THE EFFECTS OF BELIEFS ABOUT KNOWLEDGE AND LEARNING ON STUDENTS' SELF-REGULATED STUDYING

by

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Abstract

This study investigated the relationship between students' beliefs about knowledge and learning, and operations they used to study a text. Specifically, it examined the relationships among students' beliefs about knowledge and learning, their selection of learning tactics, their metacognitive processes, and achievement. Moreover, this study assessed the hierarchical structure of beliefs by investigating students' beliefs about knowledge and learning and their effect on students' learning at two levels: the general and the contextual level.

Fifty undergraduate students enrolled in an introductory educational psychology course volunteered to participate in this study. Students completed the original and a contextualized version of the Epistemological Beliefs Inventory (EBI) to assess their general beliefs and their specific beliefs related to a particular area of inquiry (social psychology). Students' used gStudy, a software application that records traces of students' study tactics as they study, to study a chapter that represented different perspectives on the causes and prevention of aggression. Prior to the study session, students' verbal ability and prior knowledge about the chapter topic were tested. Following the study session, participants rated the chapter in terms of its interest, difficulty, and familiarity; and they responded to comprehension monitoring and comprehension monitoring standards surveys. Shortly after, participants wrote the knowledge test.

Comparisons between students' responses on the two forms of EBI supported the interpretation that students' beliefs are contextual. That is, students' hold epistemological beliefs about knowledge regarding a specific topic that differ from their general beliefs. Moreover, students' contextual beliefs were found to be more related to their learning than their general beliefs.

Results from multiple regression analyses and correlational analyses suggested interesting connections among the level of sophistication of beliefs about knowledge and learning, the use of generative and less-generative study tactics, high confidence about understanding of the study materials, the number and types of standards used in comprehension monitoring, and achievement on the knowledge test.

Dedication

بسم الله الرحمن الرحيم

In the Name of Allah, the most Gracious, the most Merciful. By the Grace of Allah, I have been blessed with this knowledge, education, and a supportive family.

To my parents, Raghada and Ali, may Allah reward you for all the support that you have given me. Mom you have been my guide throughout this wonderful experience and never doubted that I would complete my journey. Dad I have been so fortunate to have a father like you, who not only encourages me to pursue knowledge, but is the source of my inspiration and success. To my brothers and sisters, your constant care and words of encouragements have guided me all over this journey.

To my children, Leen and Laith, who accompanied me in achieving this goal. At times you have had to sacrifice your enjoyment for my busy schedule and for that I am forever grateful. I am very proud of what you have accomplished and who you have become. A mother could not wish for better kids.

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Chapter 1:
Introduction

It has been argued that every person attempts to self-regulate his or her own functioning in various ways to attain goals in life. What distinguishes productive and unproductive forms of self-regulation is the quality of one's self-regulatory processes (Winne, 1995, 1997). Various theoretical models have been proposed to integrate these processes with personal and environmental factors and to explain how these elements interact to shape how learners exercise control over their learning. There is agreement among these models that self-regulated learning (SRL) is the process whereby learners act as metacognitively and motivationally active participants in their learning (Zimmerman, 1989, 1998, 2000).

Theorists and researchers have used the self-regulation construct to explain how students study and why actively engaged students tend to learn more effectively than others (Butler & Winne, 1995; Pintrich, 1995; Winne & Hadwin, 1998; Winne & Jamieson, 2002). Self-regulation, theoretically, enhances or increases performance because it activates knowledge and tailors learners' strategies that enhance the efficiency of learning and may lead to higher academic achievements (Butler & Winne, 1995; Pintrich & de Groot, 1990). Another theoretical reason for why self-regulation enhances learning is that self-regulated learners are characterized as being metacognitively aware of what they know (Zimmerman, 1995). Research suggests that self-regulation develops slowly and that only adult students at the university level demonstrate substantial levels

of self-regulatory skills in learning and studying context (Nelson, Dunlosky, Graf, & Narens, 1994). However, age is not enough to be productively self regulating. While students have preferences for study tactics (studying styles) that they deploy in different learning tasks (Kardash & Howell, 2000; Nesbit, Winne, Hadwin, & Stockley, 1997; Winne & Jamieson-Noel, 2003), several studies have shown that university students are not models of regulatory competence (Pressley & Ghatala, 1990; Peverly, Brobst, Graham, & Shaw, 2003) and that college students are not very metacognitively competent (see studies reviewed by Lin & Zabrucky, 1998).

In recent years, the spectrum of causal determinants of components of self-regulated learning has been extended. This line of inquiry has led to studying how students' beliefs about knowledge and learning might help explain why some students are more likely than others to self-regulate learning effectively (Hofer & Pinitrich, 1997). Beliefs about knowledge and knowing (known as epistemological beliefs) and beliefs about learning are qualitative conceptions that represent personal theories about the nature of knowledge, the nature of knowing, and the process of learning (Neber & Schommer-Aikins, 2002).

The findings of several studies suggest that the epistemological beliefs of college students are significantly related to their engagement in self-regulated learning (Dahl, Bals & Turi, 2005; Paulsen & Feldman, 1999; Schommer, Crouse & Rhoads, 1992). However, there are several reasons to reassess this relationship.

First, little research has been done to examine the relationship between students' use of cognitive and metacognitive knowledge and strategies that reflect self-regulated learning and the multidimensional nature of beliefs about knowledge and learning (Neber

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& Schommer, 2002; Paulsen & Feldman, 1999). Among studies that addressed this gap, contradictory results emerge. Paulsen and Feldman's study showed that all eight skill components of self-regulated learning measured by the Motivation Strategy for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991) were statistically significantly related to at least one and up to as many as three of the dimensions of beliefs about knowledge and learning (structure, certainty, speed and control). On the other hand, Neber and Schommer's study showed no significant relationship between dimensions of students' beliefs (quick learning, certain knowledge, innate ability, and simple knowledge) and SRL strategies measured by the MSLQ. These contradictory results prompt reinvestigating this relationship in the current study.

Second, several studies investigated the relationship between SRL and students' beliefs (Neber & Schommer, 2002; Paulsen & Feldman, 1999); or, the relationship between students' beliefs and their cognitive processes, their use of learning tactics and strategies (Bendixen & Hartley, 2003; Cano, 2005; Dahl, Bals, & Turi, 2005; Schreiber & Shinn, 2003). All these studies used self-report measurements to characterize students' cognitive and metacognitive processes and strategies. A few other studies used other research methods to collect data, such as interviews and think aloud protocols (Hofer, 2004; Kardash & Howell, 2000). Although these methods provide invaluable information about learners' perceptions of learning, they can be unreliable indicators about how students employ study tactics. Recently, research has shown that students can be both biased and substantially inaccurate in self-reporting the learning tactics they use when compared with traces of their actual studying activities (Winne & Jamieson, 2002, 2003; Winne, Jamieson & Muis, 2002). A reasonable explanation for this inaccuracy is that

self-report measures and interviews require thinking about actions and thought processes in retrospect and are subject to memory decay and distortion. Think aloud protocols may also interfere with the process of engaging with materials. These conjectures recommend that research on SRL, and on learning tactics and strategies should use other types of measures, such as traces of students' actual learning activities in order to verify students' learning processes and tactics (Howard-Rose & Winne, 1993). Winne and Stockley (1998) suggested that researchers use software tools to monitor and record students' activities while studying. These tools can reliably assemble and coordinate enormous amounts of data that characterize students' studying and achievement. In the Learning Kit Project (Winne, Hadwin, Nesbit, Kumar, & Beaudoin, 2005) researchers have developed a new software application (named *gStudy*) that collect traces of students' learning activities as they learn from an electronic text. So far, no previous studies have examined the relationship between students' beliefs about knowledge and learning and aspects of their cognition using traces that verify students' use of learning tactics and strategies.

Third, studies that examined the relationship between these two constructs often have collected data about SRL and/or beliefs about knowledge and learning by administering questionnaires that do not reflect the context under investigation (Neber & Schommer, 2002; Paulsen & Feldman, 1999). Models of SRL predict that learners apply different tactics, use different resources, and seek different goals depending on the learning context (Hadwin, Winne, Stockley, Nesbit, & Woszczyna, 2001). Since SRL theoretically is situationally anchored, then motivational, cognitive and metacognitive variables of SRL should be studied in specific context.

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Fourth, a cognitive perspective that takes account of personal epistemology suggests some dimensions of epistemological thinking may be activated in all contexts but the individual's position on any one of these dimensions could vary as a function of situational and contextual features. Nonetheless, to explain the moderate consistency in students' beliefs across disciplines, a hierarchical multilevel structure of universal beliefs has been utilized. According to this structure, the more context-specific beliefs exist at the bottom, which are then organized into more discipline-related or school subject beliefs, followed by more general domains (academic, work, personal) and finally some superordinate higher level structure (Pintrich, 2002). Pintrich (2002) called for empirical testing of this hierarchical structure to better understand the applicability of the epistemological beliefs in learning contexts.

