of transfer is of most interest

and value to educators and according to many psychologists rarely if ever occurs. In pioneering studies on transfer conducted by E.L. Thorndike in 1901, his research findings lead him to conclude that "the mind rarely transfers and when it does it is only to very similar situations" (near transfer). Findings from other more recent studies also support this notion suggesting that the only type of transfer that occurs is near transfer. Sweller & Cooper (1985) found that students performed significantly better when studying worked examples compared to attempting to solve problems after only receiving instruction. Students who received two or more examples performed better than students who studied one worked example. These findings suggested that there was some advantage in transferring the knowledge to a similar or identical situation (near transfer). Catrombone & Holyoak (1983) found in a similar study that little if any transfer occurred in problems that required modified subgoals and methods (far transfer). In that same study, they did however conclude that when subjects were primed and trained to view both sample problems and subsequent test problems as similar (near transfer), excellent transfer occurred.

There is the other side of this psychological/educational debate that supports the existence and teachability of far transfer. Many researchers not only support the theory of far transfer, but also maintain that information can be structured and organized to enhance far transfer. Sternberg & Frensch (1993) studied the mechanisms for transfer and determined that information could be taught in ways that promoted transfer. Based on their findings: (1) domains should be taught in a variety of contexts which allow for flexible retrieval; (2) domains should be organized in an efficient manner and should be internally and externally linked; and (3) tests should be based on use and application. Catrombone & Holyoak (1990) in a follow-up study to previous research, found that teaching a

solution procedure in terms of clearly identified units (subgoals and methods), aided subsequent adoption of the correct solution procedures in the context of novel examples. In another problem-solving study, Bassok & Holyoak (1993) found that students who were given training in abstract algebra, a clear majority were able to apply their knowledge to new domains, even when the training examples were drawn from a single domain.

Although the conflicting views on transfer appear to suggest critical differences on learning and teaching, much convergence on educational implications can be found in a concluding remark made by Detterman (1993), one of the foremost critics of far transfer:

> Time would be better spent in understanding how specific domains of knowledge are learned, how they can be learned most efficiently, and what restrictions on learning are imposed by differences in basic abilities (p. 19).

Studying the most efficient and effective methods of how a domain is learned will include not only what methods are most beneficial for the student and for promoting transfer, but also will provide guidance on how the information should be taught. This research project was designed to study these particular areas within the domain of accounting.

CHAPTER II

REVIEW OF THE LITERATURE

One of the ways cognitive scientists analyze learning and information processing is through an individual's ability to solve problems. Studies of expert and novice problem solvers provide insights related to some of the differences in information organization, information processing strategies, and problem-solving styles among learners (Lesgold 1984; Alexander & Judy 1988; Ericsson & Charness, 1994). The expert problem-solver appears to have a much more integrated network or schema within which to recognize problem solution patterns. The expert actually sees a different problem than the novice (Charness, 1988). Bassok & Holyoak (1993) claim that experts are better able to assess the pragmatic relevance of features of a problem. The experts will be better able to adjust their assessment to the requirements of particular problem structures. Learning is the process by which novices become experts (Bruer 1993, p.13). Research dealing with how novices learn and process information tells us that the novice possesses only a surface understanding of the problem and attempts to solve it are centered around explicit clues given in the problem (Bruer 1993; Glaser 1990; McKeachie, Pintrich, & Lin, 1985). For novices, the capacity to make links to deeper stored information is often not possible. On the other hand, the expert's knowledge is based on the principles and applications of the subject matter that allows the learner to quickly recognize a pattern and apply a set of appropriate rules and/or procedures to yield a successful problem solution. Research is converging on the

view that the critical factor in the development of expertise is the manner in which facts are integrated and differentiated in one's knowledge base (Chi & Chi, 1982). Much of the expert performance is based on the automaticity of being able to by-pass the preliminary time consuming problem identification and solving tasks, and being able to move automatically to a higher level of understanding and solution sets. The expert by-passes many lower level processing components and quickly moves to a higher level of performance and thinking. Glaser (1993) noted that with increasing expertise, people are able to classify problems by their solution rather than by content. This process allows limited working memory to be used more efficiently. Anderson (1984) maintained that the knowledge a person already possesses is the principal determinant of what a person can come to know. The main component of this approach is based on the theory that knowledge is a product of a person's schema or reference base. As effective teachers, we must be cognizant of and identify a person's existing schematic representations and/or baselines. This could be a daunting task to be sure, but it is possible.

There are significant differences in how students respond to questions, do their homework, and approach problem-solving on test, many of which will be discussed in chapter four. It would be extremely useful if instructors capitalized and structured lessons based on these differences. Related research is being done in an area termed dynamic testing methods. Brown and Campione (1990) are working to develop dynamic testing models that may help teachers understand and make predictions about students' learning capabilities and what domain specific elements and general learning strategies are most effective to teach particular domains.

Dynamic testing starts with a detailed analysis of what information students need to solve problems in a domain, for this research project, the domain and

detailed analysis was principles of accounting. On the basis of this detailed analysis, Brown and Campione would propose to develop a protocol of steps and prompts that a teacher could use to help students acquire competence. The steps that underlie the competency in the domain flow from general to very specific and are modeled after the processes that an expert in the field might follow. The experts in the case of the accounting class are the expert novices identified in the study. In principles of accounting the steps to competency could begin with the basic understanding of debits and credits, to the different types of accounts, to eventually understanding and analyzing the financial statements.

Methods for identifying students' baselines could be pre-tests, interviews, or open-ended assignments. Once some insight into students' baselines is achieved, instructional material and activities should be designed that tap into the pre-existing schematic representations to alter and or enhance them, much like that proposed by Piaget. According to Piaget, knowledge is acquired through the construction of a schematic network. This network consists of an individual's experience that expands with maturation and meaningful experience. When an individual is confronted with a problem, it is represented or assimilated by the person based on what they know, existing schema. Often a state of confusion or disequilibrium is created. If the problem is novel or challenging enough, a person may change or accommodate their schematic network to solve the problem, hence learning has occurred. The task force on intelligence created by the Board of Scientific Affairs, summarized Piaget's perspective in their report on intelligence: " Intelligence develops -- in all children -- through the continually shifting balance between assimilation of new information into existing cognitive structures and the accommodation of these structures themselves to the new information" (Neisser,

Boodoo, Bouchard, Boykin, Brody, Ceci, Halpren, Loehlin, Perloff, Sternberg, & Urbina, 1996).

Although the instructor would like to see instruction result in the accommodation of new schematic structures, this is not often what occurs. The learner always has the option to reject the information. Chin & Brewer (1993) identified seven ways that the student might respond to instructional material. The first response was the desired one, where the student accommodates their schematic structure and the information finds its way into long-term memory. The other six responses that the student might elect are unfortunately all too common and not desirable. The other responses range from ignoring the information, to reinterpreting the information so it conforms to their pre-existing beliefs, to rejecting the information, to judging the information as irrelevant, to holding the information separate from their currents beliefs so it does not influence them, and/or to making superficial temporary changes to their schema to be forgotten soon afterwards. Each one of these areas represents a distinct challenge in the teaching/learning process.

From a cognitive science perspective, knowledge is viewed as the acquisition of some type of competency and/or problem-solving ability. This does not mean to imply that knowledge is strictly confined to performing an observable competency. Problem-solving ability is one way to measure the acquisition of knowledge and is typically the domain in which many cognitive scientists focus their attention. A logical question in this area of investigation is what degree of influence does the organization of the knowledge base have on the observed thinking and problem-solving performance of experts and novices? Glaser (1984) defined a problem as a cognitive structure corresponding to a problem that is constructed by a solver on the basis of domain-related knowledge and its

organization. The first stage of problem solving is the initial representation or identification of what the problem is. According to Glaser (1984), "the quality, completeness, and coherence of this initial representation determines the efficiency and accuracy of further thinking". The organization of the domain specific knowledge is considered to play a major role with respect to how the problem is first perceived and ultimately solved.

The overall goal of this research project was to study and compare what representations and models expert novices and struggling novices utilize to process information and solve problems. By documenting and comparing critical differences in information processing between these two groups, insights can be gained with respect to not only what learning took place, but more importantly insights can be gained with respect to HOW the learning took place. The educational implications related to the outcomes of these studies are potentially very powerful and will be discussed in Chapter 5. By systematically studying, comparing and documenting the processes that expert accounting students and struggling accounting students are using, two very significant outcomes may be achieved. First, it may be possible to teach general problem solving techniques within the specific domain in addition to domain specific accounting problem-solving techniques. Second, if meaningful information links and efficient representational models can be identified, then more effective classroom activities that highlight these areas can be assigned.

Research on teacher cognition (Leinhardt, 1983) has focused on the relationship between teacher's knowledge of the subject and the teacher's knowledge about teaching the subject. Being an expert in a particular domain does not ensure that the expert will also be an effective teacher of that domain. Too often the more brilliant a person is in a domain, the harder it is for that person to

effectively convey the material to the student. This ability to know how to effectively transfer this knowledge to students has been termed "pedagogical content knowledge" and notes that "it includes knowledge of the most effective examples, analysis, and explanations for key topics in a domain". "It includes the ways of representing and formulating the subject that make it comprehensible to others". (Shulman 1986, p.9). How does a teacher come to know what examples, what exercises or what representations capture and create critical linkages that may help students learn material. A certain degree of this awareness may come from the teacher's experience and intuition, but a large portion of this information is stored within the students' minds, particularly the expert novices who are quickly mastering the material.

Three distinct yet related concepts of competencies that are considered to have great potential with respect to enhancing the teaching-learning process are what Robert Glaser (1984) identified as the three major aspects of competence: "(a) compiled automatized, functional, and proceduralized knowledge characteristic of a well-developed cognitive skill; (b) the effective use of internalized self-regulatory control strategies for fostering comprehension; and (c) the structuring of knowledge for explanation and problem-solving". The first cited aspect of competency deals with the stored data that a person has compiled. This is commonly referred to as declarative knowledge. The second aspect of competency deals with executive learning and thinking strategies often referred to as procedural knowledge. The last aspect of competency entails understanding of when and where to access certain facts or employ particular procedures (Alexander & Judy, 1988). This is often the competency that is related to the synthesis approach to teaching. It can be viewed as a method of teaching that uses

an optimal mix of the first two competencies. It appropriately balances the amount of domain specific knowledge taught along with the procedural skills knowledge.

These aspects of competency are closely aligned to a schema-based theory of knowledge (Anderson, 1984; Thorndyke, 1984;Glaser et al: Reed 1993; Sternberg & Frensch, 1993; Bruer, 1993). Thorndyke defines a schema as a cluster of knowledge representing a particular generic procedure, object, percept, event, sequence of events, and/or social situation. This cluster provides a framework in which an individual interprets and derives meaning and then uses this framework to understand and solve problems. Anderson defines it as an abstract structure of information and maintains that the "essence of knowledge is structure". Glaser defines schema as a modifiable information structure that represents generic concepts stored in memory. Schema represents our knowledge base that we build from our experience and upon which we develop our expectations about future experiences.

One of the main thrusts of cognitive theory and information processing is the utilization of short-term working memory and long-term memory. As competence is attained, elements of knowledge become increasingly interconnected so that proficient individuals access coherent chunks of information (Glaser, 1990). Although processing times and memory capacity differences have been documented, we all have the same basic architecture. The main difference between an expert's knowledge and a novice's is the organization and the connectedness of memory. Part of knowing something is the ability to locate the stored data and retrieve it from memory when appropriate and needed. An expert's schema or representational system is designed around critical variables that branch off into various subcategories. A novice's representational structure is not well organized and is built upon surface facts that are often unrelated. When a person

retrieves chunks of data from long-term memory into short-term memory for processing, the number of items that can be held is limited.

It is generally believed that the most "chunks" of information that a person can hold and process in working memory is between 4 to 8. A "chunk" or "knowledge structure" consists of a complex network of information links, tied together by an individual's representations of their experiences. No matter how complex or simplified, only a small part (chunk) of a person's limited short-term memory space is required to process information within a particular knowledge domain. The critical aspect of expert's working memory is not the amount of information stored per se, but it is how the information is stored and indexed in long-term memory (Ericsson & Charness, 1994). John Bruer describes this organization as associative structures whereby the individual associates certain actions with certain conditions or stimuli. The associative structures form more overriding systems that an individual uses to construct their knowledge about different domains. The expert's knowledge is highly developed and complex, built around certain key points or representations. To identify the critical variables that an expert has used to create these complex knowledge structures around would provide guidance to a teacher and/or textbook author with respect to designing instruction within a specific domain of knowledge. I do not mean to suggest that there is one optimal way to organize and represent information within a domain and that once identified, write about and teach the material this way. My position is to look for common themes and/or domain specific patterns that appear to be more powerful than others, and use these themes or patterns as a guide to enhance instruction.

Another valuable insight from this research project is the identification of various learning strategies that the expert novice students employ to learn

accounting. The methods and strategies utilized by the two groups in this study will be discussed in detail in Chapters IV and V. There are many documented non-domain specific learning strategies that expert learners already use. These strategies are teachable. Ann Brown (1978) has done extensive research on self-regulatory and performance control strategies as a means for knowledge acquisition. She found that students who are consistently superior do things such as rapidly check their work, accurately judge difficulty, apportion time efficiently, assess their progress, and predict the outcomes of their activities. Other researchers have reported supporting results (Chi, Glaser, & Rees, 1982).

Self-regulated learning is a deliberate, judgmental, adoptive process. Students that set learning goals have expectations of their progress and performance. When a discrepancy exists between how they are performing and how they expected to perform, self-regulated learners seek feedback from external sources such as peers' contributions in collaborative groups, teacher's remarks on work done in class, and answer sections of textbooks (Butler & Winne, 1995). These students are not content with simply attempting a problem. They are more driven to check their answers and continue to work until they achieve the answer. Research has shown that learners are more effective when they seek out and receive external feedback (Kulhavy & Stock, 1989).

Kuhl & Goschke (1994) outlined a general process that a student follows when attempting to solve a problem. As noted earlier, when attempting to solve a problem, the first step that occurs is the individual's initial representation of the problem and the properties and requirements of the task. This initial representation comes from the person's knowledge, past experiences and expectations. Based on this representation they set goals for themselves and choose strategies to accomplish their goals. An important element of successful

problem-solvers is the regular monitoring and feedback that these individuals utilize. If things are not going as planned they are quickly aware of it and can make necessary adjustments to work towards their goals.

It should be noted that not all expert students utilize the same strategies in all problem-solving situations. Additionally, research has shown that there are some dangers associated with simply focusing on problem-solving. Some students can solve problems but have little if any ability to explain the domain specific principles or their underlying problem solving procedures, while other students are well versed in problem-solving strategies but are unable to recognize when to choose the appropriate application of them (Glaser, 1990). These two competencies are somewhat at odds with each other. The accounting profession recently increased the number of credit hours (150) that a student must complete before being allowed to sit for professional licensing examinations such as the CPA exam. One of the thrusts behind this initiative was that although accounting graduates were graduating with a good technical base, often times they did not have a firm grasp on the thinking skills associated with their problem-solving ability. There is considerable evidence supporting the notion that cognitive skills, metaconceptual strategies, and procedures for problem-solving have different properties across specific knowledge domains.