Fifth, in spite of the empirical evidence that supports the domain specificity of epistemological beliefs (Buehl, Alexander, & Murphy, 2002; Hofer, 2000; Mori, 1999), researchers continue using general forms of questionnaires to assess students' beliefs, whereas they interpret the relationship between these beliefs and students' learning in a specific context. These studies provide useful information and could be generalized at one level of these beliefs, the general level. However, the actual effect of the specific beliefs that might be activated in a learning context might be masked. My study is also a response to Pintrich's (2002) call to test the hierarchical structure of individuals' beliefs. That is, by using both a general and a contextual measure of beliefs, two expressions of students' beliefs were investigated, and their relationships with aspects of students' cognition and metacognition were tested.

Sixth, the field lacks a sophisticated theory that explains how these beliefs function (Hofer & Pintrich, 1997) to shape how people learn. The manner in which such beliefs develop and shape in learning context should be tested empirically to help move forward theory and practice in SRL field and the epistemological beliefs field.

This research investigates whether people have beliefs about knowledge, knowing, and learning related to a specific context that are different from their beliefs about knowledge and learning in general. Moreover, if people have both general beliefs and beliefs related to a specific context, which set of beliefs affects learning? Furthermore, what are the effects of beliefs about knowledge and learning on university students' learning in the context of studying a text? Specifically, this study examined the relationship between students' beliefs about knowledge and learning and their selection of learning tactics, their metacognition, and achievement.

The theoretical framework for this study is derived from and integrates research on epistemological beliefs and beliefs about learning, self-regulated learning, and the effect of study tactics and metacognition on learning from text.

1.1 Overview of the Chapters

This study advances theory about how beliefs about knowledge and learning affect students' learning in the context of studying. Moreover, this study establishes links between self-regulated learning and beliefs about knowledge and learning. This is the first study to use traces of students' actual study tactics to reflect SRL. Previous studies have used self-report measures to collect data about study activities, and measured students' beliefs out of context. Further, this study advances theory about the

contextualized character of beliefs and the hierarchical structure of students' beliefs about knowledge and learning.

Chapter 2: Theoretical Background. This chapter sets the stage for the current study by bringing together the theoretical accounts underlying the study questions and methodology. The first section presents definitions of beliefs about knowledge, knowing and learning. Next, Schommer's (1990) model is explained since it is adopted in the current study. Two debatable issues in this field are highlighted: including the learning beliefs in epistemological beliefs studies, and the specificity and generality of these beliefs. It was imperative to comment on these issues to justify the assumptions and the methodology of the current study. Following that, theoretical models that explain how students' beliefs affect students' learning (Hofer & Pintrich, 1997; Winne & Hadwin, 1998) are presented. Theories that link learning tactics to cognitive processes are clarified. The effects of learning tactics and metacognition on students' learning are explained. This theoretical background sets the stage to test that the effects of beliefs are mediated through cognitive and metacognitive operations.

Chapter 3: Literature Review. This chapter reviews the 25 relevant empirical studies that linked students' beliefs about knowledge and learning with academic performance. Studies are organized under the assumptions tested in these studies, which are, students' beliefs about knowledge and learning affect: (a) their general academic achievement; (b) what they learn from text; (c) how they learn (their use of cognitive and learning strategies); (d) their metacognitive processes and strategies, and (e) their SRL strategies. After each section a summary and a critique is provided. Chapter 3 concludes with a statement of research questions and hypotheses.

Chapter 4: Methodology. This chapter describes the sample, the materials and questionnaires used, and procedures by which data were collected and coded.

Chapter 5: Results. This chapter presents the statistical methods and results of the current study. Results are presented in two main sections according to the research questions: Are students' general beliefs about knowledge and learning different from their beliefs about knowledge and learning in a specific context? Are there relationships among students' epistemological beliefs, their use of learning tactics, the type and number of standards they use to monitor their understanding, their confidence about their understanding, and their achievement?

Chapter 6: Discussion and Conclusion. This chapter presents a discussion of the results in the light of the theoretical accounts and in comparison with relevant previous research. The chapter concludes with some directions for future research.

Chapter 2:
Theoretical Background

2.1 Epistemological Beliefs and Beliefs about Learning

As people who learn new things everyday, we develop beliefs about what knowledge, knowing, and learning are. Our beliefs about the nature of knowledge relate to the structure and certainty of the knowledge (e.g., the belief that knowledge consists of simple isolated facts). Our beliefs about the nature of knowing relate to the source of knowledge and justification of knowing (e.g., the belief that knowledge can be constructed by interacting with the environment). Our beliefs about learning relate to the learning process (e.g., learning takes time and effort).

Historically, beliefs about the nature of knowledge and knowing—known as personal epistemology—have been the interest of philosophers who tried to answer questions about the nature, the limits, and sources of human knowledge. Over the past decade, the topic of personal epistemology also has been of particular interest among educational psychologists (Hofer & Pintrich, 1997; Pintrich, 2002; Schommer, 1994; Schraw, 2001; Schraw & Sinatra, 2004).

In addition to investigating the same philosophical questions, educational psychologists usually aim at investigating one or both of the following questions: How do students progress through levels of sophistication concerning these beliefs (e.g., Boxter Maglda, 1992; Kitchener & King, 1981)? How do these beliefs facilitate or constrain students' understanding, reasoning, thinking, learning and achievement (e.g., Schommer, 1990)? Within both areas of research, divergent definitions, labels, theoretical models,

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and methodologies have been used to explore these questions (Hofer & Pintrich, 1997). Examples of different labels used for this construct are: epistemological reflection (Baxter Magolda, 2004), epistemological theories (Hofer & Pintrich, 1997), reflective judgment (King & Kitchener, 1994), epistemological resources (Hammer & Elby, 2002), and epistemological beliefs (Schommer, 1990). Moreover, scholars have developed various theoretical models that range from proposing one general dimension of epistemological thinking that changes over time in a stage-like manner (known as developmental models; e.g., Kuhn, 1991), or models that propose a small number of dimensions (known as cognitive models; e.g., Schommer, 1990). Among these models, there is some agreement about two general areas that represent the core structure of personal epistemology: the nature of knowledge and the process of knowing (Hofer & Pintrich, 1997). Nevertheless, some models consider other dimensions as important components of personal epistemology, such as Schommer's (1990) model. This causes discrepancy in the nature and number of the dimensions among different models, and creates further debate in the field. Moreover, despite the growing interest in this field, the importance of the specificity or generality of these beliefs is still undecided (Schraw, 2001).

In the following sections, the debatable issues of including learning beliefs in epistemological beliefs studies, and the specificity and generality of these beliefs are summarized. Before presenting these debates, Schommer's (1990) model is explained for the following reasons: the model integrates beliefs about learning in addition to epistemological beliefs, the model and the measure, Schommer Epistemological Beliefs Questionnaire (SEQ; Schommer, 1990), have been used extensively to test the

relationship between students' beliefs and learning, and the model is used as a framework for the current study.

2.1.1 Schommer's Epistemological Beliefs Model

Marlene Schommer was interested in linking epistemological beliefs to aspects of learning. She noticed that most of the early epistemological beliefs researchers (e.g., Kintchener & King, 1981; Ryan, 1984) restricted their conception of epistemological beliefs to the more traditional philosophical notion, and that all previous models represented personal epistemology as a unidimensional construct. Schommer (1990) claimed that this limited conception of personal epistemology caused inconsistent results when these researchers examined the relationship between personal epistemology and students' learning. In response, Schommer (1990) contended that in order to capture the full complexity of personal epistemology, it should be reconceptualized as a multidimensional construct. According to Schommer, epistemological beliefs are systems of more or less independent beliefs about the nature of knowledge, knowing and learning. What is meant by *system* is that there are multiple beliefs to be considered, while *more or less independent* implies that a person could be at different levels of sophistication on each of these dimensions. Schommer proposed five dimensions of beliefs. Two dimensions are about the nature of knowledge: (a) beliefs related to the structure of knowledge, extending from knowledge is simple and organized as isolated facts to knowledge is complex and organized as interrelated concepts; (b) beliefs related to certainty of knowledge, extending from knowledge is absolute or certain to knowledge is tentative and evolving. The third dimension is about the process of knowing and is related to the source of knowledge (i.e., how people come to know something). This

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dimension extends from the belief that knowledge comes from authority to the belief that

knowledge is the product of reason. Schommer supplemented her model with two other

dimensions related to the nature of learning. The first of these two dimensions is based on

the speed of learning, extending from learning takes place quickly or not at all, to

learning takes place gradually. The other dimension is based on students' control over

their learning, extending from the ability to learn is fixed or uncontrollable and cannot be

changed, to the ability to learn can be improved and therefore controlled over time. With

this conception, Schommer (2002, 2004) argued that epistemological beliefs can be

studied individually or in various combinations with an underlying assumption that

individual beliefs, as well as unique combinations of beliefs, may have different effects

on learning.

2.1.1.1 The Integration of Beliefs about Learning in Schommer's Model

Schommer (2002) explained that the rationale to include beliefs about learning in

her model was to make a link between *believing* and *learning*. Therefore, if researchers

are attempting to look at a bigger picture, they need to include beliefs about learning

because these beliefs are related to how knowledge is acquired. Schommer (2004) stated

that additional belief dimensions (i.e., speed of learning and control of learning) have

been found to be related to numerous aspects of learning, such as persistence in the face

of a difficult task, planned thinking time, and valuing of education. Moreover, the

network of human beliefs consists of multiple types of beliefs, so logically these two

types of beliefs are probably related or even intertwined. In her synthesis of research on

epistemological beliefs, Schommer (1994) gave an example to illustrate this relation:

students' belief about their role in learning (active learners or passive listeners) is a

reflection of two epistemological beliefs, the beliefs that knowledge is absolute and that authority has the knowledge.

On the other side of the debate, Hofer and Pintrich (1997) argue that for conceptual clarity, the content of the construct of epistemological beliefs should be limited to students' beliefs about the nature of knowledge and the process of knowing. They insist that having these boundaries around the construct will provide clarity and progress to the research and theorizing in the field. For Pintrich (2002), the empirical evidence does not support using these beliefs as part of personal epistemology because the empirical support is constrained by the theoretical assumption of the model. In other words, when researchers start with an assumption of the existence of other dimensions (e.g., beliefs about learning) within a construct, they create questionnaires with items that assess these dimensions. If the factor analysis confirmed that there are different dimensions (beliefs about knowledge, knowing, and learning) then the results might support that all these beliefs affect students' learning, but do not confirm that beliefs about learning are components of this construct.

From the above debate it appears that although some researchers oppose adding beliefs about learning to the personal epistemology construct, they acknowledge the importance of beliefs about learning on students' learning (Hofer, 2001; Hofer & Pintrich, 1997; Pintrich, 2002). Their main concern was about the conceptual clarity of personal epistemology as a construct. Although I agree with these researchers about the appropriateness of a universal definition for this construct (e.g., Hofer & Bintrich, 1997) I also agree with researchers who consider human beliefs as one system that includes many types of beliefs (e.g., Schommer, 2004). These beliefs interrelate, affect each other, and

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work either individually or in groups to affect students' learning. Therefore, researchers should continue investigating different beliefs that might affect students' learning in order to develop better understanding of the complex learning processes.

Following this line of reasoning, this study adopts Schommer's model, however, specific labels are given to different types of beliefs, that is: beliefs about knowledge and beliefs about learning.

Another debate in the field that motivates the current study is presented in the next section.

2.1.2   Specificity/Generality of Beliefs and a Hierarchical Structure Solution

One characteristic of personal epistemology that remains elusive is the specificity or generality of beliefs about knowledge and knowing (Hofer, 2000). That is, do people have general epistemological beliefs that provide a guiding framework that affects their performance across a variety of problems, contents, domains or contexts? Or do they have specific beliefs related to different contents, domains, and contexts?

Early work in this field was influenced by Piagetian developmental theory. Piaget's work on cognitive development was guided by one common conception, that the problem of knowledge (the epistemological problem) cannot be considered separately from the development of intelligence (Hofer, 2000). Therefore, he considered the development of intelligence as one aspect of biological growth, and explained performance differences across domains as a result of a lag in operations or processes across tasks or domains (Hofer, 2000). Accordingly, many of the personal epistemology models maintain the assumption that beliefs and thinking are general and transcend

domain boundaries. As this area of research has matured, this assumption has been questioned (Hofer & Pintrich, 1997).

Sternberg (1989) argued that the issue of domain specificity versus domain generality in cognition must be a false dichotomy. Further, he suggested that development has elements that are both domain general and domain specific. Adopting this line of reasoning, Hofer and Pintrich (1997) suggested that it is possible for both general beliefs about knowledge and specific beliefs about domains to exist in an interconnected network of ideas. Correspondingly, Buehl and Alexander (2001) argued that if knowledge might be multifaceted (i.e., has different forms and different levels) then students' epistemological beliefs may be likewise. That is, if students' can retain varied forms of knowledge in their memories, then it is plausible that the beliefs they hold about knowledge can be similarly varied. For example, although students may believe that knowledge is uncertain in general, they may also consider schooled knowledge rather certain. Likewise, Pintrich (2002) argued it may be that there is some hierarchical or multilevel structure of beliefs, with more contextual beliefs at the bottom (e.g., beliefs related to school subjects), followed by more general domain beliefs (e.g., mathematics as an academic domain), and finally at the top of the hierarchy some abstract higher level beliefs (e.g., the certainty of knowledge in general). Pintrich explained further that cognitive models of personal epistemology consist of a specific number of dimensions of epistemological thinking that are activated in all contexts, but the individual's position on any of these dimensions could vary as a function of situational and contextual features. Therefore, the same student might think differently about the certainty of knowledge in a natural science context in contrast to a social

science context (Pintrich, 2002). Relative to these theoretical assumptions, empirical studies were invited to explore the multifaceted nature (Buehl & Alexander, 2001), the network structure of beliefs (Hofer & Pintrich, 1997), or the hierarchical structure of beliefs (Pintrich, 2002). Interested in a rather specific level of beliefs, Hofer (2000) invited more work to address the contextuality of beliefs about the degree to which learners make epistemic judgments appropriate to a specific context (e.g., the certainty of particular information, or the credibility of the source), and how such judgments differ depending on the context.

In their review of measures of epistemological beliefs, Buehl and Alexander (2001) noted that current measurements are designed specifically to assess general beliefs about knowledge and knowing (e.g., EBI, SEQ). These measures may not be sensitive to make claims about differences in individual's beliefs across domains and contexts (Buehl & Alexander, 2001; Hofer, 2000), or about the relationship between these beliefs and other constructs. Hofer (2000) argued that most studies that tested the domain generality or specificity of these beliefs either used these general forms of epistemological assessment, or used inadequate methods to refer to the context or domain under investigation. Consequently, several reviews of epistemological beliefs studies reveal either partial support or contradictory results related to this issue (Buehl, Alexander & Murphy, 2002; Hofer, 2000; Schommer & Walker, 1995).

This study responds to Hofer's (2000) call by testing the contextuality of students' beliefs and to Pintrich's (2002) call by testing the applicability of students' beliefs at two levels of the beliefs hierarchy (general and contextual level). The original EBI (a general measure of beliefs) and a contextualized version of this inventory (in which statements

were altered to address knowledge related to the topic under investigation) were used. Specifically, the degree of similarity between students' responses to the original EBI and to the contextualized form of EBI was tested. Also, the predictive power of beliefs about knowledge and learning was examined to investigate which form of beliefs, general or contextual, more closely related to learning.

2.2 The Effect of Students' Beliefs on their Learning: Theoretical Account

The field lacks a comprehensive theory that explains how and why beliefs about knowledge and learning can affect cognition, motivation, and learning (Hofer & Pintrich, 1997). However, there are several attempts to explain how these beliefs function in a theory-like form.

2.2.1 Hofer and Pintrich's Model

Hofer and Pintrich (1997) suggested that epistemological beliefs might function as implicit theories that can bring about certain types of goals for learning. These goals then function and affect self-regulatory cognition and behavior (including the use of learning and metacognitive strategies) which consequently influence achievement. In other words, the effects of personal epistemologies on students' learning and achievement are mediated by goals and self-regulatory strategies.

According to this theory there is a causal relationship between personal epistemology and students' learning, and this relationship is at the same time recursive, with academic success and learning outcomes feeding back into students' beliefs about knowledge and knowing (Pintrich, 2002). In other words, students with more

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sophisticated epistemological beliefs often achieve at higher levels, and the more advanced level of achievement may bring about a more advanced view of knowledge and learning.

Recently, Hofer (2004) elaborated the previous model by proposing more details about the mechanism of mediation, specifically through self-regulatory strategies. Building on the work of Kitchener (1983) and Kuhn (1999), she reconceptualized personal epistemology by expanding metacognition to encompass epistemic cognition. Specifically, she situates beliefs about the certainty and simplicity of knowledge within metacognitive knowledge, and the source of knowledge and justification for knowing within metacognitive monitoring and judgments.

In the light of the previous models, beliefs about knowledge and learning affect students' learning through their effect on metacognitive monitoring and metacognitive control, the key components of SRL. This new conceptualization suggests investigating how beliefs about knowledge and learning function within models of SRL. Winne and Hadwin's (1998) self-regulated studying is one SRL model that incorporates epistemological beliefs. In the following section I explain their model and show how these beliefs theoretically affect how students' study.

2.2.2   Winne and Hadwin's Self-Regulated Studying Model

Winne and Hadwin's (1998) self-regulated studying model describes studying as a " metacognitively powered self-regulated learning" that spans four linked and weakly sequenced stages: defining the task, goal setting and planning, enacting study tactics and strategies, and metacognitively adapting studying for the future. In the stage of defining

the task, learners' perceptions about a learning task are influenced by factors (Conditions) related to the learning task and environment (e.g., resources, time, social context, instructional cues) and cognitive and affective factors (e.g., beliefs, dispositions, styles and motivational factors, knowledge of study tactics and study). Based on the learners' perception of the task, learners start planning and setting goals to approach the task. Learners then engage in activities (Operations) that create information (Products) that can be monitored in relation to standards. At each stage, students generate internal feedback and may be provided with external feedback (Evaluation). This updates their understanding of a task, plans they create, the study tactics they enact, and may invite adaptations of their perception of the task and studying. In this model, several decisions, such as allocating more time for studying, exerting more effort, deploying or altering specific study tactics, are made as a result of metacognitive monitoring in which specific standards are used. In this model, the standards used in the monitoring process are also defined by the task conditions.