Psychologist have shown that superior performance within a domain is dependent on domain specific knowledge (Chi, 1985; Glaser, 1984) and that individuals who utilize domain specific metacognitive strategies outperform those who do not (Alexander & Judy, 1988; Brown, 1978; Chi, Glaser & Rees, 1982; Flavel, 1981; Garner, 1987). In complex disciplines, domain specific strategies have been found to be more effective than general problem-solving strategies. In less complex domains, general problem skills have been found to be of greater

value than the acquisition of domain specific procedural skills (Alexander & Judy, 1988; Bassok & Holyoak, 1993). In sum, the overall emphasis of instruction and/or learning is a function of domain specific information and the problem-solving capabilities of the learner. If a person already possesses good self-regulating learning techniques, then the emphasis for teaching that person would be on the development of domain specific knowledge. Conversely, if a person has a good domain knowledge background, then the focus of instruction could be on the development of general problem strategies and self-regulating techniques. Recent work on problem solving done in knowledge-rich complex domains shows strong interactions between structures of knowledge and cognitive processes. These results of this research suggest the need to consider teaching some areas of all competencies: domain specific knowledge, general strategies, and specific domain strategies. A certain critical mass of domain specific knowledge is needed to be learned by the student with subsequent instructional activities geared toward thinking and problem-solving. The student is still allowed to incorporate into his/her own schema their individualized interpretations and ways of knowing.

The possibility of being able to identify and optimize appropriate learning strategies in the classroom is becoming more promising based on further studies in developmental psychology and cognitive science. These studies are beginning to look at the cognitive processes being developed within the context of the acquisition of structures of knowledge and skill. "There are some knowledge structures, such as measurement, number concepts, and arithmetic problem-solving, that do have a wider applicability than others. When these are acquired, then learning and thinking in a variety of domains can be enhanced" (Glaser, 1984). To identify and focus on these structures that the expert novice students are utilizing in the principles of accounting could provide similar type structures.

Analysis of the cognitive strategies and mental modeling that expert novice students utilize could determine the mix appropriate for principles of accounting. To empirically study what the expert novice accounting students internalize and represent compared to what the struggling novice internalizes would gather valuable insights if common strategies and knowledge structures could be identified. Once these knowledge structures or links are identified, it would become easier to know in what areas the struggling students were deficient in and instruction could be better focused on key missing areas. This research project was designed to examine the relationship between knowledge compilation and procedural knowledge and to identify the critical elements of internalization and the most effective ways to accomplish this. Again this does not imply that there is one way to learn, perhaps only more efficient or appropriate ways.

This research project also looked at what role the textbook played in the students' learning. This will be discussed in more detail in Chapters IV and V. Several studies related to establishing connections between types of textbooks and differential levels of student comprehension have been done. Brown & Reeves (1987) found that the knowledge that can be acquired is limited by the current state of the learner. Difficulty level of the material and the knowledge base of the learner was reported to have the most significant influence on the acquisition of knowledge. The driving force behind much of this work is Vygotsky's notion of zones of proximal development (ZPD).

From Vygotsky's point of view, the ideal level of difficulty of material should be just outside and beyond the learner's zone of knowledge. Vygotsky's theory of learning was that learning is a social construct and that it is culturally determined. A student advances through progressive steps of learning with the assistance of a master teacher or more advanced peers. Each person possesses a

learning range of potential rather than a fixed state of learning ability. Vygotsky viewed the mind as elastic in its cognitive growth and unbounded in terms of its extent and potential for growth (Smagorinsky, 1995). Higher order of "thinking" is what is regarded in a particular culture as highly valued. People will pursue what is rewarded and is encouraged. He felt that the mind was unbounded in that each person had an unlimited capacity for development and what was necessary to accomplish this development was the appropriate use of mediating tools such as books, mentoring and meaningful social experiences. The ZPD is a range of ability that is constantly in a state of evolution. Development consists of using socially mediated assistance to move towards the higher levels of the range, which is itself always developing into a new and more complex state. A person's schema is constructed from socially learned and reinforced experience. Cognitive development is socially rooted and advanced by mentioning. A person internalizes cultural knowledge and then regulates their own thinking and knowing.

It is very important for a teacher to identify the ZPD and the many different levels of difficulty that are appropriate based upon the individual's knowledge and cultural background. The overlying problem is that every learner's baseline is unique. One of the problems of teaching a large introductory course like accounting principles is that the knowledge base level is so greatly varied and there are so many students. The textbook does make allowances for much diversity among learners and the instruction provided by the teacher is typically generic. It is extremely difficult, but not impossible, for a teacher to identify where each student is at with respect to their background and knowledge base and assign the appropriate learning activities.

Another body of research on textbooks is the text comprehension theory of van Dijk and Kintsch (1983; Kintsch, 1994) in which different levels of

comprehension were distinguished. The three levels identified were text, textbase, and situation model. The text level is simply the linguistic encoding of the written material which would correspond to memorization. Many students are stuck at this level and is why I have allowed them a one page study sheet for exams. I suspect that this level of competency is due to a number of contributing factors one of which is the design of the textbook itself which is often far removed from the student's reference base. The next level of competency is textbase, which is the semantic representation and organization of the overall meaning of the text by the student. This level of understanding allows the student to learn the material well enough to get through the semester but the knowledge acquired has little if any long-lasting impact. The highest level of comprehension is the situational model where integration into existing schema and higher understanding occurs. This level of comprehension is the most meaningful and long-lasting and is also the ideal for education. Research (Mannes & Kintsch, 1987) has shown that well written textbooks are very good at achieving high levels of remembering and reproducing text, but are not very good at stimulating inference and problem-solving within the domain. Reasoning depends mainly on mental models in which a person can stimulate an event that is described in a written or spoken text (Greeno, Moore & Smith, 1993).

Many textbooks are written by the experts in the particular discipline who have very little experience if any, related to education and learning theory. Chapters are written, problems are created, and effective teaching and learning is assumed to happen. In addition, the instructors using these textbooks are usually experts in the field with little or no knowledge base in learning theory. Too often the professor follows the book, assigns the problems, and prepares tests from the provided test banks, and assigns the semester grade. So much data and

opportunity for insight and educational advancement are lost in this simplified process. It would be of great value to identify what aspects of the textbook the expert novices utilized compared to the struggling novices and focus on those areas that are more effective from a student's perspective, not a Ph.D. author's. Each individual's knowledge is constructed and is unique, but that there are more effective ways to organize knowledge based on powerful schematic links within domains. I am not convinced that the textbook and related materials provided by publishers are optimal, but they are becoming a bit more attuned to active learning and thought provoking activities.

John Bruer in his recent book "Schools for Thought" states that "one of the goals of education is to help children-(universal novices)-become reasonably expert within certain domains of knowledge". To do this effectively, we have to know, in some detail, what stages learners pass through on their mental journeys from novice to expert. Cognitive science tells us how we can then help children progress from relative ignorance through a series of partial understandings to eventual subject mastery. A research study using the balance scale problem illustrated how learners develop cognitive production systems (Siegler & Klahr, 1982). The results of their study showed that once critical variables were identified, the teaching of these variables allowed for advanced comprehension and performance. One of their balance scale studies showed that 5 year olds could not perform conflict problems (different weights and different distances). The researchers identified that five year old children could not process or encode distance. The children were very good at remembering weights but could not reproduce the distances. This was demonstrated by showing the children a scale for several seconds and then removing it from view. Even after much emphasis was given to "which pegs the weights were on", the children could only reproduce

weights. The children did not yet have the construct of distance. Strategies had to be developed to teach the children to encode distance. The pegs were assigned numbers, with larger numbers assigned the pegs farther from the middle. The children were instructed to say outloud the number that the pegs were on. They were asked to tell which peg had a higher number. Repeated drilling in this area improved their ability to reproduce distances when the experiment was redone. However, with this ability to encode distance, the 5 year olds' performance on predicting conflict problems did not improve. Siegler and Klahr then proceeded to teach the 5 year olds problem-solving strategies utilizing distance. Their performance quickly escalated to the 9-13 year old problem-solving level. When the researchers were able to identify the missing critical variable (distance encoding), and teach them it, the children were able to perform at greatly increased levels. This finding would appear to have some strong implications for teaching expertise in a complex field such as accounting.

One could genuinely argue that the overall goal of education is not to make someone an expert in a particular field. The real goal of education is more to develop one's mind to think rationally, critically and independently. I don't think that cognitive scientists such as Bruer or Glaser would disagree with this notion at all. The cognitive scientist perspective is that certain domains of knowledge are measured by expert performance and that these domains require learners not only to become critical thinkers but also demand expert levels of performance. Some examples of these fields mentioned in Bruer's book are science, engineering and mathematics. Many consider the expert knowledge level of accounting to be similar to those disciplines.

CHAPTER III

METHOD

Hypotheses

The following null hypotheses were tested:

1. There are no differences in the curriculum/performance based measures across phases of the study for the Expert Novice student.
2. There are no differences in the curriculum/performance based measures across phases of the study for the Struggling Novice student.
3. There are no differences in the information considered to be important across Expert/Novice conditions.
4. There are no differences in the representative structures of information across Expert/Novice conditions.
5. There are no differences in the contents of the interviews across Expert/Novice conditions.
6. There are no differences in the recorded problem-solving narratives across Expert/Novice conditions..
7. There is no correlation between traditional academic predictors, i.e. ACT score, high school G.P.A. and performance in the accounting principles class.

Participants

The participants used in this study were chosen from two principles of accounting classes consisting of 45 and 65 students each ranging in age from 18 to 25. These classes were taught by the researcher who has been teaching this course for nine years. A questionnaire was administered the first day of class to all 110 students to establish similar accounting baselines and study habits (see appendix A). Only students indicating no prior academic or professional accounting experience were considered for the study. Additionally, individual differences for time spent reading chapters and time spent on homework were controlled for. A comprehensive final examination was also administered the first day of class to further control for baseline accounting knowledge. Only students scoring below 60% on the exam were considered for selection. The purpose for these screening procedures was to identify only those students with no accounting experience and no prior accounting coursework.

After having identified participants with no prior accounting coursework, the next phase of the sample selection process was to select the two sample groups of students. On the basis of the first three 20 point quiz scores and the first 100 point examination, 14 expert novices were identified. Their cumulative point averages ranged from a low of 87.5% to a high of 101.9% . The second group consisted of 13 struggling novices with cumulative point averages ranging from a low of 51.9% to a high of 66.9%. All 27 of the subjects passed the initial baseline screening criteria. The mean cumulative scores after the first three quizzes and first exam for the expert novices was 150.9 points (94.3%), and the mean cumulative score of the struggling novice group was 97.2 points (60.8%) (t value = - 19.13, p = .000).

Table 1

Point total after first three quizzes and the first examination

(Total possible points 160)

	Struggling Novice (13)	Expert Novice (14)
	90 (56%)	150 (94%)
	103 (64%)	161 (101%)
	105 (66%)	150 (94%)
	91 (57%)	158 (99%)
	104 (65%)	150 (94%)
	99 (62%)	158 (99%)
	105 (66%)	140 (88%)
	83 (52%)	151 (94%)
	107 (67%)	148 (93%)
	91 (57%)	145 (91%)
	99 (62%)	146 (91%)
	93 (58%)	152 (95%)
	94 (59%)	140 (88%)
		163 (102%)
Mean	97.2	150.9
Standard Deviation	7.429	7.113
T- Value	-19.13	
Significance Level	.000	

At no time during the research project was any member of the group appraised as to why they were being studied.

Instrumentation

As mentioned in Chapter 1, much of this research is based on the research and book by John Bruer "Schools for Thought" which focuses on identifying significant differences between how expert novices and struggling novices learn, construct knowledge, process information, and solve problems. There were three distinct instruments (dependent variables) used in this process to measure these cognitive processes. The instruments used were:

1. Fine-grained content analysis of student study sheet
2. Problem-solving narrative by student
3. Post-test learning strategy interview with student

The first instrument analyzed to attempt to identify significant differences between the two groups was a student study sheet that the students are allowed to create for test-taking purposes. For the last five years, accounting students in the researchers class have been allowed to create a one page advance organizer to use during examinations. They have complete freedom to include on this sheet anything that they feel is important to help them pass the accounting examinations. The only stipulation is that all information must be hand-written. There can be no photo-copies of any specific problem solutions. There are two critical pieces of data that can be gathered from analyzing these advance organizers. First, the one page examination organizers (Morgan, 1989) were content analyzed to determine if there are critical differences in information considered important to the expert novice and struggling novice student and if there are differences in what criteria the two groups used in deciding what information to include on the study sheet. The second critical piece of data to be gathered from content analyzing the student

study sheets is to identify how the two groups of students represent the information on their study sheets. Since there can be no photocopying of any data, all the data contained on the study sheets are representations made by the students. The study sheets provide insights into not only what the students consider to be important, but also how this information is organized and cognitively represented.

The second instrument utilized in this research project was tape-recorded problem-solving narratives. On two of the four examinations, five students from each group took the exam in a separate room and spoke into a portable tape recorder to record their problem-solving procedures. The same questions were marked (one third of the questions), on each test and the students were instructed to think outloud as they attempted to solve the problems. Detailed qualitative comparisons of the problem-solving procedures were made between the two groups. This piece of data provides for some critical analysis of problem identification, information processing, and problem solving. Although four of the students elected not to participate, there was generally good cooperation overall.

The third piece of data utilized in the study was a student survey that each student in the two groups completed after each exam (see appendix B). This instrument provided both critical quantitative and qualitative data. The quantitative data provided information on time spent reading the chapters, time spent on homework, time spent studying for each exam, and time spent on preparing the study sheet. The questionnaire also provided qualitative information as to how the students studied and learned. On each one of the four interview surveys completed, question three addressed studying/learning techniques (Brown, 1978; Bruer, 1993) such as: outlining the chapter, underlining or highlighting, summarizing, use of mnemonics, formulating questions, taking notes, breaking down chapter into units, and using figural or graphic representations. Qualitative

aspects of the survey interview sheet were questions such as how the student studied for the exam, how did they solve a difficult homework problem, how did they decide what did and did not go on the study sheet, and how did they learn some of the major topics from the unit exam such as debits ands credits or inventory valuation. A survey interview sheet was administered to each student in the study after each of the four examinations.

The last piece of data kept, one that most teachers keep, is the cumulative semester performance based on the quiz and test scores. The primary measurement used to monitor the curriculum base measures were the four tests given over the course of the semester. The means, standard deviations and sample sizes for the struggling novices and expert novices across phases 1 through 4 were measured and actual results will be reported in Chapter IV.