According to this model, beliefs are one of the factors that influence learners' perception of the learning task. Consequently, this perception affects learners' planning and goal setting, and their enacting specific tactics and strategies to perform the task. When learners monitor their understanding and evaluate their progress, these beliefs might work alone or with other factors to create standards to evaluate their understanding of the materials. Based on this evaluation, learners take critical decisions like terminating study, changing the learning tactic or strategy, and allocating more time to the task. For example, if a student has naive beliefs about learning and knowledge (e.g., every thing to be learned should be learned quickly, and that knowledge consists of discrete unrelated

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facts), and is told to study a text, naïve beliefs might lead to setting a specific goal (e.g., memorize the written facts) and selecting a specific tactic (e.g., repeat the written facts as in rote rehearsal). Such a student might stop studying before acquiring sufficient knowledge because her naïve beliefs might serve as a standard for monitoring learning.

In sum, according to the previous theoretical accounts, students' level of epistemological sophistication influences study activities—for example, the use of study tactics that support deep processing of the study materials—as well as metacognitive processes. In other words, students' beliefs about knowledge and learning influence what and how students learn.

Recently, Pintrich (2002) called for more empirical studies to investigate how epistemological beliefs are related to facets of self-regulated learning. Specifically, he argued that to improve understanding of how beliefs are related to learning, studies should use more dynamic process-oriented research designs, and that this relationship should be examined in the context of actual learning.

This study responds to Pintrich's (2002) call for studies that link epistemological beliefs to aspects of SRL models. The primary objective of the current study is to investigate the influence of students' beliefs about knowledge and learning on self-regulated-studying and achievement. Specifically, I test if students' beliefs affect their selection of study tactics and whether their judgments of learning at the end of the study session are related to their beliefs about knowledge, knowing and learning? Also, I examine whether standards students reported using to evaluate their understanding were related to their beliefs.

In the following section, I explain how different study tactics, theoretically, affect the quality of learning outcomes.

2.3   Study Tactics and the Quality of Learning

Study tactics are activities carried out by learners during the learning process to construct knowledge. The basis for a theory of study tactics comes from the information-processing approach to human learning. According to this approach, learning occurs as a result of three cognitive processes namely, selecting relevant information, organizing the incoming information, and integrating incoming information with existing relevant knowledge (Mayer, 2003). This approach suggests four possible learning outcomes. First, if the learner fails to select relevant information, no learning will occur. Consequently, the student will perform poorly on retention tests, which cover the material, and on transfer tests, which require applying the material in new situations. Second, if the learner pays attention to the material but does not work on organizing it, then nonmeaningful learning will occur. In this case, the student would be expected to perform well on the retention test but poorly on a transfer test. Third, partially meaningful learning occurs when the learner selects and organizes relevant information but fails to integrate it with existing knowledge. This learner would perform well on retention and on certain types of transfer tests called near transfer. Fourth, when all three learning processes are engaged, the learner builds a meaningful learning outcome that supports good retention and full transfer performance (Mayer, 2003).

Vermunt (1998) differentiated between two types of learning strategies: deep and surface. Deep strategies include active transformation of knowledge for better understanding of the meaning of the text. Students using the deep strategies put in longer

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study hours, and make detailed notes from the text. Surface learning strategies, on the other hand, include reproduction of knowledge as presented in the text. Students using the surface strategies are interested in memorizing facts and disjointed pieces of data.

The notion of generative processing of information is closely related to the above mentioned transformation of knowledge. Generative processing involves generation of relations to connect background knowledge with new text information or to restructure an idea to accommodate the learning demands. Generative processing theoretically produces higher quality learning outcomes than less generative forms of processing (Biggs, 1996; Greene & Ackerman, 1995).

All these theoretical accounts share the view that study tactics and strategies guide the learner's cognitive processes during learning and that, in general, more effortful processing is related to better performance. Following this reasoning, study tactics can be categorized in terms of the cognitive processes they affect. Underlining and verbatim copying of selected words are study tactics aimed at the selection of relevant information. These types of tactics are most likely to guide the learner's attention toward the proportion of the text that is copied. Also, these tactics are considered surface tactics that are a less-generative form of processing. Summarization, paraphrasing and elaborating (i.e., writing a description in one's own words of how the idea relates to something else), on the other hand, involve selecting relevant information and then organizing the ideas to create a condensed statement that represents the meaning of the text. These tactics are considered deep tactics that correspond to generative processing of the material.

The above reasoning proposes that, when learners use deep tactics (summarizing, paraphrasing, and elaborating), the quality of learning is better than when they use

surface tactics (highlighting, verbatim note taking). Therefore, learners who use deep

tactics are expected to do better on a knowledge test, than those who use surface tactics.

In the current study, I used a software application called *gStudy* to collect data

about how students studied a text. Specifically, this software records traces of learning

tactics that students used as they study. "Traces are observable indicators about cognition

that students create as they engage with a task" (Winne & Perry, 2000, p. 551).

According to Winne and Perry, to make inferences about standards used in

"metacognitive monitoring and cognitive operations applied in exercising metacognitive

control operations, traces must be coupled with a model of cognition" (p. 552). In this

section, study tactics are linked to a model of cognition (as suggested by Winne & Perry,

2000), that sets the stage to test the effect of beliefs about knowledge and learning on

learning and performance. Moreover, it is now plausible to test that this relationship is

mediated by cognitive and metacognitive operations. I hypothesize that if students'

beliefs serve as standards during metacognitive monitoring, then using deep study tactics

is related to more sophisticated beliefs about knowledge and learning. In addition, I

hypothesize that students' use of deep study tactics is related to better achievement on the

knowledge test.

2.4   Metacognition and the Quality of Learning

Metacognition refers to knowledge about one's thinking process, or the awareness

of one's cognitive processes and how they work (Flavell, 1979). This knowledge is used

to monitor and control cognitive processes.

Comprehension monitoring, the process of evaluating and identifying

comprehension problems (Otero, 1992), has been conceptualized in several ways. One

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line of inquiry is based on calibration. Calibration is the ability to assign correct

probabilities to judgments of learning. It consists of measuring the relation between

learners' prediction of understanding text and their actual performance, as measured by

questions on the main points of the text (Glenberg & Epstein, 1985; 1989). Measures of

under- and overconfidence are commonly used to evaluate calibration (Bjorkman, 1992).

Overconfidence ratings are differences that result when people assess confidence in their

knowledge to be greater than what their knowledge actually is. Confidence in knowledge,

might affect how learners regulate learning (Stone, 2000). Models of SRL predict that

learners with better calibration should be better at learning (Winne & Jamieson-Noel,

2002). In other words, the accuracy of monitoring information processes is critical for

students' learning because learners take significant decisions based on these judgments. If

a learner has high confidence about mastery of the material, she might make a wrong

decision, such as terminating studying before actually understanding the material. On the

other hand, if a learner has low confidence about her mastering the material she might

continue studying. High confidence is used in the current study as an indication of

students' lack of metacognitive ability, which might deleteriously affect their learning.

Ryan (1984) noticed that research on the comprehension monitoring process has

overlooked the nature of comprehension standards embodied in the monitoring process or

the role these standards play in academic performance. Ryan hypothesized these

standards reflect the learner's conception of the desired learning outcomes. This

conception, in turn, reflects the learner's beliefs about knowledge and learning. Ryan

used Perry's (1970) framework of epistemological beliefs to explain this relationship. In

this developmental model, the conception of knowledge is developed from viewing

knowledge as an unorganized set of discrete and absolute truths (dualistic orientation) to

a more mature conception of knowledge as an array of interrelated propositions

(relativistic orientation). Given that dualists conceive of knowledge as a set of discrete

truths, they ought to assess reading comprehension in terms of the number of propositions

that can be retrieved from memory. On the other hand, given that relativists conceive of

knowledge as the framework within which particular facts are interpreted, they ought to

assess reading comprehension in terms of the degree to which coherent relationships can

be established among the propositions in a text. Further, Ryan suggested that the nature

of these standards should influence performance indirectly by controlling the level at

which the text information is processed. For example, if reciting the important

information in the text is used as a standard for learning, it will orient the learner towards

selecting the important information and simply rehearsing it. In other words, such

standards would encourage less generative tactics for learning which reflect surface

levels of text processing. On the other hand, if the ability to construct meaning by

connecting facts in the text is used as a standard for learning, it will orient the learner

toward organizing and integrating facts in the text. In other words, such standards would

encourage generative tactics for learning which reflect deep levels of text processing.

Moreover, Ryan (1984) hypothesized that comprehension monitoring that

involves a wide range of criteria should be associated with better memory for and

understanding of the text than monitoring that uses fewer criteria. This effect on learning

could be explained as the learner attending to various aspects of the text to satisfy

multiple criteria. Although Ryan found support for all the above hypotheses, the

framework he used restricted his results. In the current study, the same line of reasoning

is followed and the same hypotheses are tested. However, Schommer's (1990) model, which incorporates a wider range of belief dimensions, is used to test the above hypotheses. Moreover, the hypothesis that using a specific type of standard would encourage different levels (i.e., deep or surface) of text processing is tested through actual traces of students' learning tactics.

In the next chapter, studies that examined the relationship between students' beliefs about knowledge and learning, and their academic performance are reviewed.