Table 2

Means, Standard Deviations, and Sample Sizes of Test Achievement Scores Across Struggling Novice and Expert Novice Groups

	Phase			
Groups	1	2	3	4
Struggling Novice Group (n=13)				
Mean	X	X	X	X
SD	Y	Y	Y	Y
Expert Novice Group (n=14)				
Mean	X	X	X	X
SD	Y	Y	Y	Y

Design

A two factor repeated measures design was utilized for this research project. The two factors are the differences within the two groups and the differences between the groups:

			T1a	T2a	T3a	T4a
		1				
		2				
		3				
		4				
		5				
X1b	Expert	6				
	Novices (13)	7				
		8				
		9				
		10				
X2b	Struggling	11				
	Novices (14)	12				
		13				
		(14)				

The independent variables in this study are the four repeated phases (four unit tests) of the investigation (T1a - T4a) and the student grouping of expert novices and struggling novices. The dependent measures in this research project are test scores (curriculum/performance based measures), the contents of the study sheets, the contents of the learning techniques interviews, and the taped problem-solving narratives. Individual differences in accounting experience and study routines were controlled for by a comprehensive pre-test and information surveys.

CHAPTER IV

RESULTS

This research project was designed to analyze and evaluate differences in cognitive activities between expert novice accounting students and struggling novice accounting students. This study is based on the theory of schematic and basic information processing differences between experts and novices. What is both unique and exciting about this study on expert performance is that the subjects identified as "experts" are really novices who have had no prior experience or knowledge in the area. They are simply students who are able to represent, process, and retrieve information more efficiently and effectively than their struggling novice counterparts. A detailed multi-faceted analysis and comparison was performed on components of knowledge representation, study and learning habits, and problem-solving protocols. The dependent variables used in this study were students' test scores, content of student note sheets, post-test interviews, and narrative problem-solving protocols tape recorded during test-taking activities.

Results Related to Testing Null Hypothesis One

The differences in the curriculum based measures across the two groups were found to be significant. In addition, there were several notable deviations among individuals of both groups across phases of the study. The mean score on all four examinations was 61.4% for the struggling novice group and 91.1 % for the expert novice group (t value = -6.63, p = .000). Table three presents the

tests of repeated measures statistical results for the entire study and the breakdown of the curriculum based measures of the two groups at each separate phase.

Table 3

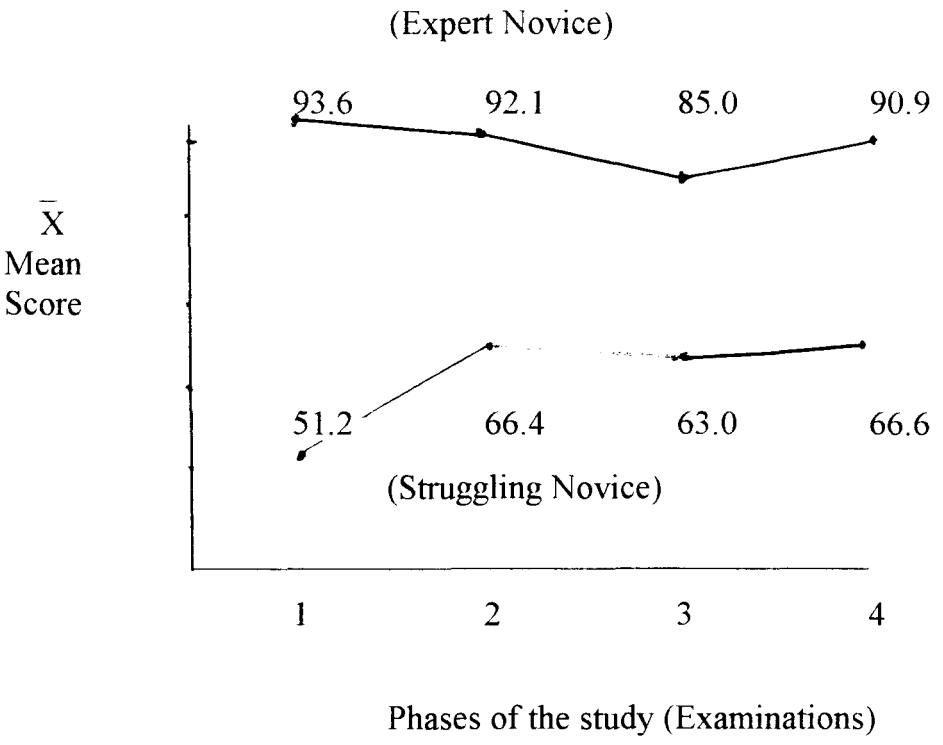
Tests Results for Between and Within Subject Effects

Between	SS	DF	MS	F	Sig Level
Group	23727.47	1	23727.47	93.16	.000
Within	6367.31	25	254.69		
Within	**SS**	**DF**	**MS**	**F**	**Sig Level**
Factor	511.65	3	177.55	2.74	.049
Group X Factor	2280.47	3	760.16	12.22	.000
Within	4663.62	75	62.18		

The average scores for the two groups across the phases of the study are displayed in Figure # 1 on the following page.

Figure # 1

Average Differences for the two groups across phases of the study



Although the between groups differences were found to be significant across all four phases, there is less of a difference particularly at phase three. There was an ordinal interaction at phase 3, where the mean difference was reduced down from a high of 42.4 points at phase 1 down to a 22 point difference at phase three. Possible explanations for this finding at phase three are discussed in the next chapter.

Table 4

Test Scores, Means, Standard Deviations, Sample Sizes, and Achievement Test Scores Across Struggling Novice and Expert Novice Groups

	Phases			
Groups	1	2	3	4
Struggling Novices:				
Individual breakdowns				
of Test Scores	47	58	61	47.5
Group (n=13)	38	73	74	62.5
	53	52	65	66
	56	63	58	62
	50	70	83	79
	55	64	56	70
	54	88	79	85
	59	64	68	69
	38	49	35	38
	58	70	53	64
	47	52	62	70
	55	78	89	83
	56	52	47	70
Mean Test score	51.2	66.4	63.0	66.6
SD	6.94	13.2	15.0	13.0

(Table 4 Continued)

Groups	Phases 1	2	3	4
Expert Novices:				
Group (n=14)				
	99	101	100	95
	110	94	72	94
	97	100	100	95
	105	92	99	95
	80	88	78	79
	100	88	102	96
	84	104	84	90
	92	81	79	92
	92	79	81	85
	96	90	92	94
	98	95	65	95
	89	92	78	76
	95	91	71	92
	111	94	91	95
Mean	96.3	92.1	85.0	90.9
SD	8.87	7.0	12.2	6.4
t-values	-14.8	-7.52	-4.03	-6.09
Significance level	.000	.000	.001	.000

The first null hypothesis was designed to test for differences in the curriculum/performance based measures across phases of the study for the expert novice students. This hypothesis was crafted to measure within group variance among the expert students. In other words, an effort was made to determine whether expert novice group scores remained significantly superior to the group scores of the struggling novices across all phases of the study. Given the results reported above, the first null hypothesis was rejected. The expert novice group scores remained superior over all phases of the study. There were however several interesting movements for five of the 14 expert novice students. Table 5 presents individual deviation scores for 5 of the 14 expert novices across the phases of the study. Discussion related to possible reasons for these deviations is discussed in the next Chapter. The other nine expert novice performance levels remained very consistent across all phases of the study.

TABLE 5

Table of Deviation Performance Based Measures for Expert Novices

	Phases of Study			
	T-1	T-2	T-3	T-4
Expert 1	91	89	78	85
Expert 2	95	91	74	91
Expert 3	90	92	78	80
Expert 4	110	94	72	95
Expert 5	98	95	65	92
Overall class mean score	74	78.8	71.3	70

Results Related to Testing Null Hypothesis Two

The second null hypothesis was designed to measure within group variance for the struggling novice group. The second null hypothesis was also rejected. As noted earlier, the mean score on the overall average performance on the four semester exams for the struggling novice group was 61.4%, compared to 91.1% for the expert novice group, (t-value = -6.63, p = .000). There were however interesting fluctuations for five of the struggling novices across phases of the study. Table 6 presents individual deviation scores for these 5 struggling novices.

TABLE 6

Table of Deviation Performance Based Measures for Struggling Novices

Struggling Novice (13)	Test 1	Test 2	Test 3	Test 4
Struggling Novice 1	59	70	83	79
Struggling Novice 2	47	91	61	47.5
Struggling Novice 3	55	78	89	83
Struggling Novice 4	54	87	79	85
Struggling Novice 5	38	73	74	62

There were no other significant deviations for the other 8 struggling novices.

Results Related to Testing Null Hypothesis Three

The third null hypothesis was crafted to test for differences in the information considered to be important across the Expert Novice group and the Struggling Novice group. A comparative analysis of the content of student study sheets across expert novice and struggling novice groups was performed on the data set.

A series of chi-square analyses were used to test this hypothesis. As noted earlier, each student was allowed to construct a one-page study sheet, filling it with any information that they felt would aid them in taking their examinations. A content analysis was performed on the study sheets for examinations two and three, noting the frequencies that critical pieces of information appeared on the study sheets of the two groups of students. It should be noted that on test two, only eight of the 13 struggling novices chose to prepare a study sheet whereas 12

of the 14 expert novice students chose to use one (chi-square = 2.05, p = .152). For examination three, the number of expert novices using a study sheet stayed the same (12 of 14), but the number of struggling students using a study sheet rose from eight of 13, to 11 of 13. Examination number two was designed to cover two chapters, the first chapter dealt with setting up and recording transactions in special journals and the second chapter dealt with merchandise accounting and the multi-step income statement. Examination number three covered three separate chapters. The first chapter covered accounting for cash and creating a bank reconciliation. The second chapter of the examination dealt with accounting for accounts receivable, notes receivable and temporary investments. The third chapter covered valuing and accounting for inventory.

Given the results of a series of X^2 tests, the third null hypothesis was rejected. The comparative analysis of the study sheets provided the emergent content list of items. The comparative content analysis of the study sheets for the expert novices and struggling novices indicated that there were significant differences across groups. The most critical pieces of information that should be present on an examination covering special journals and a multi-step income statement would be detailed comprehensive examples of these two topics. A comprehensive example would cover the possibility of a long problem on these two topics and also answer a variety of multiple choice questions. Examples of special journals and accompanying entries appeared on 8 of the 12 expert novices study sheets while only appearing on three of the eight struggling student's sheets (chi-square = 1.6, prob =.199). A comprehensive multi-step income statement appeared on 6 of the 12 expert novice's study sheets compared to 1 of the 8 of the struggling novices' sheets (chi-square = 2.97, p = .085). Although there was a great variety in the information contained on the study sheets, no other significant

differences in content between the two groups was found. Table 7 provides a detailed breakdown of the study sheets for examination two.

Table 7

Detailed Content Analysis of Student Study Sheets for Test 2

	Expert Novice(12)	Struggling Novice (8)
Multi-step Income Statement	6	1
Detailed page of entries	6	5
Pictures of F.O.B. Truck	1	2
Special journals & entries	8	3
Detailed Chart of Accounts	2	3
Miscellaneous entries	4	3
Miscellaneous terms (definitions)	4	5
Example of revenue journal	0	1
Internal control pyramid	0	2
Solution to homework problem	1	1
Detailed financial statements	3	0
Prior T & F Questions from Quizzes	1	0
Comparison of Periodic & Perpetual Inv.	2	0
Accounts Receivable Subsidiary Ledger	1	0
Designed special journals	1	0

(Table 7 Continued)	Expert Novice(12)	Struggling Novice(8)
7 steps of Accounting Cycle	1	0
Adjusting And Closing Entries	1	0
Effects of omitting adjusting entries	1	0

Significant differences across groups on the study sheets were also found for examination three. As noted earlier, examination three was designed to focus on three distinctly different chapters: cash and bank reconciliations; accounts receivable, notes receivable and temporary investments; and inventory valuation and accounting for inventory. The information critical to be included on a study sheet for this examination is a comprehensive example of a bank reconciliation, detailed examples of setting up an allowance for doubtful accounts and writing off accounts receivables, and comparative examples of the different ways of valuing inventory and the effect that these valuations have on the financial statements. Of secondary importance would be entries for accounting for petty cash, examples of the two methods of estimating ending inventory when the periodic inventory system is used, and accounting for notes receivable. Some of the critical differences in study sheets between the expert novices and struggling novices were as follows: An example of a bank reconciliation appeared on all 12 of the expert's study sheet while appearing on only three of the 11 struggling novice study sheets (chi-square = 13.38, prob = .0000). Examples/entries of setting up the allowances and writing off accounts appeared on 8 of the 12 expert novice's study sheet while appearing on only 4 of the 11 struggling novices (chi-square = 2.112,

prob = .146). Inventory valuation models appeared on 3 of the 12 expert novice study sheets and did not appear on any of the struggling novice study sheets. Entries for creating a notes receivable, discounting, and dishonoring a note was present on 6 of the 12 expert study sheets and on 2 of 12 struggling novice's sheets (chi-square = 2.56, prob =.110). There were no other significant differences found in content of the study sheets between the two groups. Table 8 provides a detailed breakdown of the contents of the study sheets for examination three:

Table 8

Detailed Content Analysis of Student Study Sheets for Test 3

	Expert Novice(12)	Struggling Novice (11)
Complete Bank Reconciliation	12	3
Current Asset Section of B/S	3	1
Inventory Calculation Examples	3	0
True & False Questions from previous Quizzes	1	0
Definitions of Temporary Investments	5	3
Examples of Temporary Investments	3	0
Inventory Methods and Effect on I\S	5	3
Voucher System Example	3	0
Entries to Set-up Allowance and Write off accounts to it (Both Methods)	8	4
No Definitions	3	0

(Table 8 Continued)	Expert Novice(12)	Struggling Novice (11)
Petty Cash Entries	4	0
Aging Receivables Illustration	1	0
Gross Profit & Retail Method of Estimating Ending Inventory	5	0
Excessive Definitions	2	10
Inventory Errors and Effect on Income	2	2
Comparative Income Statement prepared Using LIFO,FIFO and Average Cost	1	0
Discounting a Note Receivable Example	6	2

One final measure used to evaluate content differences in the study sheets of expert novice students and struggling novice students was the selection criteria used by the two groups to determine what data was to be included on the sheet. In addition to the analysis of the content, students from both groups were interviewed to address questions dealing with studying and learning routines. The results of these surveys are discussed in detail in the hypothesis number four section presented below. Question number five of the survey deals specifically with hypothesis three. This question asked the students to describe how they decided what to include on their study sheets. The most significant difference in the selection criteria appeared to be choosing things that the student did not know or had difficulty understanding. Five of the 12 expert novices used this as the criteria in choosing what to include on their sheet while 2 of the 11 struggling novices

who used study sheets had this as their criteria for inclusion (chi-square = 1.495, prob = .221). Other critical differences found were that twice as many expert novices (4), compared to struggling novices (2) used key points from the instructor's lecture as their selection criteria. Lastly, 3 of the 12 experts reported that they used what the teacher had mentioned as being important as one of their criteria for selection while only one of the 11 struggling novices reported that they used this criteria. There were no other significant differences in selection criteria found between the two groups. Table 9 provides a detailed breakdown for selection of items for the study sheets.

Table 9

Breakdown of Criteria for selecting Study Sheet Contents

	Expert Novice(12)	Struggling Novice (11)
Everything	0	2
Stuff From Notes	0	3
Answers to Homework Problems	2	1
What Teacher Said was Important	3	1
Key Points from lecture	4	2
Key Terms and Points	2	2
Things I did not Know	5	2
What I Couldn't Memorize	0	2
Things Covered in Quizzes	2	0
Highlighted Information	3	0
Concepts Necessary to Solve Problems	1	0
Difficult Things	2	0

Results Related to Testing Null Hypothesis Four

Null hypothesis four was designed to test for differences in the representative structures of information across Expert Novices and Struggling Novices. This hypothesis dealt with how the student represented and organized the information on their study sheets once selected for inclusion.

The fourth null hypothesis was rejected. The analysis of the study sheets revealed that were representational, organizational, and qualitative differences between expert novice study sheets and struggling novice study sheets. These differences can be categorized as follows:

Organizational - There is a clear difference in the organizational structure of the expert novices' study sheets andthat of the struggling novices. Eleven of the 12 experts' study sheets were organized either by chapter or by major topic compared to only 3 of the 11 struggling novice study sheets (chi-square = 9.991, prob = .002). The majority (8 out of 11) of the struggling novice study sheets did not appear to follow any organized system. Definitions and examples appeared to be randomly copied onto the study sheet. Examples and discussion of these study sheets are presented in Chapter V.

Representation of information - Ten of the 11 study sheets of the struggling novice, could be classified as definition or text based. These study sheets included definitions with very few examples and/or problems. Only two of the 12 expert novice study sheets were classified as definition based (chi-square = 12.667, prob = .000). The ten "non- definitional" study sheets were very problem or example oriented and four of these 10 did not contain even one written definition.

Another interesting difference in this problem versus definition representation is that on 4 of the experts' study sheets, numbers were not used in the examples. These students used X's in place of the actual numbers. The students were asked during post-test interviews why they used X's in place of the actual numbers. The reason given by all four of them was that the X's represented a model and/or template which offered more flexibility in solving variations of the concept that might be asked on the examination. One of the two struggling

students who was problem oriented used X's instead of numbers. Discussion and illustrations of these differences is discussed in greater detail in Chapter V.

Results related to testing Null Hypothesis Five

The fifth null hypothesis was designed to test for differences in the contents of the interviews of Expert Novice and of the Struggling Novice students. After each examination, students from both groups were asked to sit for an interview dealing with many aspects of their studying and learning habits. Questions ranged from how students studied for the particular examination to how they approached solving a difficult problem to how they went about reading a chapter. (See Appendix B.)

The fifth null hypothesis was also rejected. The analysis of the interview data indicated that there were significant differences in many of the study habits, reading techniques, problem-solving techniques, and criteria for choosing information to be included on the study sheets. In response to how the students studied for an examination, 9 of the 13 struggling novices responded that they read the book, only 4 of the 14 expert novices said that they studied for an examination by reading the book (chi-square = 3.846, prob = .05). Other significant differences in methods of study utilized by the expert novices were that many of them used the study guide (6) compared to 3 for the struggling novices, and they studied their notes, (6) compared to 2 for the struggling novices. Table 10 presents a breakdown of information related to how the two different groups studied.

Table 10

Responses to How Studied

	Expert Novice(14)	Struggling Novice (13)
Studied Quizzes	3	0
Studied Book	4	10
Reviewed Homework	5	3
Wrote Study Guide	6	3
Studied Notes	6	2
Did Extra Problems	1	0
Reread Parts I Didn't Understand	3	0
Listened to Soft Music when Studied	1	0
Read Chapter Summaries	3	0
Self-exam Questions	1	0
Studied Illustrative Problem	3	0
Studied Key Points	3	0
Made My Own Examples	1	0
Saw Tutor	0	3
Went through all Transactions	1	1
Outlined Main Points	1	1
As I Read through chapter, I Made Sheet	3	0

Another area that was addressed during the course of the interview was related to how the student read an assigned chapter. The techniques and frequencies of the two groups are presented in Table 11.

Table 11

Reported Reading/Studying Techniques of Expert and Struggling Novices

	Struggling Novice(13)	Expert Novice(14)
Study in Group	6	1
Outline Chapter	4	2
Underline/highlight	12	7
Summarize Chapter	7	6
Used Mnemonics	1	2
Formed own questions	3	2
Take notes	10	11
Breakdown Chapter into units	9	6
Use figural/graphics	1	4

The interview/questionnaire also addressed quantitative aspects of the students' studying habits. These aspects consisted of the average time spent reading a chapter, average time spent on homework per chapter, average hours spent studying for the examination and average time spent on preparing the one-page study sheet. The results of the time variables between the two groups were not found to be significant. These results are reported in table 12.

Table 12

Reported average times spent on the various components of study/learning activities for the Struggling Novice

		Average hours spent on			
	Average Test Score	Reading Chapter	Doing Homework	Studying for Exam	Preparing Study Sheet
Novice	62	2.5	1.75	2	1.25
	73	3.0	1.6	6.0	4.3
	57	2.1	3.0	5.2	2.0
	62	1.5	2.5	2	1.5
	56	2.5	1.0	3.3	1.1
	40	1.8	1.8	2.3	1.3
	76	1.7	1.0	2.5	X
	76	3	1.5	3.5	2
	59	6	1.5	8.6	.6
	62	1.3	2.7	5.1	.8
	59	2.8	3	3.8	1.7
	61	.5	1	1	2
	65	2.0	2.0	4.0	X
Average	62	2.3	1.9	3.8	1.7

X = Did not use a study sheet

Table 13

Correlations for the Struggling Novice group

	Hrs.Hwk	Hrs.St.Sht	Hrs.St..Ex	Hrs.Rd.Chp	Test.Scr
Hrs.Hwk	1.0000 (13) P= .	-.0801 (11) P= .815	.2036 (13) P= .505	-.0816 (13) P= .791	-.2449 (13) P= .420
Hrs.St.Sht	-.0801 (11) P= .815	1.0000 (11) P=	.0387 (11) P= .910	-.1121 (11) P= .743	.5060 (11) P= .112
Hrs.St.Ex	.2036 (13) P= .505	.0387 (11) P=.910	1.0000 (13) P=	.7784 (13) P= .002	.0849 (13) P= .783
Hrs.Rd.Chp	-.0816 (13) P= .791	-.1121 (11) P= .743	.7784 (13) P= .002	1.0000 (13) P=	.0540 (13) P= .861
Test.Scr	-.2449 (13) P= .420	.5060 (11) P= .112	.0849 (13) P= .783	.0540 (13) P=.861	1.0000 (13) P= .

Table 14

Reported average times spent on the various components of study/learning activities for the Expert Novice

	Average Test Score:	Reading Chapter	Doing Homework	Studying for Exam	Preparing Study Sheet
Experts	84	3.5	2	6	1.8
	87	.5	1.8	.8	.4
	84	1.5	1.7	2	1.2
	92	0	1.5	2	1
	84	1	2.5	2.5	2.5
	86	.8	1.5	1.8	1
	94	2.8	4.8	3	X
	100	2.5	3	4.5	2.25
	99	1.5	2	1	1
	99	.4	.5	1	.5
	91	2	2.5	5.5	.8
	97	.8	3	1.4	X
	100	.3	1	1.3	1.3
	86	2.5	1.0	1.3	1.3
Average	91.6	1.4	2.0	2.5	1.2

Table 15

Correlations for the Expert Novice group

	Hrs.Hwk	Hrs.St.Sht	Hrs.St..Ex	Hrs.Rd.Chp	Test.Scr
Hrs.Hwk	1.0000 (14) P= .	.4784 (12) P= .116	.4059 (14) P= .150	.5013 (14) P= .068	.1752 (14) P= .549
Hrs.St.Sht	.4784 (12) P= .116	1.0000 (12) P=	.8047 (12) P= .002	.7349 (12) P= .006	..0770 (12) P= .812
Hrs.St.Ex	.4059 (14) P= .150	.8047 (12) P=.002	1.0000 (14) P=	.7073 (14) P= .005	-.1578 (14) P= .590
Hrs.Rd.Chp	.5013 (14) P= .068	.7349 (12) P= .006	.7073 (14) P= .005	1.0000 (14) P=	-2195 (14) P= .451
Test.Scr	.1752 (14) P= .549	.0770 (12) P= .812	-.1578 (14) P= .590	-.2195 (14) P=.451	1.0000 (14) P= .

These results and possible explanations are discussed in the next chapter.

Results Related to Testing Null Hypothesis Six

The sixth null hypothesis was designed to test for differences in the recorded problem-solving narratives between Expert Novice and Struggling Novice students. As noted earlier, students from each group recorded their thought process during examinations two and three.

The sixth null hypothesis was rejected. A qualitative analysis comparing the tape-recorded problem solving process of the two groups revealed significant differences between how the expert novice and struggling novices represented the

problem, processed information and how they ultimately solved the problems. A few narrative examples are provided below to illustrate some of these differences.

Test Question # 1

This first test question dealt with writing off accounts receivable that had been determined to be uncollectible. There were two methods that the students learned to address this type of question (the allowance method that sets up a reserve and a corresponding bad debt expense in advance of the account receivable actually going bad, and the direct write-off method that recognizes the bad debt expense only at the time that the account is written off as uncollectible). This question dealt with writing off an account receivable using the direct write-off method. This method does not require setting up an allowance. The correct process/entry in this situation is to debit the expense and to credit the account receivable.

Actual Question

If the direct write-off method of accounting for uncollectible receivables is used, what general ledger account is debited to write off a customer's account as uncollectible?

A. Uncollectible Accounts Payable

B. Accounts Receivable

C. Allowance for Doubtful Accounts

D. Uncollectible Accounts Expense (Correct answer)

Struggling Novice Problem-Solving Process

Although both students got this answer correct there were some significant differences in their problem-solving procedures. The struggling novice read through the problem and immediately proceeded to read through the answers and said " I choose D because the expense is where you want to have the write-off made."

Expert Novice Problem-Solving Process

The expert novice read through the question and emphasized: "this problem is using the direct write-off method and the problem is asking for the account to be debited." The student finished reading the question and before reading the answers stated: " With the direct write-off, there's no allowance set-up." The student then looked at the answers and states: " It can't be C because there's no allowance. It obviously can't be B because we are writing it off (and not setting it up), and it can't be A. This only leaves the correct answer D."

Test Question # 2

This next question deals with the allowance method for writing off accounts receivable. In this problem the student has to choose the entry that sets up the correct amount in the allowance calculated by using the analysis/aging of accounts receivable.

Actual Question:

The Allowance for Doubtful accounts has a credit balance of $900 at the end of the year (before adjustment), and an analysis of accounts in the customers ledger indicates doubtful accounts of $ 15,000. Which of the following entries records the proper provision for doubtful accounts?

A. Debit Uncollectible Accounts Expense, $900; credit Allowance for Doubtful Accounts, $900
B. Debit Uncollectible Accounts Expense, $14,100; credit Allowance for Doubtful Accounts, $14,100 (correct answer)
C. Debit Allowance for Doubtful Accounts, $900; credit Uncollectible Accounts Expense, $900
D. Debit Allowance for Doubtful Accounts, $15,900; credit Uncollectible Accounts Expense, $15,900

Struggling Novice Problem-Solving Process

This particular problem the struggling novice got wrong. The student quickly read through the problem and stated: " $15,000 + $900 is $15,900. The answer is D."

Expert Novice Problem-Solving Process

After the expert novice reads through this problem and before even looking at any of the possible answers, his thought process was reported to be as follows: " The problem states that the allowance has a credit balance of $ 900. If the allowance already has $900 left in it we don't need to put in the full $15,000. The correct entry would be to debit the bad debt expense and credit the allowance $14,100. Let's see if that one is there. We can eliminate C and D right away. There it is, answer B."

Test question # 3

This question dealt with taking a note receivable to the bank before it matures. The bank will then calculate the amount of interest they will charge and subtract it from the gross proceeds (maturity value of the note). This process is called discounting a note receivable. This basically is getting a collateralized loan from the bank. To solve this problem, the student must follow a two-step process.

Actual question

A 60-day, 12% note for $ 10,000, is dated May 1, is received from a customer on account. If the note is discounted on May 21 at 15%, the proceeds are:

A. $10,030 (Correct Answer)

B. $170

C. $9,830

D. $10,000

Struggling Novice Problem-Solving Process

After reading the problem, the student reportedly went directly to the answers: "I'm going to waive answer A. Answer B doesn't have a clue. $9,830 would not fit and $10,000 would not stay the same. I'm going to have to go with answer A". It should be noted that this was a lucky guess. The process described would not yield a successful solution to the problem.

Expert Novice Problem-Solving Process

After reading the problem and before looking at any answers, the student reported the following thought process: " This is discounting a note. Using the formula from class (Principal x Interest x Time), gives you a maturity value of $10,200, then take the bank's interest rate times the number of days left on the note which is 40 because the note was held for 20 days. This will give you $ 170 of interest. Subtract this from the maturity value and you get $10,030 and there it is answer A."

Test question # 4

This problem deals with inventory valuation utilizing different methods and the impact it has on cost of goods sold. This was covered extensively in class and in assignments. The correct answer is B.

Actual question:

During a period of consistently rising prices, the method of inventory that will result in reporting the greatest cost of merchandise sold is:

A. fifo

B. lifo (Correct Answer)

C. average cost

D. weighted average

Struggling Novice Problem-Solving Process

After reading through this problem, the struggling novice reported that they thought through the problem as follows. "Hmmm, rising prices is inflation, with FIFO cost of goods sold goes down and inventory would be going up, uhh..... FIFO is the answer." This was an incorrect response.

Expert Novice Problem-Solving Process

The expert read the problem and made the following comments. " FIFO will give you the greatest income which means lowest cost of goods sold, so (with LIFO), you have to reverse it. Rising prices is normal. Selling your highest priced goods (LIFO), gives you the lowest income and highest cost of goods, so its B."

Result Related to testing Null Hypothesis Seven

Null hypothesis seven was designed to test whether or not there was a relationship between traditional academic predictors (ACT score) and performance in the accounting principles class. The seventh null hypothesis was rejected. The analysis of the results of the correlation between the students' ACT scores and the curriculum based measures yielded a correlation coefficient of .874 which was clearly significant ($P > .0000$). Finally, it should be pointed out that the ACT score accounted for 76% of the variance of Academic performance across the two groups in the study.

CHAPTER V

DISCUSSION

In this final chapter, a discussion of the results related to testing each of the seven null hypothesis is presented. A special effort will be made to discuss the findings of this research project and relate them to the research described in Chapter two. General limitations of this research project and suggested areas for future study are also presented in what follows.