Chapter 3:
Literature Review

Since the early 1980s, educational psychology researchers have investigated the

relationship between students' beliefs about the nature of knowledge and learning, and

students' academic performance. This review includes 25 empirical studies that were

published in peer-reviewed journals and had students from all academic levels as

participants. All the reviewed studies used a general cognitive approach to

epistemological thinking that allows for the possibility of multiple dimensions or

components that are somewhat independent of each other (Pintrich, 2002). This approach

also allows more quantitative methodologies and makes use of questionnaires to

investigate the relationship between students' beliefs and different aspects of their

academic performance. Specifically, the reviewed studies conceptualized students'

beliefs about knowledge and learning as a complex system that consists of multiple

independent dimensions or theories, each of which has a unique effect on students'

learning. One exception to these criteria, Ryan's (1984) study that conceptualized

students' beliefs as a unidimensional construct, is included in the review given that

Ryan's study is considered the cornerstone for linking students' beliefs to their academic

performance and because the current study methodology models some aspects of that

study.

Studies were selected if they examined the relationship between students' beliefs,

and general academic achievement or any aspect of students' cognition and

metacognition (either as a main focus or as a secondary focus of the study). This review

includes studies that investigated students' beliefs about knowledge and knowing

(epistemological beliefs) only, or studies that incorporated beliefs about learning.

Detailed description about the context of the study, the measurement tools and the

statistical results are provided to offer a clearer view how relationships between students'

beliefs and learning have been investigated.

3.1   An Overview of the Organization of the Literature Review

What students think knowledge is and how they think learning occurs have

become critical components in understanding students' learning. Researchers who sought

to uncover a link between students' beliefs and their learning were interested in how

student' beliefs about knowledge and learning are part of the process of learning, and

how these beliefs affect or mediate processes of knowledge acquisition and knowledge

construction. The reviewed studies tested at least one of the following assumptions,

students' beliefs about knowledge and learning either enhance or constrain: (a) their

general academic achievement, (b) what they learn from a text (their comprehension and

knowledge acquisition), (c) how they learn (their use of cognitive and metacognitive

processes and strategies), or (d) students' use of SRL strategies. Studies in this review are

organized into sections according to the main assumption of the study. Some of the

reviewed studies that tested more than one assumption are mentioned briefly under the

other sections.

3.1.1   Students' Beliefs about Knowledge and Learning Affect Academic
Achievement

Studies reviewed in this section investigated the relationship between students'

beliefs about knowledge and learning and either (a) general academic achievement

measured by students' grade point average (GPA) or (b) grades in an academic course or subject. In these studies, researchers did not set students a specific learning task and assess students' performance on that task.

Ryan (1984) used Perry's model and seven items from Perry's original 46 item instrument to classify 85 undergraduate students into either dualists or relativists. According to this model, dualists are students who view knowledge as either right or wrong, and as an unorganized set of discrete and absolute truths accessible only to authorities. On the other hand, relativists are students who view knowledge as integrated and uncertain array of propositions evaluated on a personal basis by using the best available evidence. Ryan (1984) assessed students' performance in a semester long psychology class to connect students' beliefs to their academic achievement. Epistemological beliefs correlated with students' course grades even after the effect of academic aptitude (SAT scores) or amount of college experience was eliminated statistically, $r=-.27$, $p=.01$. That is, dualists were more likely than other students to achieve less in the psychology class. (The relationship between students' beliefs' and their metacomprehension also was investigated in this study and is presented in the metacognition section.)

In a cross-sectional design study, Schommer (1993) investigated the development of 863 secondary students' beliefs about knowledge and learning, and the relation of these beliefs to overall academic achievement. Schommer administered a modified version of the Schommer Epistemological Questionnaire (SEQ: Schommer, 1990) to high school students. (Details about her original SEQ are presented in the next section.) The SEQ was used to assess students' beliefs on four dimensions: certain knowledge, simple

knowledge, quick learning, and innate ability. Students' GPAs were used as an indication

of academic achievement. Schommer regressed students' GPAs on the four dimensions

of beliefs. Results showed that all the dimensions of beliefs were significant predictors of

students' overall achievement. Specifically, higher GPAs were correlated with weaker

beliefs in quick learning (r=-.26), simple knowledge (r=-.20), certain knowledge (r=-.12),

and fixed ability (r=-.15). In the same study Schommer tested whether epistemological

beliefs predict GPA after general intelligence scores (measured by Cognitive Ability

Test) were taken into account. Another regression was performed using data for 205

students. Results showed that only verbal IQ and Quick learning were statistically

significant predictors of students' achievement. That is, students with higher intelligence

(r=.50, R=.5, R^2 change=.25) and less inclination to believe in quick learning (r=.29,

R=.56, R^2 change =.06) were more likely to have higher GPAs. Based on these results

Schommer offered a conservative interpretation to the effect that at least one beliefs

dimension (quick learning) predicts students' achievement.

In a longitudinal study, Schommer, Calvert, Gariglietti, and Bajaj (1997) selected

a sample of 69 high school students who completed the SEQ in 1992 and again in 1995 to

examine development in epistemological beliefs and links between these beliefs and

academic performance. Three regression analyses were performed to determine whether

epistemological beliefs predict academic performance measured by GPAs obtained from

1992 and 1995. Results showed that only beliefs in quick learning was a statistically

significant predictor of students' general achievement. That is, students' beliefs in quick

learning in 1992 predicted their GPA in 1992, B=-.45, p<.05. Students' belief in quick

learning in 1995 predicted their 1995 GP, B=-.49, p<.001. These results suggest that the

less students believed in quick learning, the better GPAs they earned. Interestingly, none of the other dimensions in both years predicted GPA significantly and none of the 1992 beliefs predicted GPAs in 1995.

In another study, Schommer and Dunnel (1997) investigated 69 gifted high school students' beliefs about the nature of knowledge and learning, and how these beliefs are related to their general academic achievement and their problem solving ability. SEQ was used to measure students' beliefs on four beliefs dimensions: certain knowledge, simple knowledge, quick learning, and innate ability. Students were grouped as meeting their academic potential according to their GPA (0 if GPA<3, and 1 if GPA ≥3). Four analyses of variance were conducted to determine the relationship between students' beliefs (the four dimensions) and their general academic achievement. Differences between the two groups were found significant only for the belief in fixed ability. That is, students reaching their academic potential were more likely to believe the ability to learn can improve compared to students who did not reach their potential.

In a study investigating middle school students' beliefs, Schommer, Brookhart, and Hutter (2000) tested the relationship between students' beliefs and their achievement measured by GPA. Three hundred sixty students responded to a 30-item epistemological beliefs questionnaire developed to assess their beliefs about three dimensions: stability of knowledge, speed of knowledge, and ability to learn. Students' GPAs were regressed on epistemological beliefs scores to test the predictive values of epistemological beliefs. Stepwise regression showed that beliefs in fixed ability and beliefs in quick learning were statistically significant predictors of achievement (B=-.24, B=-.18, respectively). That is,

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the less students believed in fixed ability to learn and quick learning the better GPAs they earned.

Paulsen and Wells (1998) conducted a study to examine differences in epistemological beliefs among undergraduate students across major fields of study classified by Biglan's taxonomy. The major fields of study of 290 students were classified according to Biglan's taxonomy into two dimensions: hard-soft (the degree of paradigmatic development of a field) and pure-applied (the degree to which a field emphasizes applications to practical problems). Students from six fields of studies completed the SEQ to assess their beliefs on the four-dimensions of Schommer's model. Analyses of variance were used to examine whether students' epistemological beliefs varied systematically across their domains of studies. Students majoring in pure fields of study (humanities, social sciences, natural sciences) were significantly less likely than students majoring in applied (education, business, and engineering) fields of study to hold naïve beliefs about simple knowledge, quick learning, and certain knowledge. Students majoring in both applied and hard fields of study (e.g., engineering) were statistically significantly more likely than those majoring in both pure and soft fields (humanities and social sciences) to hold naïve beliefs about certain knowledge. Regression analyses confirmed the above results when students' background factors including GPA were controlled for in the equation. Regression results also indicated that students with higher GPAs were less likely than those with lower GPAs to believe in simple knowledge ($B=$-.15, p=.05).

Hofer (2000) examined the dimensionality and the disciplinary variations of epistemological beliefs. The Discipline-Focused Epistemological Beliefs Questionnaire

(DEBQ) was developed to assess students' beliefs about the nature of knowledge, as reflected by the certainty and simplicity of knowledge; and the nature of knowing, as reflected by the source of knowledge and the justification of knowing. In each of the 27 items of the DEBQ, a reference was made to the target subject matter. Students completed the DEBQ twice, once for psychology and once for science, and responded to the SEQ. Hofer examined the relationship between (326) students' beliefs, and their GPAs, and psychology and science course grades. A series of dependent t-tests revealed statistically significant differences in students' beliefs about psychology and science. That is, students considered science knowledge to be more certain, unchanging, attainable and less justified by personal experience than knowledge in psychology. In addition, for science, authority was viewed as the source of knowledge more than for psychology. Results showed that the simplicity/certainty of knowledge beliefs in psychology were statistically significantly correlated to students' GPAs (r=-.22) and to psychology grade (r=-.31). Further, the certainty/simplicity of knowledge beliefs in science were statistically significantly correlated with students' GPAs (r=-.12), and with psychology grades (r=-.18). Students' general beliefs (i.e., measured by SEQ) were statistically significantly correlated with students' GPAs(r=-.28), and their grades on both psychology(r= -.31) and science(r=-.17). In the light of these results, Hofer argued for the existence of discipline-specific epistemological beliefs. However, the statistically significant correlations between the corresponding dimensions across domains and with SEQ indicated that there might be both a domain-specific and a domain general aspect of epistemological beliefs.