The research project described in this dissertation was designed to test for critical cognitive processing and learning differences between what have been defined as "expert novices" and "struggling novices" in an introductory accounting class. The main areas of investigation were the mental representations of knowledge, the information processing within a novel domain, and the problem-solving protocols of the two groups. The initial focus of this research project was to identify and document differences in information processing and cognitive problem solving approaches that high performance students utilize compared to under performing students. Based on insights gained from analyzing what schematic representations and cognitive processes the expert novice students followed, the ultimate goal was to construct more effective learning experiences to teach principles of accounting.

Discussion related to Null Hypothesis One

The first null hypothesis was designed to focus on the consistency of the performance of expert novice students across the four phases of the study. As stated in Chapter IV, the overall mean of the curriculum based measures for the expert novice group was found to be 91.1 %. It should be noted that there were five expert novices whose scores deviated across the phases of the study. All of them occurred at test number 3 (underlined score). A systematic analysis of qualitative and quantitative factors was done in an effort to determine possible causation. The deviations in performances reported in Chapter IV are summarized below.

TABLE 5 (reproduced)

Table of Deviation Performance Based Measures for Expert Novices:

Expert Novices (14)

	Phases of Study			
	T-1	T-2	T-3	T-4
Expert 1	91	89	78	85
Expert 2	95	91	74	91
Expert 3	90	92	78	80
Expert 4	110	94	72	95
Expert 5	98	95	65	92
Overall class mean score	74	78.8	71.3	70

As reported in the previous chapter, there were ordinal interaction effects found with respect to examination three. One of the contributing factors to the Experts' score at test three was the increased difficulty of this exam as measured by the overall class mean score as compared to the first two examinations. The small increase in difficulty would not account for the entire drop in scores as reported above. An examination of the student interview protocols revealed that the drop in performance for experts 2, 4, and 5 were directly related to time and effort. Expert 2 said that he knew that he had a very high A average in the class and therefore did not put in a sufficient amount of additional time to prepare for this examination. This statement was confirmed in his reported times spent on homework which dropped from 3 hours to .5 and his study time dropped from 1 hour to .5. Although expert 4's time and effort did not significantly change for test 3, the contributing factor for his low score on test three was that this student had a 2.5 hour professional licensing exam one hour after the accounting exam. He admitted to me that he was very distracted during the accounting test. Expert 5 also admitted to not focusing on exam three due to a high average in the class. He said that he concentrated his efforts on other classes in which he was behind. His chapter reading time fell from 1 hour to .5 an hour and the average time spent on homework dropped from 2 hours to 1 hour. There were no significant differences found in times spent reading, studying, or homework for experts 1 and 3, nor were there any differences in their reading/learning processes. An examination of the interview protocols indicated that the two students found the particular chapters more difficult. The hypothesis that there were no differences in performance across phases of the study was rejected. With very few exceptions, the experts remained experts.

Discussion Related to Null Hypothesis Two

The second null hypothesis was crafted to test for differences in the curriculum/performance based measures across phases of the study for the struggling novice students. This hypothesis was rejected, but there were several notable fluctuations by 5 of the 13 struggling novices. Further, the results presented in the previous chapter indicated that there were significant ordinal interactions with examinations two and three. Again, the five notable individual fluctuations among the Struggling Novices presented in Chapter IV are summarized below.

TABLE 6 (reproduced)

Table of Deviation Performance Based Measures for Struggling Novices (13)

Struggling Novice (13)	Test 1	Test 2	Test 3	Test 4
Struggling Novice 1	59	70	83	79
Struggling Novice 2	47	91	61	47.5
Struggling Novice 3	55	78	89	83
Struggling Novice 4	54	87	79	85
Struggling Novice 5	38	73	74	62

Struggling Novice #1 increased his studying times from 2 hours for test 1 to 5 hours for test 2 and to 13 hours for test 3. His study time for test four was back to 2 hours but he reported spending seven hours preparing his study sheet, which was partly spent studying it. Given these findings, it seems reasonable to conclude that his improvement can be attributed to increased effort and determination.

Struggling Novice #2 was a very interesting and rather troubling case. After receiving a low F (47%) on the first examination, he then recovered and scored a 91% on examination #2. His time reading the chapters increased for test 2 from 1 hour to 2 hours, and his time spent on homework increased from 1 hour to 3 hours. His time spent on preparing for test 3 (score = 61), did drop for reading the chapters from 2 hours to 1 hour, His time spent for doing homework decreased from 3 to 2 hours. This student appeared to have lost interest and motivation after test 2. Finally, it should be noted that he was very quiet and refused to be interviewed after test 4.

Struggling Novice #3 increased his study times from two hours to four hours for examinations 2-4 along with the way he studied. He reported studying much earlier for examinations 2-4. For test 1 he reported that he did the majority of his studying the night before the test. For examinations 2-4, he began studying one to two weeks before the actual test. This student said that he began to highlight and outline the chapters after his performance on test 1. An additional qualitative factor for this student's improvement that manifested itself in the post-test interview, was that his two friends in the class got A's and B's. He reported that he was embarrassed and was not going to let his friends show him up.

Struggling Novice 4 increased his study time from 1 hour to 4 hours and reading time per chapter from 1 hour to 3 hours. This student also began seeing a tutor after the first examination.

Struggling Novice 5 increased her study times from 2 hours to 4 hours and reading the chapters from 1 hour to 2 hours. This student appeared to be very motivated after receiving a 38 on the first test. She said that she was very embarrassed to have gotten such a low score. She also reported that since the instructor was taking the time to study her, the least she could do was try harder.

Discussion Related to Null Hypothesis Three

Systematic examination of the student generated study sheets revealed that there were significant differences across groups with respect to what was considered important material and the criteria used to decide what got included on the sheet. A significant difference between the two groups of students was the criteria used for selecting information to be included on the study sheet. Almost half of the expert students (5 of 12) chose information that they did not know or were not sure of as a selection criteria compared to only 2 of 11 (18%) of the 11 struggling students. This selection process made for a more stream-lined and manageable study sheet. A commonly reported theme among the expert novice students was that there was no real purpose to including something on the study sheet if the information was already known. The study sheet was considered to be primarily a reference guide to be used as a last resort. On the other hand, the struggling novice group reported that "everything" should be included on the sheet. Often times the overloaded study sheet appeared to be an extremely unmanageable reference guide that was poorly organized and inefficient.

The chapters in the accounting principles book were organized around 1 to 3 major topics with minor subtopics branching off. The vast majority of all four examinations dealt with the major topics of each chapter. The expert novices did not fill up their sheets with extraneous material. They appeared to have a better insight with respect to what the salient features of each chapter were and they were more efficient attending to important textual information. A significant common theme of the expert novice study sheet was that their sheets were built around the main topics of the chapter and contained examples of the main issues. For example, 12 of the 12 expert novice study sheets contained a comprehensive example of a bank reconciliation where only 3 of the 11 struggling students

included one on their sheets. The expert student's study sheets did not have as much material on them as those of the struggling novices. Additionally, the expert novices did not spend as much time preparing the study sheets compared to the struggling novices (1.2 hours vs. 1.7 hours).

Some of the more interesting exercises that 10 of the expert students did when creating their study sheets were as follows: They would create the study sheets or at least mark things that would be included on their study sheet as they read the chapters. One expert student stated: " When it would come time to study, I would reread the chapter highlighting what would go on and what wouldn't go on the study sheet." Another expert student focused on including information that could help him solve problems. This student said: " I would include topics covered heavily in class, bold-faced items in the chapter, and other basic important topics necessary to solve other problems." Here the student was more interested in putting general information and broad examples rather than copying specific minute details and definitions. This student often applied the concepts to his own examples or ones that were provided in class lecture. Another expert student stated: " I would include important topics, like things that you talked about in class, shaky topics, and things related to the stated objectives in the chapter." The stated objectives appeared on the first page of each chapter and were broad-based goals a student should be able to perform after reading a chapter. Another expert student noted: " I would include important things from my notes, bold words from the chapter, stuff that I was unsure of and reminders about how to do it." Lastly an expert student noted: " I would include main points from the chapter, like the objectives, also I would include anything that had a big example in the chapter because it is probably important."

Table 8 presented in Chapter IV summarized the breakdown of all study sheet selection criterion. Although there were no other clear significant differences across groups, it can be seen that the expert novices use many novel approaches like reviewing old quiz questions that they had gotten wrong, reviewing highlighted or bolded information and reviewing problem-solving concepts. The expert novice subjects focused more of their attention to the broader concepts and examples rather than detailed examples.

Discussion Related to Null Hypothesis Four

The analysis related to Hypothesis Four was mostly qualitative in nature and dealt with how the information was constructed and organized on the study sheets. As indicated in Chapter IV there were several organizational and representational differences in the study sheets between the two groups. The first significant difference noted in chapter IV was the overall organizational structure of the study sheets. All but one of the expert novice's study sheets (11 of 12) were organized either by chapter and/or main topic. In contrast, only three of the 11 struggling novice study sheets were organized in this manner. This is consistent with the theory that the essence of knowledge is structure (Anderson, 1984, Glaser et al; Bruer, 1993). The expert novices' study sheets appeared to be well organized, efficient, and the information was easily accessible.

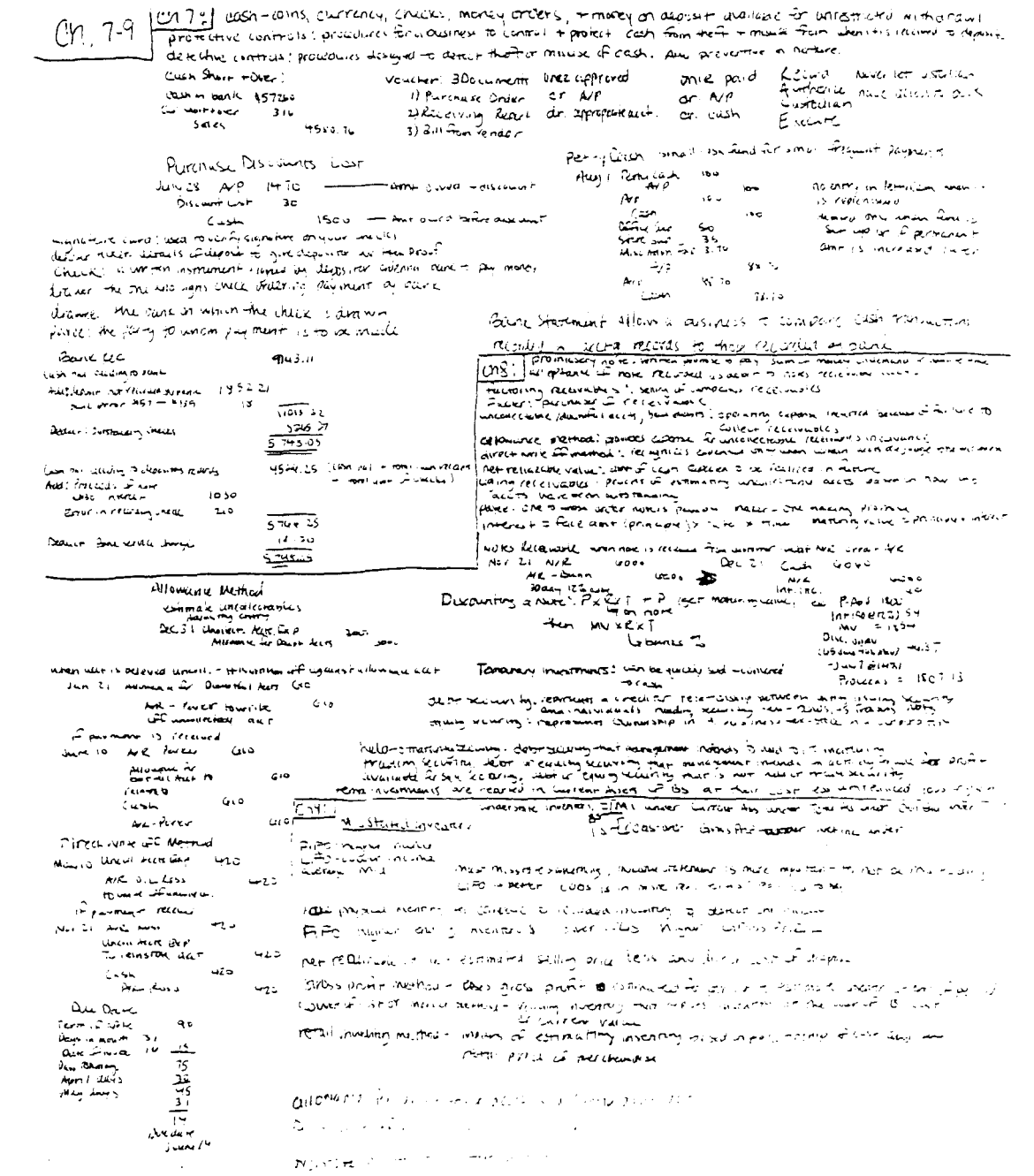
Organizational Differences (Note the Expert Novice study contained in Illustration # 1 on page 66.)

This study guide is clearly organized around each chapter. Additionally the major problems/objectives of each chapter were clearly represented with an example. The main points of chapter 7 were the bank reconciliation and petty cash which are clearly represented. Chapter 8's main point/topics were setting up and writing off accounts receivable to the allowance for bad debts and accounting for notes

receivable. This student included comprehensive yet concise and easy to follow examples of these topics. Chapter 9 was about inventory valuation which was not represented very well on this study sheet. There were no examples and/or illustrations present. When questioned about this on the survey, the student responded that she could very vividly calculate inventory under the various methods covered in the chapter so there was no need to include them on her study sheet. This student scored 102 (extra credit points) out of 100 points on this examination.

Illustration 1

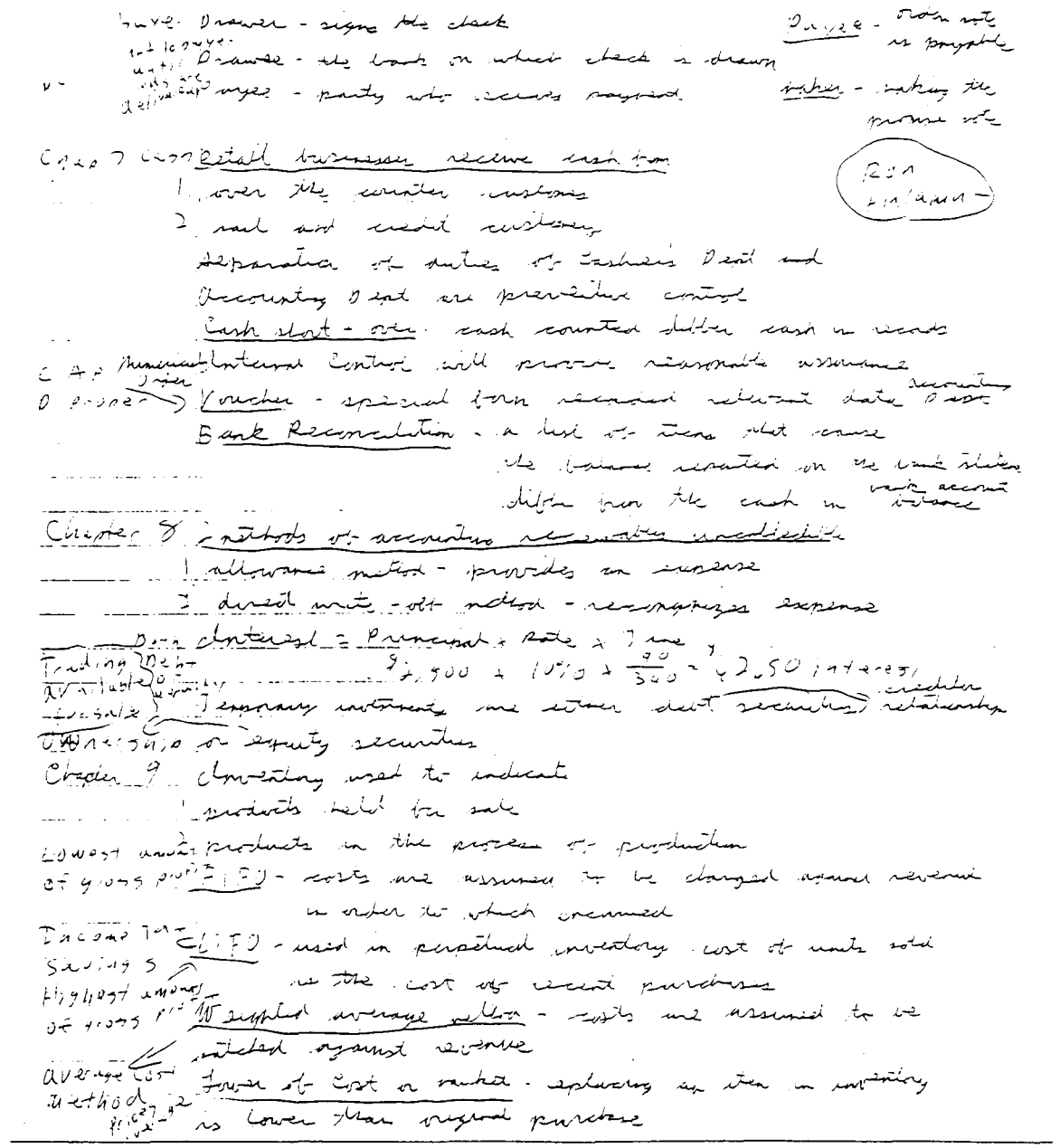
Expert Novice Study Sheet #1



The comparative structures of the study sheets of two struggling novices reveal some significant differences from the preceding expert study sheet.

Illustration 2

Struggling Novice Sheet # 1



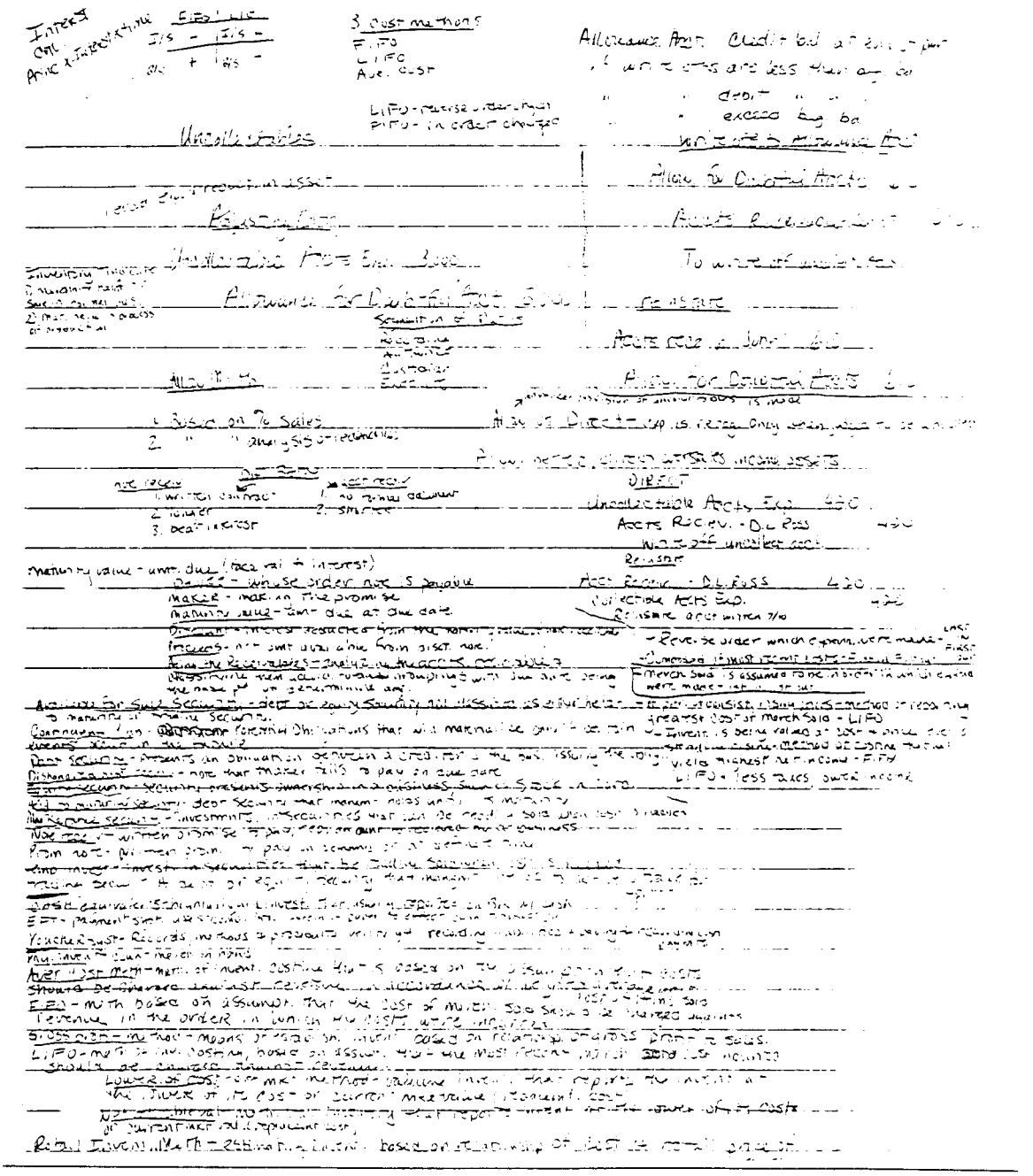
The first struggling novice's study sheet (test score 35) was broken down by chapter, but the information appeared to be fragmented, unrelated and mostly unimportant. Material related to chapter 7 contained no information or examples of petty cash and only a textbook definition of a bank reconciliation. Only surface definitions with no application or connectedness to solving problems was provided for chapters 8 and 9. This is consistent with research suggesting that novices possess only a superficial understanding of the problem and their attempts to solve it are centered around explicit clues given in the problem (Bruer, 1993; Glaser, 1990; McKeachie, Pintrich, & Lin, 1985). This student reported spending 2 hours reading each chapter, 1 hour doing homework, 3 hours studying for the examination, and 1.5 hours preparing his study sheet. It is clear that the reasons that this student was struggling are not from lack of effort. It was shown in the results of times spent studying and working on material (Null Hypothesis 5) that the only category that the expert novices were higher on was time spent on homework. It should be noted that this was only a narrow margin of 2.0 hours vs. 1.9. The second struggling novice's study sheet also provided insights into the knowledge base of the students.

Close examination of the second struggling novice study sheet will reveal additional differences. (Refer to Illustration # 3 on page 69 for Struggling Novice Study Sheet # 2). Analysis of this struggling novice study sheet (test score 62) although somewhat better, still revealed a similar lack of organization and utility. This sheet did not follow any consistent pattern of organization. It did contain an example of writing off an account receivable, but this was only a small part of the topic. More class and book time was spent on different ways of calculating the allowance and entries for setting it up. Additionally, the definitions included on

the sheet do not seem to follow any pattern and for the most part appeared to be copied straight form the book.

Illustration # 3

Struggling Novice Study Sheet # 2



Representational Differences

In addition to the overall organization of the study sheets, another critical component was the representations of the information itself. As reported in Chapter IV, the vast majority of the struggling novices' study sheets (10 of 11) contained definitions or text-based information (eq., definitions copied from the book). In contrast, only two of the 12 expert novices' study sheets fell into this category. The other ten expert novices study sheets contained problem/example based information. The following examples are provided to illustrate the differences across groups:

(Refer to Illustration # 4 on page 71 for Struggling Novice sheet 3)

It is clear that this student spent a great deal of time on his study sheet (2 hours) and that it is fairly organized (by chapter). The problem with it is that the study sheet consists of copied definitions that are unrelated to problem-solving. This student scored a 56 on this, the third exam. By this time of the semester, the students should be very aware that the tests are not definitional in nature. The tests are very problem-oriented. Contrasting the representational structure of the struggling novice's study sheet with that of the following expert novice study sheet will highlight noticeable differences. (Refer to Illustration # 5 on page 72 for Expert Novice Study Sheet # 2)

The composition of this study sheet is represented almost entirely by examples and applications. There are very few definitions. The study sheet contains the main objectives from each of the chapters. For chapter 7, he has included a bank reconciliation, chapter 8 includes all the entries to set up and write off accounts receivable to the allowance and entries related to accounting for notes receivable.

Illustration # 4

Struggling Novice Study Sheet 3

CH 7 : CASH

→ Cash includes currency, checks, money orders, and money on deposit for unrestricted withdrawal from banks.

Protective controls - to protect cash from the time it is recieved until deposited.

Detective controls - procedures designed to detect theft or misuse of cash.

→ all cash in the mail is sent to the cashier's department, bank deposit ticket, accounting, ledger.

→ a cash change fund account is currency on hand to make change.

Debit - misc. administrative expense

Credit - other income section.

voucher system - a set of methods and procedures for authorizing and recording liabilities and cash payments

voucher - any document that serves as proof of authority to pay cash or a special form on which is recorded relevant data about a liability.

purchases discounts lost = (loan x rate x days x year)

petty cash - funds used to pay misc. expenses.

signature card - card signed when checking acct is opened

drawer - one who signes the check

drawee - the bank on which the check is drawn

payee - party to whom payment is to be made.

statement of account - record of all checking accts.

bank reconciliation - listing of items and amts. that cause the cash balance to differ from the cash in bank account balance.

compensating balance - minimum cash balance.

CH 8: Receivables | Investments | JASON QUIGLEY

→ The term recievables includes all money claims against other entities, including people, businesses, and other organizations.

accounts receivable - selling merchandise or services on credit; balance sheet.

notes recievable - written promise to pay a sum of money at a definite time.

other recievables - include interest, taxes, and recievable from officers or employees.

→ The selling of a company's recievables is called factoring, and the purchase of the recievables is a factor.

→ failure to collect: uncollectable accts, doubtful accts, or bad debts.

allowance method - expense for uncollectable recievables in advance to their write off.

direct write off - only when certain accts are judged to be worthless.

net realizable value - reducing the value of the recievables to the amt. of cash expected to be collected in the future.

→ The total amount written off against the allowance account during a period will rarely be = to the amt. in the account beginning (a note recievable is due at later time)

→ when an account that has been written off is collected in a later fiscal year, it may be reinstated by debiting accounts recievable and crediting uncollectable.

→ a day the note is past its maturity date is due date. days or months).

interest : amount x rate (%) x time (3/12).

maturity value : amount + interest + time.

contingent liabilities - potential obligations

→ temporary investments are either debt securities or equity securities.

debt security - represents a creditor relationship between the entity issuing the security and individuals holding the security.

equity security - represents ownership in a business. An example is stock.

held to maturity - management holds its security

trading security - debt/equity to make profit

→ Disclosures related to recieveables are presented either on the face of the financial statements or in accompanying notes

CH 9 : Inventories

Inventory is used to indicate merchandise held for sale in the normal course of business AND materials in the progress of production or held for production.

→ control over inventory should begin as soon as inventory is received.

perpetual - citation of dates, recordings, etc. etc.

periodic - no attention to dates whatsoever.

→ The first step of a physical inventory is to determine the quantity of each kind of merchandise.

FOB shipping point - title passes when goods are shipped.

FOB destination - title passes until goods are delivered.

FIFO - costs are assumed to be charged against revenue in the order in which they were incurred.

LIFO - the costs of the units sold is the cost of the most recent purchases.

average cost method - an average unit cost for each type of commodity is computed each time a purchase is made.

→ average cost is a compromise between FIFO and LIFO. The effect of price trends is averaged in determing the cost of merchandise sold & ending inventory.

→ merchandise inventory is presented in the current assets on B/S.

retail inventory method - based on the relationship of the cost of merchandise available for sale to the retail price of the same merchandise.

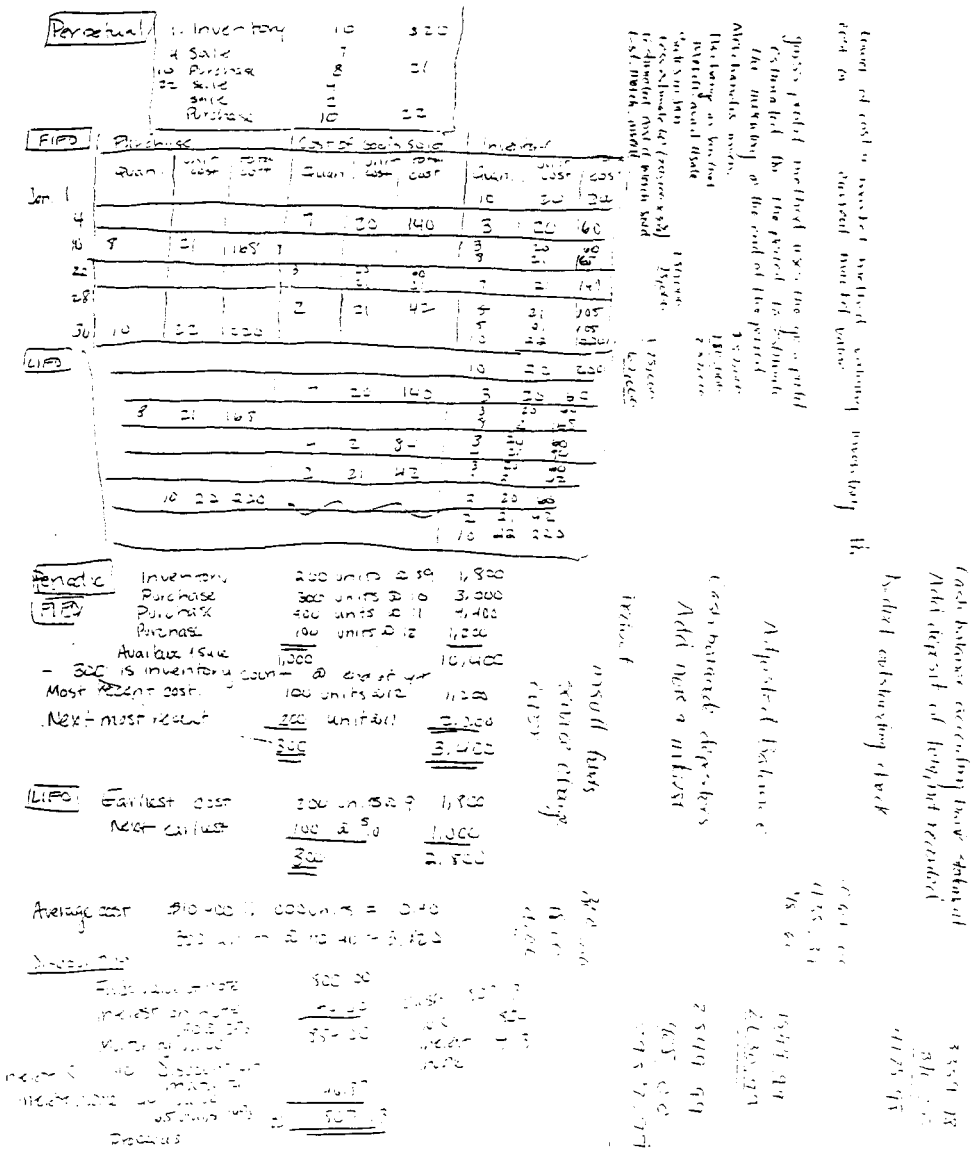
gross profit method - uses the gross profit estimated for the period to estimate the inventory at the end of the period.