Mori (1999) examined students' beliefs about knowledge and learning in general, their beliefs specific to language learning, the relationship between these two beliefs and the relationship between the two types of belief and students' achievement. One hundred eighty seven university students enrolled in a course in Japanese completed a 40-item epistemological belief questionnaire that was designed to assess students' beliefs on five dimensions: fixed ability, simple knowledge, quick learning, certain knowledge, and omniscient authority. Students also responded to an 82-item questionnaire to assess students' beliefs about Japanese language learning in seventeen hypothesized beliefs dimensions including the same five dimensions used to assess the students' general beliefs. The GPA's for 92 students and their achievement in Japanese (daily quizzes, achievement exam, proficiency test, and course achievement) were used to examine the relationship between students' beliefs and their achievement. The factor analysis of the general epistemological beliefs questionnaire revealed five reliable factors similar to the ones proposed. On the other hand, the factor analysis of the language beliefs questionnaire showed six reliable factors after minimizing the number of items to 42. These dimensions were labelled as, analytical approach of learning, risk taking, ambiguity avoidance, reliance on first language, Japanese is easy, and kanji (a system of Japanese writing) is difficult. Pearson correlations results showed that the five general epistemological beliefs and the six beliefs related to learning Japanese were for the most part uncorrelated. This suggested that language learners' general epistemological beliefs and their specific beliefs about language learning could be generally characterized as independent constructs. However, two relatively high correlations were found between similar general and domain specific dimensions: simple knowledge and avoid ambiguity

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r=.45; and quick learning and risk taking r=-.45. This suggests some aspects of general beliefs might be transferred into or exhibited in specific domain beliefs. Correlations between students' scores on beliefs dimensions and their achievement measures showed statistically significant correlations between innate ability (the general dimension) and both proficiency test scores (r=-.31) and GPA(r=-.22). On the other hand, three dimensions of the specific language learning beliefs were statistically significantly related to several achievement measures. Specifically, beliefs on ambiguity avoidance in learning Japanese related to scores on the achievement test (r=-27, p<.01), beliefs in the analytical approach to learn Japanese related to scores on the Japanese course(r=.21, p<.05), beliefs that Japanese is easy to learn related positively to all achievement measures.

In another recent study, Cano (2005) investigated the effects of epistemological beliefs on learning approaches (details about this aspect is presented in the learning strategy section), and on academic performance of 1600 Spanish secondary students. Students responded to a Spanish version of SEQ to assess their beliefs on three dimensions: belief in quick effortless learning, belief in simple knowledge, and belief in certain knowledge. The average of students' grades on all subjects was taken as a measure of academic performance. Linear structural equation modelling procedures were employed to evaluate a proposed model that student' beliefs and their approaches to learning affect their performance. The model accommodated the data reasonably. Results showed that the effect of students' beliefs on academic performance occurs directly, through quick learning (*B*=-.20) and simple knowledge (*B*=-.09), and indirectly, through their influence on learning approaches (details about the indirect effect is in the learning

strategy section). That is, the more students believed knowledge is simple and that learning occurs quickly and without effort, the less well they performed academically.

In a recent study targeted at investigating changes in epistemological beliefs of elementary science students as a result of nine-week science unit instruction, Conley, Pintrich, Vekiri and Harrison (2004) examined the relationship between students' beliefs and their achievement. One hundred eighty seven students responded to a 26-item questionnaire twice, to assess their beliefs in relation to science before and after receiving the unit of instruction. The questionnaire was used to address four dimensions: source of knowledge, certainty of knowledge, development and evolution of knowledge, and justification of knowledge. Students' achievement was assessed using a combination of math and reading achievement test scores from the Stanford Achievement Test. Zero-order correlations indicated statistically significant relationships between achievement and all four dimensions of students' beliefs measured before and after the course of instruction: source of knowledge ($r=.39$, $.46$), certainty of knowledge ($r=.49$, $.51$), development and evolution of knowledge ($r=.29$, $.27$), and justification of knowledge ($r=.28$, $.22$). The positive correlations in this study indicated that the higher achieving students expressed more sophisticated beliefs (i.e., all beliefs dimensions scored so that high sores represent sophisticated beliefs).

3.1.1.1 Summary and Critique

This section included (10) studies which give some support to the hypothesis that students' beliefs about knowledge and learning predict their general academic achievement as well as their achievement in specific school subjects. However, although the results were consistent in that more sophisticated beliefs were related to higher

achievement, they were inconsistent in terms of the dimensions that were found to be associated with students' achievement. Table 3.1 summarizes the beliefs dimension that showed to associate with students' achievement.

Table 3.1:   Beliefs Dimensions Associated with Achievement.

Research Study	Certain knowledge	Simple knowledge	Omniscient Authority	Justification of knowing	Innate ability	Quick learning
Ryan (1984)		*				
(dualistic includes all three beliefs)						
Schommer (1993)						*
Schommer et al (1997)						*
Schommer & Dunnel (1997)					*	
Paulsen & Wells (1998)		*				
Mori (1999)					*	
Hofer (2000)	*					
(these two beliefs measured together)						
Schommer et al (2000)					*	*
Conley et al (2004)	*	*		*		
Cano (2005)		*				*

* The relationship was statistically significant at p<.05 or less.

As shown in Table 3.1, while Conley et al.'s (2004) study showed significant relationships with three dimension (all the investigated dimensions in the study), almost all other reviewed studies showed only one dimension associated with achievement. It is worth noticing that quick learning, innate ability (beliefs about learning), and beliefs in simple knowledge were the most frequent dimensions to associate with achievement. The strength of association shown by correlation coefficients and standardized beta coefficients reflect weak to moderate statistically detectable relationships between some students' beliefs dimensions and their general achievement.

In most of the studies reviewed in this section, the effects of other factors that might affect students' performance were not assessed. I argue that the correlation between students' beliefs about knowledge and learning and their performance could be because both constructs are related to general academic aptitude (e.g., verbal ability), prior knowledge, academic experience, or to other personality variables. If the beliefs and the achievement variables were adjusted for the effect of other variables that might affect them, the correlation between the two constructs might be negligible (e.g. Schommer, 1993). For that reason, it seems reasonable to examine the possible effect of such other variables.

Without a doubt, general academic achievement has been the most frequently described learning outcome in research. However, it is essential to consider other measures of academic performance that reflect students learning in specific learning contexts.

3.1.2 Students' Beliefs about Knowledge and Learning Affect What They Learn from a Text

Studies reviewed in this section are studies that link students' beliefs about knowledge and learning with their achievement when they learn or study text material. These studies tested the direct effect of students' beliefs on their comprehension and specific qualities of learning from a text, such as the ability to interpret and integrate conflicting ideas.

In responding to Ryan's (1984) work in which he linked students' beliefs with their academic achievement, Schommer argued that Ryan used a dichotomous model that is too simple to describe the complexity of epistemological beliefs. From the late 1980s,

Schommer with a group of researchers started a research program to investigate the

nature of beliefs about knowledge and learning and their effect on learning and

performance. Schommer (1990) started her work by developing and validating a paper

and pencil measure (SEQ), to assess students' beliefs on the five dimensions she

proposed in her model (innate ability, simple knowledge, quick learning, certain

knowledge, and omniscient authority). Using the SEQ, Schommer (1990) examined how

the beliefs of 86 junior college students affected their comprehension and their

metacomprehension (this aspect of the study is presented in the metacognitive processes

and strategies section). Of the sample, 41 students read a passage about aggression which

included four plausible theories of aggression with the underlying theme that any

tentative resolution would require a theory that integrates aspects of all theories. The

remaining 45 students read a passage about nutrition which highlights controversial

issues about the usage of Vitamin B6. Both passages did not have the conclusion

paragraph. Students were tested on their ability to master the material and to draw

conclusions. As an indicator of prior knowledge, students reported the total number of

classes they had taken which were relevant to the passage they read. Several regression

analyses, controlling for verbal ability, prior knowledge, and gender, were performed. To

test the effect of epistemological beliefs on students' interpretation of information,

students' conclusions for both passages were combined. The regression revealed that

quick learning predicted oversimplified conclusions, B=-.18, p<.05. Also, certain

knowledge predicted certain conclusions, B=-.33, p<.01. That is, students who believe

knowledge is certain tended to draw more absolute conclusions than students who

believed that knowledge is tentative. To test the effects of students' beliefs on their

performance, separate analyses were performed for each performance test. Only the

quick learning dimension predicted performance on the psychology mastery test, $F(1,$

$26) = 9.15$, B=-.16, MSe=2.07. That is, students who believed that learning occurs quickly

or not at all tended to draw oversimplified conclusions from the text, and to perform less

well on the mastery test. However, none of the five dimensions of beliefs predicted

performance on the nutrition performance test. Schommer explained that this result was

because the nutrition test was not psychometrically sound. Based on the above results

Schommer's conclusion was that students' beliefs affect their comprehension and how

they process information when they learn from a text.