FIFO - yields the lowest amount of gross profit.

LIFO - yield a lower amount of inventory at the end of the period, a higher amount of cost of merchandise sold, and a lower amount of gross profit than the other two methods. → income tax savings.

Illustration # 5

Expert Novice Study Sheet 2



Chapter 9 contains a very comprehensive easy to follow inventory valuation example. This student does not waste space on unimportant definitions. On the interviews, this student responded to the question how do you determine what to include on your study sheet in the following manner: " I pick the main points of each chapter (objectives), and anything that has a big example in the book is probably important. I make sure that I understand it and include it on my study sheet". This expert novice scored 99 on this test.

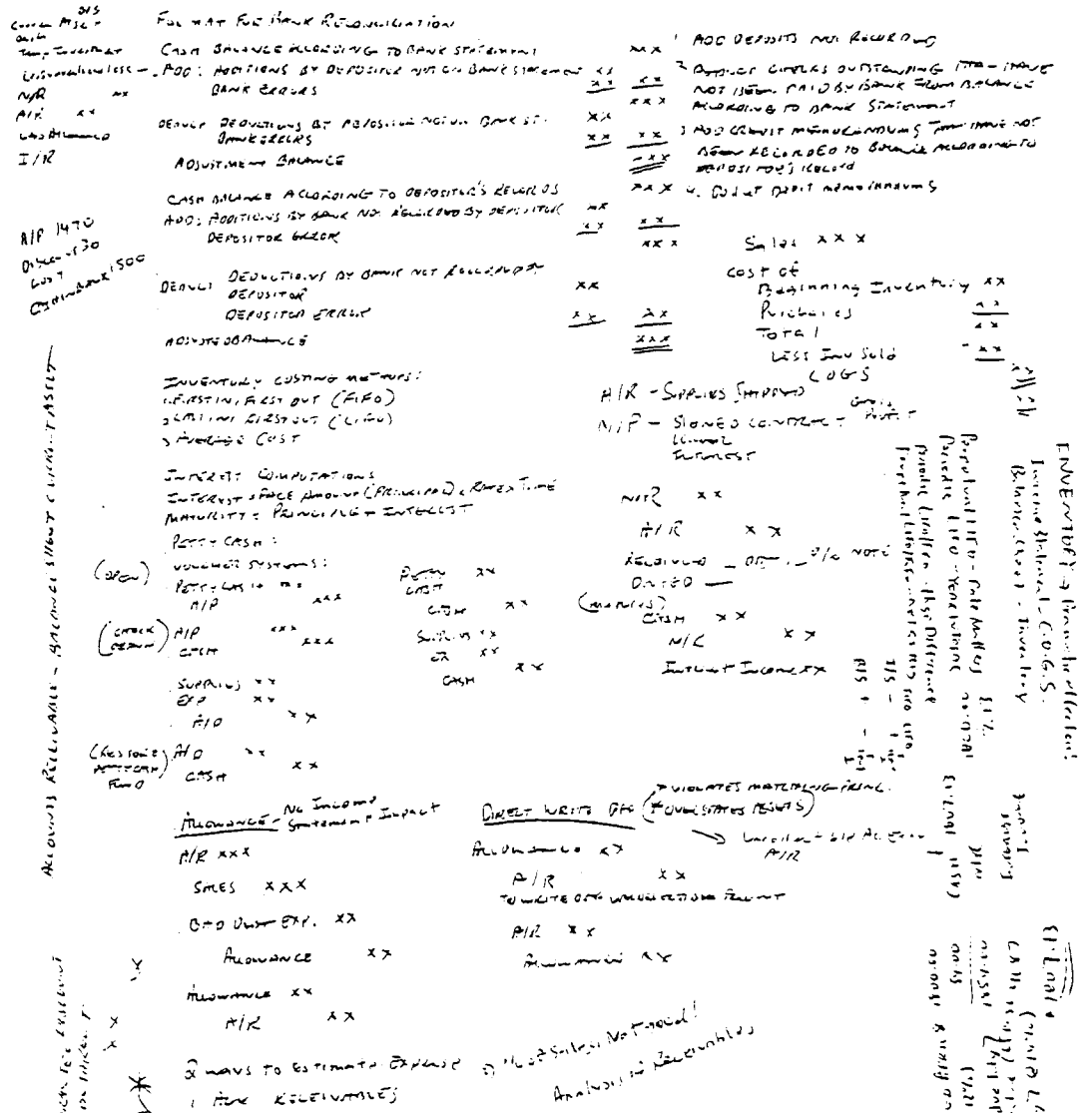
Other unique representations of Expert study sheets

In addition to the expert representations of information as a problem or example, several other interesting characteristics of expert novice study sheets are illustrated on the following expert novice study sheet: (Refer to Illustration # 6 on page 74 for Expert Novice Study Sheet 3)

This expert novice, whose semester average was 99%, also constructed his study sheet based on the problem/example format, but did not use any numbers. These examples on his sheet are taken from the book, but he has reconfigured all the numbers as Xs. His response when interviewed as to why he did this was: " I put the Xs because I didn't want to get locked into a narrow answer. By putting the Xs, I just wanted the basic format that would be flexible to solve many versions of the problem." He has included on his sheet all of the main topics and/or objectives from each chapter.

Illustration # 6

Expert Novice Study Sheet 3



(Refer to Illustration # 7 on page 76 for Expert study Sheet # 4)

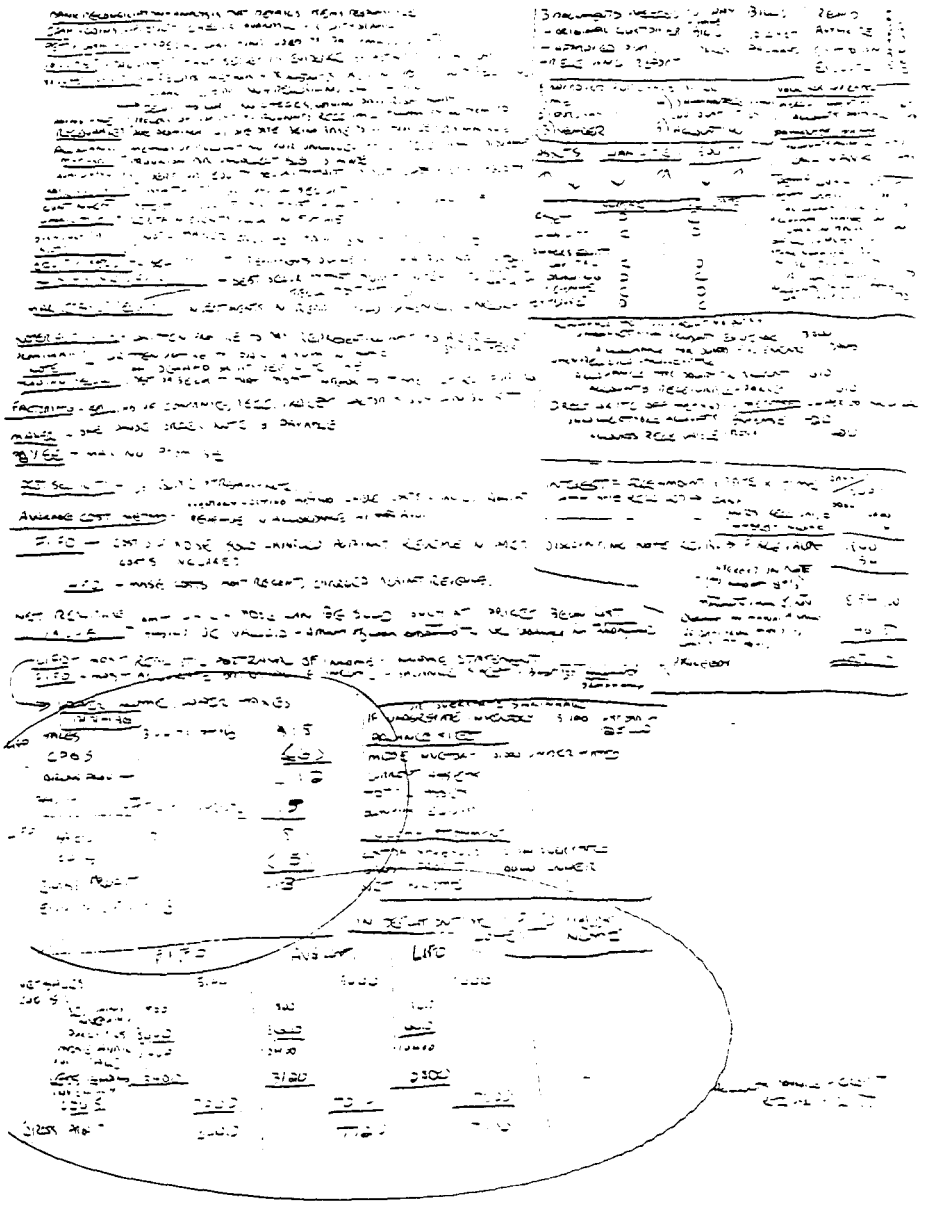
The unique representations that this expert novice student came up with are the original examples or creations of examples based on illustrations given in class. Class presentation was a lecture utilizing visual aids. The instructor set up an inventory of VCR tapes with dollar values ranging from $1 to $6. This student copied this illustration onto his study sheet along with another variation dealing with inventory valuation methods and the resulting effect on the financial statements. This student applied these inventory concepts as opposed to simply copying a definition or copying examples from the textbook. This student averaged 100% across the four examinations. In responding to how information was selected for his study sheet, this student replied: " I looked for major concepts, titles of sections, bold-faced words and basic ideas that I thought you would ask based on your lectures. The system that this expert novice followed for learning the material should serve as a model for others. His system was : " I read the chapters and always did the homework. Then at test time, I reviewed the homework again and made my study sheet which would include any problem areas from the homework."

One other interesting difference between the expert novices and the struggling novices that was noted was how often the students actually used their study sheets while taking their examinations. The expert novices rarely referred to the study sheets during the examinations, where in all cases the struggling novices referred regularly to their study sheets. Some of the expert novices quotes on using the study sheet were: " I do not use a study sheet because I feel that I must learn all the material, and using a study sheet would allow me to skate on the material." Another similar quote was: " I did not use the study sheet. I already

know the stuff. I hear what you say and it sticks." This student had a semester average of 99%. I noticed that he never brought a book to class nor did he take

Illustration # 7

Expert study Sheet 4



notes during class. He would just sit in class and intensely stare at the instructor paying acute attention to everything said or done. He reported to me that shortly after class he would go back to his room, put on soft music, and do the homework based on what he heard in class. When I questioned him about this, he said that the homework gave him a clear indication of what the chapter was about and what was important. After the homework was done, which he admitted was often a struggle, he would go back and thoroughly read the chapter knowing what he should pay attention to. Another expert novice student said: " Even though I had the study sheet, more than 2/3 of the time I already knew it (the material) and didn't have to use it."

Discussion related to Null Hypothesis Five

As reported in Chapter 4, Null Hypothesis Five addressed differences in study, reading, and learning habits. The null hypothesis was rejected because some significant differences did exist in the ways the two groups approached their learning activities. The findings reported in Table 11 indicated that the struggling novices actually spent more time on average reading chapters (2.3 hours vs. 1.4 hours), more time studying for the examinations (3.8 hours versus 2.5 hours), and more time preparing the study sheets (1.7 hours vs. 1.2 hours) than the expert novices. The only component that the expert novices spent more time on was doing the homework (2.0 hours versus 1.9 hours). The two activities that were found to be positively related to the test scores were hours spent on homework (r=.1752) and hours spent on study sheet (r= .0770). These relationships though were very weak. The success of the expert novices is clearly not a time on-task variable. The critical variable appears to be one of organization of information efficiently and effectively utilizing time. They seem to have a better awareness of the salient features of the chapters and what material is more likely to be tested.

They spend their time studying general concepts, examples, and applications as opposed to definitions and detailed examples. Negative relationships were found between the test scores of the expert novices and the time spent reading the chapters (- .2195) and the time spent studying (- .1578). For the Struggling Novices, there was a fairly strong correlation between test scores and hours spent on the study sheets (r=.5060). Even though hypothesis three and four were designed to test for the relative ineffectiveness and lack of utility of the struggling novices' study sheets, this correlation would suggest that by spending time on the sheets, the struggling novices were actually learning through the process of constructing them. A negative correlation was found between the test scores of the struggling novices and amount time spent on homework (r=-.2449). A possible explanation for this negative relationship is that the struggling novices were spending large amounts of time on unsolved homework problems which is an indication of the student being lost.

The student questionnaire was crafted to address many qualitative components of reading, learning, and studying. A significant qualitative difference was found between the two groups with respect to how they studied. Nine of the 13 struggling novices reported the primary method for studying for an examination was to read the book. This response was given by only four of the 14 expert novices. The logical question then is how do the expert novices learn the material and then prepare for an examination if they are not rereading the chapters. Although the responses varied among the expert novices, a clear pattern was evident. An explanation of their answers indicated that they studied old quizzes (3), reviewed homework (5), wrote the study guide (6), and studied their notes (6). All of the following processes appeared at least once for the expert novices: they did extra problems; they listened to soft music; they read chapter summaries; they

did self-exam questions; they did illustrative the problem; they studied key points; they made their own examples; and they outlined the main points. It is clear that the expert novices were more innovative in their study habits and viewed reading the book as an ineffective means of studying. In contrast, this was the primary mode of studying for the struggling novices (10 of 13).

Another significant difference found between the two groups was related to the motivation to get the correct answer when approaching a difficult problem. The expert novices regularly sought feedback to determine how they were doing. Some expert novice quotes from the student interviews were as follows: " On a difficult problem I would use the illustrative problem and examples from class notes. If something was still hard, I made sure it would go on my study sheet. Also I would keep reading and going over the part in the chapter until I got it right. If I still couldn't get it, I asked you the next day in class." Another expert novice said that: " On a difficult problem, I would review similar problems in the book, if I still didn't understand, I would ask peers. If this still didn't work, I would ask the instructor". Another expert novice reports: " On a difficult problem I went over each step thoroughly making sure I did everything correct. I Compared my answers sometimes with others or with the illustrative problem to make sure I was doing it right." An example of how an expert novice tenaciously approached a difficult problem is illustrated by the following comment: " If I didn't understand a difficult problem, I broke it down until I did understand it. I would make up ways to remember the materials I read. It was more important knowing the technique and why something was done rather than just getting an answer." Lastly an expert novice said that: "I keep reviewing and not stopping until I understand why something is the way it is". In sum, these processes that the successful students appear to be using are consistent with research on Feedback and Self-Regulated

Learning (Butler & Winne, 1995) who reported that effective learners develop idiosyncratic cognitive routines for creating feedback while they are engaged with academic tasks. It should be noted that related to learning in general, one expert novice whose semester average was 95 % said that: " I always do the homework, all the homework, and you should use your own logic as to what is more important and critical to learn. Some things lead to other things and are critical to know before being able to learn related material, like you must understand the concepts of periodic or perpetual inventory systems before you start learning LIFO or FIFO."

Taken together, the findings reported above support the notion that there were a number of significant differences between the expert novices and the struggling novices. The expert novices utilized more innovative and time efficient methods to study and organize the material to be learned. The expert novices placed a greater emphasis on application and concretizing of the material rather than merely reading about it in the abstract. The expert novices placed great importance on understanding and getting the correct answers to problems. They experienced considerable cognitive conflict when they could not understand and/or get the correct answer while reading a chapter and/or doing a homework assignment. Consequently they pursued whatever means necessary to master the material. These methods ranged from reviewing the illustrative problems, to checking among themselves, to asking me on the telephone or the next day in class. They appeared to have great motivation to understand the material at hand.

Discussion Related to Null Hypothesis Six

This null hypothesis was designed to focus on the problem-solving protocols recorded during test-taking. The results from a variety of questions are presented and described in Chapter IV. A review of these results indicated some

significant differences in problem-solving techniques between the expert novice and struggling novice groups. The first significant difference found across groups was that the expert novices appeared to recognize salient features/characteristics of the problem before looking at the answer set compared to the struggling novices. The struggling novices usually read the problem and proceeded directly to the answers in search of some problem solving clue. A clear example of this is reported in the third problem presented in the results section related to testing Null Hypothesis Six. The problem dealt with discounting a note at the bank that required a rather complex two step process which was thoroughly covered in class. The struggling novices went right to the answers after reading the question and began making guesses. The expert novices finished reading the question and identified significant aspects of the problem before looking at the solutions. One expert novice said that: "This is discounting a note. Using the formula from class Principal x Interest x Time gives you a maturity value of $ 10,200, then you take the bank's interest rate times the number of days left on the note which is 40 because the note was (already) held for 20 days". The student went on to solve the problem flawlessly and arrived at the correct answer of $10,300 before even looking through the solutions.

Another example of this process was evident in the responses to the first question described in Chapter Four. The first question dealt with writing off an account receivable using the direct write-off method. The struggling novices read the question and again went straight to the solutions looking for a problem solving clue. The expert novices on the other hand, read the problem and identified several characteristics of the problem and/or topic before looking at the answers. One expert novice said: " With the direct write-off, there is no allowance to set up (to write the account off to)". This example represents a critical difference

between the two methods of writing off an account that was covered in class. After identifying this element, this expert novice immediately eliminated two of the four possible choices.

These differences between experts(expert novices) and novices(struggling novices) in problem identification are consistent with the research findings by Ericcson & Charness (1994) who claimed that experts see a different problem than novices and solve the problem based on the applicable underlying principles and concepts. The results are also consistent with Bassok & Holyoak (1993) who reported that experts are better able to assess the pragmatic relevance of features of a problem.

Another significant difference observed between the expert novices and the struggling novices was that the expert novices either knew the answer or had a very firm idea of the answer before looking through the choices. The struggling novices scanned the answers looking for surface clues after reading the problem. Additionally, if the expert novice did not know the answer, he/she systematically eliminated the wrong ones as evidenced by one of the expert novices taped problem-solving protocols: " The answer can't be C because there is no allowance, it obviously can't be B because we are writing it (the account) off, and it can't be A (because there is no such thing), this only leaves the correct answer D." Another expert novice student said that: "I never guessed at my answers. I usually know the answers before looking through the choices. If I was unsure, I would use process of elimination by working backwards to see if the answer would work."

Discussion Related to Null Hypothesis Seven

As reported in the Chapter Four, there was a very high correlation found between the ACT scores and the academic performance of the subjects studied (r = .874). This is not surprising given that the ACT test is administered as a test of academic

achievement potential (r = .6). There is also a well documented relationship between intelligence and academic performance (r = .55) (Neisser, Boodoo, Bouchard, Boykin, Brody, Ceci, Halpern, Loehlin, Perloff, Sternberg, & Urbina, 1996). Although the correlation between traditional academic achievement tests and academic performance is clearly greater than .5, this still only accounts for approximately 25% of the variance in performance. Given the findings, there appears to be a great deal of opportunity to increase academic performance of students by understanding what the experts and expert novices do to learn material in novel domains and to modify teaching practices to capitalize on these processes.

Summary, Limitations and Suggestions for Future Research

Significant qualitative and quantitative differences were found in information processing, cognitive representations and learning/studying habits between the expert novice and struggling novice students. Furthermore, once a student was identified as an expert novice, he/she tended to remain a superior student. Struggling novices appeared to be more likely to change. They showed marked improvements during the study. These improvements were documented in five of the 13 students studied. There were significant differences found in the way expert novices and struggling novices organized and represented information. Expert novice study sheets were found to be highly organized around either the chapter contents and/or the main examples and/or illustrations. In contrast, Struggling novices' study sheets were found to be very scattered, lacked clear organizational patterns, and were primarily definition-based including very few examples and/or illustrations of problem solutions.

There were a number of significant and interesting differences related to how the two groups studied, read, and learned. An analysis of the quantitative variables revealed that the expert novices actually spent less time on average

reading the chapters, less time studying for exams, and less time preparing their study sheets. The only category that the expert novice students spent more time on was doing the homework. The margin across groups was negligible (2.0 hours vs. 1.9 hours). The differences in the two groups' test performance was clearly not a time on-task variable. The expert novices' superior performance was attributed to a much more efficient utilization of time and their ability to attend to the salient concepts of the chapters. The expert novices were much more focused on the larger concepts and applications of the principles in a problem solving format. This was documented through a systematic analysis of the contents of the study sheets and the student interviews. The struggling novices were not clearly focused. For the most part, they appeared to be unorganized and definition based. In studying for an examination, 9 of the 13 struggling novices said that they simply studied or reread the chapters. This response was given by only four of the 14 expert novices. The remaining expert novices said that they spent their study time applying the principles in various activities that included things like: reviewed homework; did extra problems; did self-exam problems; worked through the illustrative problems; and made their own examples. They appeared to be much more engaged in the material than the struggling novices who simply read the chapters again when studying for a examination.

Another critical difference documented in the study was the tenacity and motivation of the expert students to arrive at the correct answer. When an expert novice encountered a difficult concept in the chapters or problems in the homework, they continued to engage in problem solving until resolution was achieved. Solutions were accomplished by a variety of means. Expert Novice students would continue to work until they solved the problem. They would seek each other out to find the answers or they would ask me over the telephone or in

person the next class period. There appeared to be considerable cognitive conflict when they did not understand the question put to them. This motivation was not detected in the struggling novice group.

Lastly, the problem solving protocols of the two groups was found to be significantly different. The expert novices identified the problem more accurately and often solved the problem before looking for a textbook answer. Many of the struggling novices engaged in only a surface reading and understanding of the problem accompanied with an immediate search of the answers looking for some type of clue or hint to what the answer might be. If the expert novices did not know the answer, they would systematically eliminate possible answers until only the correct one was left. This systematic problem solving process was not observed for the struggling novices. There was high correlation (r=.874) found between the ACT scores and the academic achievement scores attained by the students serving as subjects in this research project.

Some of the limitations of this research project are described below. The two accounting classes from which the sample groups were selected consisted of 110 students. After initial screening to eliminate students with any prior accounting coursework and/or practical experience, the remaining population of students from which to choose was approximately 65. From this group, the 14 expert novices and 13 struggling novices were identified and chosen as participants. It would have been of course, better to have studied a larger number of both expert novices and struggling novices. Looking back at some of the students who initially were eliminated due to prior accounting experience, their semester scores were certainly in the struggling novice category. Additionally, some of the students who indicated prior accounting coursework and were eliminated from the study, scored below 60% on the preliminary screening

comprehensive final examination which would have enabled them to be considered for inclusion in the study. Some of these students would have qualified as expert novices and others as struggling novices.

Another potential limitation of the research project was the accuracy of student reporting of the times engaged in active study. After each examination, the students completed post-test learning surveys. Students were asked to report how long they spent reading a chapter, doing homework, and studying for an examination. The examinations covered several chapters. Often there was a one month lag between the time they finished work on the first chapter of a unit and the examination on that unit. More accurate reporting would probably have occurred if the students were asked to respond to a brief survey immediately after each chapter was completed. This procedure may have better captured the times spent on homework and/or reading the chapter. Additionally, more inquiry may have been possible related to how the students represented the material in each chapter rather than reporting on the three chapters taken together. It should be noted that students reported very few unique cognitive representations for learning the concepts and applications across chapters. It is recommended that a research project be designed to compare the schematic representations of expert and novice groups. One other possible weakness, particularly with the struggling novices, was the potential bias related to reporting their studying and/or reading times. It is my belief that many of these students over-reported their times to show me that they were really trying to distinguish themselves. There may have been a reluctance on their part to openly admit their lack of effort.

One of the most interesting and insightful parts of this research project was the tape-recorded problem solving narratives done by the students. Unfortunately, some of the students who could have provided valuable information refused to

cooperate. I found this to be the case for many of the struggling novice students. They were already struggling in the class and to distract them during the examination with recording their thought process proved to be too disturbing, and perhaps too embarrassing for them. Although some struggling novices did consent to tape-record themselves, it is recommended that future investigations include some type of small incentive and/or extra credit for participating in the research project. Another aspect that was rather disappointing, was that within the context of a few of the students' recording sessions, there were some equipment failures and their narrative protocols were lost. It is strongly recommended that in future studies, that some initial training be implemented to ensure proper recording.

It is recommended that the following areas of research be considered. An obvious extension of this research project would be to study other accounting classes. The research project could be replicated for other accounting principles I classes to compare and contrast the results across studies. Research could also be done on different accounting classes such as accounting principles II, intermediate accounting, cost accounting, and/or advanced accounting. The initial purpose of this research project was to systematically investigate what the successful student was doing methodologically and cognitively and to contrast the expert novice student with the struggling novice student. Once substantive differences across groups are clearly documented, then the ultimate goal would be to modify instructional techniques to capitalize on the use of the expert novice techniques. Some of the possible modifications based on the research findings would be to practice study sheet construction, give more emphasis and time to solving problems, and provide more practice applying material rather than merely lecturing. Research projects could be designed to measure the effectiveness of classes that incorporate these components into them.

A factor of great influence that was only lightly touched upon here was the area of student motivation. Follow-up research dealing with expert novice and struggling novice comparisons might include a larger component designed to measure, compare, and manipulate motivational factors across expert novice and struggling novice groups.

As pointed out in the limitations section, an area of great interest and value appeared to be examination of the problem-solving narratives. Although the problem solving narratives were tape recorded, it is recommended that these procedures be greatly expanded. Many of the critical variables needed to learn accounting and solve the problems are probably to be found in a fine-grained examination of the problem-solving protocols. More work in this area seems warranted.

Finally, a limitation mentioned above, and an opportunity for further research, would be to conduct a comparative investigation of the schematic representations of the expert and struggling novices. Although this was one of the initial goals of this research project, the lapsed time between surveying the students and the time spent learning the contents of an individual chapter probably confounded the results to some degree. Instructional exercises that are designed to encourage imaging and mental construction of the material should be developed and carefully researched. This seems to be an area of great potential for investigation and could provide valuable insights into better learning and instruction in the years to come.

APPENDIX A

STUDENT BASELINE INVENTORY SURVEY

Student Inventory Survey Name _____

1. Age

	M	F
2. Sex	[ ]	[ ]

	H/S	College	Graduate	Doct.
3. Education level of mother	[ ]	[ ]	[ ]	[ ]
Education level of father	[ ]	[ ]	[ ]	[ ]

4. On average, the number of hours spent reading assigned chapter for a class?

<1	2-3	3-5	>5
[ ]	[ ]	[ ]	[ ]

5. On average, the number of hours spent on homework?

<1	2-3	3-5	>5
[ ]	[ ]	[ ]	[ ]

6. What accounting classes have you taken prior to this class?

7. Have you ever worked in some accounting capacity? If so, explain.

8. How do you expect to do in this class and why?

9. What other courses are you taking this semester?

10. What other activities are you involved in this semester and # of hours it takes?

APPENDIX B

STUDENT LEARNING/STUDYING SURVEY

Student Name _____ Date _____

1. Approximately how many hours did you spend reading a chapter? _____ Doing the homework? _____ Studying for the exam?_____ Preparing your study sheet _____?

2. How did you study for this exam?

3. Describe how you approached reading a chapter? Did you utilize any of the following techniques:

* Outline the chapter
* Underline or highlight any of the chapter
* Summarize any material in your own words
* Use mnemonic techniques
* Formulate your own questions
* Take your own notes
* Breakdown chapter into units or concepts
* Use figural or graphic representations

4. Describe how you approached solving a difficult homework problem?

5. How did you decide what information should be included on your study sheet?

6. Did you do anything special or unique to learn the material for this test?

7. How did you learn the bank reconciliation material?

8. How did you learn the material on Accounts receivable?

9. What stands out in your mind about the chapter on inventory that helped you learn the material?

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VITA

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The final copies have been examined by the director of the dissertation and the signature which appears below verifies the fact that any necessary changes have been incorporated and that the dissertation is now given approval by the committee with reference to content and form.

The dissertation is, therefore, accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

4/5/97
Date

Ronald R. Morgan
Director's Signature