In another study, Schommer, Crouse, and Rhodes (1992) explored the relationship

between beliefs on simple knowledge and comprehension, explicitly focusing on how

beliefs about the nature of knowledge related to the comprehension of integrated text

material. One hundred thirty eight university students read a highly integrated statistical

text. Measures assessing mastery of the material, prior knowledge measured by the

number of courses studied that were related to statistics, and the use of study strategies

measured by the Study Strategy Inventory (SSI; Weinstein, Palmer & Schulte, 1987,

cited in Schommer at el. 1992) were administered. (Detailed information about this

aspect are presented in the learning strategies section.) The researchers used the SEQ to

assess students' beliefs about knowledge and learning. Students' confidence in

understanding the passage was also assessed. (Detailed information about this aspect are

presented in the metacognition section.) Regression analyses were conducted controlling

for prior knowledge and sex. Students' beliefs in simple knowledge predicted

comprehension (measured by the mastery test). Specifically, the more students regarded

knowledge as a collection of isolated facts, the worse they performed on the mastery test. These relationships were significant when GPA and age were controlled for as well. Schommer and her colleagues concluded that students' belief in simple knowledge has a direct negative effect on comprehension.

In another study, Qian and Alvermann (1995) investigated relationships among epistemological beliefs, learned helplessness, and conceptual understanding and application reasoning in conceptual change learning. Two hundred twelve high school students completed 32 items adapted from the SEQ to asses students' beliefs on three dimensions: quick learning, simple-certain knowledge, and innate ability; and a 10 item questionnaire to differentiate between learned helplessness and a mastery approach. Students' studied a refutational science text about Newton's theory of motion. A prior knowledge test that related to the text topic was used to classify students into accretion, tuning, and restructuring groups. The accretion group consisted of students who scored above 50% on the prior test and whose answers were incomplete but did not reflect misconceptions. These students were assumed to need to accrete considerably. The tuning group consisted of students who scored above 50% on the prior test but whose answers showed some misconceptions. Finally, the restructuring group consisted of students who earned low scores on the prior test and had misconceptions. Students' understanding of the concepts and their ability to apply the information they studied in the text was assessed using an achievement test. Results from structure coefficients in canonical correlation analyses indicated that beliefs about simple-certain knowledge and quick learning contributed statistically significantly to conceptual change learning. The full model explained 23% of the variance in students' scores on the achievement test.

This moderate relationship suggested that the more students held beliefs about simple-certain knowledge and quick knowledge, the poorer they performed in conceptual change learning.

Schommer and Walker (1995) tested the assumption that students' epistemological beliefs exist independently of a specific domain. Researchers assessed 97 university students' epistemological beliefs about mathematics and social studies using a modified version of the SEQ. Students were instructed to complete the SEQ twice: once with mathematics in mind and the other with social studies in mind. Reminders of the target domain were inserted at the top of each page. In addition, the target domain was mentioned explicitly in every third item. After filling the questionnaires, 38 students of the group studied a social studies passage, 44 students studied a mathematics passage, and both answered 15 multiple-choice items related to the passage they studied. Regression analyses were performed to determine whether domain-specific epistemological beliefs predict comprehension of the passage within domains or between domains. Researchers controlled for prior knowledge using the number of courses students had studied in the target domain. Results indicated that both domain specific beliefs predicted passage performance similarly across both passage conditions. Specifically, when students' performance on social science passage was used as a dependent measure and scores on the four dimensions of beliefs related to social science were served as predictors, beliefs in certain knowledge in social studies predicted performance on the social science test. When the four dimensions of beliefs related to mathematics were used to predict social science scores, beliefs in certain knowledge in mathematics predicted performance on the social studies test. These results indicated that

the less students believed in certain knowledge in social studies or in mathematics, the better they performed on the social science test. When students' performance on the mathematics passage was used as a dependent measure and scores on the four dimensions of beliefs related to mathematics served as predictors, beliefs in simple knowledge in mathematics predicted performance on the mathematics test. When the four dimensions of beliefs related to social science were used to predict mathematics test scores, beliefs in simple knowledge predicted test scores. These results indicated that the less students believed in simple knowledge in either social studies or in mathematics, the better they performed on the mathematics test. Moreover, correlations between corresponding pairs of domain-specific beliefs dimensions were substantial, yet they were not as strong as test-retest correlations (r ranged from .48 to .65). The levels of sophistication between domains were consistent for the majority of the students on two dimensions: fixed ability (70% consistent) and simple knowledge (65% consistent), while the percentage of students who maintained consistent levels of sophistication on quick knowledge and certain knowledge was only 57% consistent. In the light of these results, the researchers concluded that beliefs about knowledge and learning were predominately domain independent. However, they noted that the evidence only supported a moderately domain-independent stance, and that students may have general beliefs about knowledge and learning that are adjusted when they reflect on a specific domain.

In another line of inquiry, researchers investigated epistemological beliefs as one reader characteristic that affects learning from a text. For example, Kardash and Scholes (1996) were interested in how students' general beliefs about the certainty of knowledge, the strength of their beliefs about a controversial issue, and their tendency to engage in

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and enjoy complex effortful thinking impacted their interpretation of a text that presented

conflicting evidence concerning that controversial issue. To answer this question, 68

college students, primarily juniors and seniors, read an inconclusive text about the

relationship between AIDS and HIV. Students then completed the following measures:

one item to assess their pre-existing belief about the relationship between AIDS and HIV,

the Need for Cognition Scale (Petty & Caccioppo, 1981, as cited in Kardash & Scholes,

1996) to assess their predisposition to engage in effortful cognitive processing, and wrote

a conclusion for the text to assess their ability to integrate the text information. Students'

beliefs on four dimensions—certain knowledge, quick learning, depend on authority, and

innate ability—were assessed using 42 items from the SEQ. A multiple regression

analysis revealed three statistically detectable predictors of students' certain conclusions:

the certainty of knowledge; the strength of beliefs regarding HIV and AIDS relationship;

and Need for Cognition Scale score. These results suggest that the more students believed

in the uncertainty of knowledge, the more likely they were to express the inconclusive

nature of contradictory evidence on a controversial topic. On the other hand, students

who viewed knowledge as certain were more likely to misinterpret contradictory

evidence. Another important conclusion of this study was that the strength of people's

specific beliefs about the controversial topics is as important as general epistemological

beliefs in determining how they will interpret inconclusive evidence while learning from

a text. This implies that researchers should include measures of domain or topic specific

beliefs in their investigations of these topics.

In another study, Rukavina and Daneman (1996) investigated the effect of beliefs

about the structure of knowledge on students' comprehension and successful integration

of competing scientific theories. A sample of 122 students (82 tenth and twelfth grade

high school students and 40 college undergraduate students) was presented with a series

of texts that discuss competing scientific theories either in the same text or in different

texts. The students also completed a series of measures to assess their acquisition of

scientific knowledge and working memory span. The researchers used 12 items from the

SEQ that address beliefs about the structure of knowledge (complexity/simplicity).

Depending on their scores on these items, students were classified as having mature or

immature knowledge beliefs. Students with mature beliefs believed that knowledge is

complex, and consists of integrated ideas, whereas students with immature beliefs

believed that knowledge is simple, and consists of a collection of isolated facts. A series

of ANOVAS indicated that students' beliefs about the structure of knowledge played a

significant role in learning and integration of knowledge. That is, students with mature

beliefs demonstrated greater knowledge acquisition overall (mean score of 63%) than

students with immature beliefs (mean score of 48%). Moreover, students with immature

beliefs learned more from texts that presented the competing theories together in one text

and in an integrated fashion, as compared to when the theories where presented in

separate texts. On the other hand, students with mature beliefs performed equally well on

the mastery test. Based on these results, the researchers concluded that students' beliefs

about the complexity of knowledge facilitate learning and integrating new information.

Lin (2002) investigated the effects of different computer graphics types and

epistemological beliefs on students' performance. One hundred sixty seven grade four

students completed a version of the Epistemological Belief Questionnaire (EBQ;

Jacobson & Jehng, 1998 cited in Lin, 2002). The EBQ was translated to Chinese and

revised for elementary school students. It was used to measure students' general beliefs on four dimensions: first time learning, quick learning, omniscient authority, and simple knowledge. Students were assigned randomly to three computer-based environments that represented identical content in varied modes for graphics. Students took their time to learn the content and wrote a post-test that elicited concept learning immediately following the instruction. Four two-way ANOVAs were conducted to verify if there were main effects and interactions involving students' epistemological beliefs and different graphics types on students' learning. Prior to the analyses students were classified on each dimension of belief into two groups (naïve and mature) according to their scores on each dimension. The results indicated that there were no main effects or interactions between students' beliefs and computer graphics types on their learning.

Bendixen and Hartley (2003) examined the relationship between epistemological beliefs, metacognition (detailed information about this aspect of the study is presented in the metacognitive processes and strategies section), and students' achievement in a hypermedia environment. One hundred sixteen undergraduate teacher candidates responded to the Epistemological Beliefs Inventory (EBI; Schraw, Bendixen, & Dunkle, 2002) to assess their beliefs on five dimensions: certain knowledge, simple knowledge, omniscient authority, fixed ability, and quick learning. Students' metacognitive awareness was measured using the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994). To control for factors that might affect students' performance, the researchers included a measure for reading comprehension (Nelson-Denny reading comprehension test) and a measure for logical reasoning (Syllogisms). Students studied a chapter about Yugoslavia using a hypermedia instructional tutorial for thirty minutes. To

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assess learning, students responded to 11 short-answer items related to the chapter

content. Hierarchical regression was performed to examine whether epistemological

beliefs and metacognitive awareness would predict achievement after accounting for the

variance associated with students' logical reasoning, GPA, and reading ability. With all

variables included, the model explained 31% of the variance in the achievement test

scores. Results showed that students' reading ability and GPA were significant predictors

of achievement. Three of the five epistemological beliefs dimensions were found to be

significant predictors: omniscient authority (B=-.197), quick learning (B=.286), fixed

ability (B=-.280). Omniscient authority and fixed ability correlated negatively with

achievement, whereas quick learning correlated positively. The direction of the

relationship between quick learning and achievement contradicted the researchers'

assumptions and previous research. Researchers attributed the lack of the relationship

between achievement on the test and certain and simple knowledge to the fact that

reading for comprehension and recalling of factual information is a well-defined problem.

Well-defined problems can be solved without epistemic assumptions.

Kardash and Howell (2000) used a think aloud protocol to examine the effect of

epistemological beliefs and topic-specific beliefs on the type and frequency of cognitive

and strategic processes (detailed information about this aspect of the study is presented in

the cognitive and learning strategies) used by 40 undergraduate students to comprehend a

dual-positional text. Kardash and Howell used the text on the debate about the

relationship between HIV and AIDS that was previously used in Kardash and Sole's

(1996) study). Data were collected from students about their beliefs about the relationship

between HIV and AIDS, the text difficulty, interest, and familiarity. Students' completed

a vocabulary test to assess their verbal ability, and wrote an unexpected test of free recall of information presented in the 24 hours after the reading session to assess their comprehension. Students' beliefs were collected using 42 items selected from the SEQ and factor analyzed as part of a larger set of data taken from 288 undergraduate students. The four factor solution comprised dimensions labelled as follows: the nature of learning (includes items about innate ability, avoid ambiguity, depend on authority), quick learning, the certainty of knowledge, and avoid the integration of knowledge. Students were classified according to their scores on each of the four dimensions using the median (i.e., students with scores above the median were classified as holding naïve beliefs, whereas students with scores below the median were classified as holding sophisticated beliefs). Four separate ANOVAs, 7 (processing category type) x 2 (beliefs: naïve vs. sophisticated), were conducted using the general linear model procedure. Results showed that students' beliefs were unrelated to recall of text information. The researchers explained that these results were caused by a number of factors including the one day delay and not telling participants they would be tested.

3.1.2.1 Summary and Critique

Studies reviewed in this section tested the relationship between students' beliefs about knowledge and learning and their academic achievement when they learn from a text. Eight studies tested the relationship between students' beliefs and achievement on a test after they read or studied a text. However, these studies provided contradictory results. While six studies found at least one belief dimension to associate with acquiring knowledge from a text (as measured by a knowledge test), two studies found no statistically detected relationship with any of the beliefs dimensions. Dimensions that

repeatedly showed a statistically significant relationship with students' achievement on a

knowledge test were beliefs in quick learning, certain knowledge, and simple knowledge.

Table 3.2 shows the dimensions of belief that associate with learning from text.

Table 3.2: Beliefs Dimensions Associated with Learning from Text

Research Study	Certain knowledge	Simple knowledge	Omniscient Authority	Justification of knowing	Innate ability	Quick learning
Schommer (1990)						•
Schommer et al. (1992)		•				
Schommer & Walker (1995)	•	•				
Qian & Alvermann (1995)		* (these two beliefs measured together)				*
Rukavina & Danemann (1996)		•				
Kardash & Howell (2000)	No direct effect was detected on any of the dimensions					
Lin (2002)	No direct effect was detected on any of the dimensions					
Bendixer & Hartley (2003)				*	*	**

* A statistically detectable negative relationship was found with this dimension at p<.05 or less
** A statistically detectable positive relationship was found with this dimension

All statistically detectable relationships between students' beliefs and

achievement were negative, that is, students with less sophisticated levels of these belief

dimensions tended to achieve lower on the knowledge tests. However, in Bendixen's and

Hartly (2003) study, quick learning correlated positively with learning from a text in a

hypermedia environment.

All studies except one, Schommer and Walker (1995), assessed students' general

or abstract beliefs about knowledge and learning. Schommer and Walker assessed

students' beliefs in specific academic domains level (mathematics and social studies).

However, the questionnaire that was used to assess students' specific beliefs has been

criticized (Hofer, 2000). Although the participants were directed to keep a particular domain in mind and a reference to the domain was include every three items, the procedure may not be adequate to provide evidence of beliefs pertinent to a specific domain.

It is also worth noticing that in the reviewed studies, while some researchers made some efforts to control for factors that were known to affect learning from a text (Kardash & Howell, 2000; Schommer, 1990, Schommer et al., 1992); some researchers did not (Linn, 2003; Schommer & Walker, 1995; Rukavina & Daneman, 1996). In both her studies, Schommer and her colleagues (1990; 1992), controlled for students' prior knowledge using the number of courses students studied, age, sex, and high school GPA. On the other hand, when Kardash and Howell (2000) controlled for a variety of factors known to affect students' learning —verbal ability, prior knowledge related to the text topic, the level of familiarity, interest, and difficulty—the relationship between students' general beliefs about knowledge and learning and their learning from text was negligible.

Yet, in the two studies that found no statistically detectable effect of these beliefs on students' learning from text (Kardash & Howell, 2000; Lin, 2002), researchers classified students into two groups (naïve and mature) on each dimension using the mean or median scores, so that they could employ analyses of variance techniques. This classification and the use of these statistical methods might decrease power to detect differences if they did exist. It would be more appropriate to use techniques such as regression analysis to test the relationship between beliefs and achievement.

Some of the reviewed studies indicated out a link between students' beliefs and qualities of learning from texts, such as the ability to interpret controversial issues, and

the ability to integrate conflicting viewpoints that were presented in the texts (e.g.,

Kardash & Scholes, 1996; Schommer, 1990). Such a link between students' beliefs and

the quality of their learning outcomes motivated investigating the effect of these beliefs

on how students engage in the actual learning process which in turn could explain the

effects of these beliefs on learning outcomes. Theoretically, much of the effect of beliefs

about knowledge and learning is indirect through their effect on cognitive and

metacognitive strategies.

3.1.3 Students' Beliefs about Knowledge and Learning Affect How They Learn: The Use of Learning and Cognitive Strategies

Studies reviewed in this section investigated the relationship between students'

beliefs about knowledge and learning and their use of learning strategies, or investigated

whether the relationship between students' beliefs and their academic performance is

mediated by students' use of cognitive and learning strategies.

Schommer and colleagues (Schommer, Crouse, & Rhodes, 1992) investigated the

direct and indirect effect of 138 students' beliefs in simple knowledge on their

comprehension when they read a highly integrated statistical text. Measures assessing

mastery of the material, prior knowledge, and the use of study strategies (measured by the

Study Strategy Inventory (SSI; Weinstein, Palmer & Schulte, 1987, cited in Schommer et

al. 1992) were administered. The researchers used the SEQ to assess students' beliefs on

four beliefs dimensions. A path analysis was used to test the hypothesis that the effect of

belief in simple knowledge on test performance is mediated by study strategies. Results

showed a statistically detectable relationship between belief in simple knowledge and

test-preparation strategies, and between test-preparation strategies and test performance.

Schommer and colleagues concluded that students' belief in simple knowledge has an indirect negative effect on students' achievement mediated by test-preparation strategies.

Using a think aloud protocol, Kardash and Howell (2000) tested Schommer's et al. (1992) contention that the effect of students' beliefs influence academic performance indirectly by their effect on strategy selection. Specifically, Kardash et al. examined the effect of epistemological beliefs and topic-specific beliefs on the type and frequency of cognitive and strategic processes used by 40 undergraduates to comprehend and monitor their comprehension of dual-positional text. Students' beliefs were collected about four dimensions labelled: the nature of learning, quick learning, the certainty of knowledge, and avoid integration of knowledge. Researchers analyzed students' verbatim responses into seven processing strategies categories, developing awareness, accepting ambiguity, establishing intrasentential ties, establishing intersentential ties, using background knowledge, making judgment and evaluation, processing text inaccurately (illusion of knowing). Four separate ANOVAs, 7 (processing category type) x 2 (beliefs: naïve vs. sophisticated), were conducted using the general linear model procedure. Unexpectedly, individual differences in students' beliefs did not interact detectably with the specific types of strategies that students used. Rather, certain cognitive processing categories were used significantly more often by students than were others regardless of the level of sophistication of their beliefs. However, differences in students' beliefs about the speed and effort involved in learning influenced the overall frequency of a variety of cognitive and strategic processes they used. That is, the effect was quantitative rather than qualitative. The researches explained that the lack of relationships among students' beliefs, their strategy use, and their achievement, was caused by a number of factors

including, the one day delay, not telling participants that they would be tested, and the instructions given to the students were unlikely to elicit deep elaborating strategies.

Koller (2001) was interested in whether students' beliefs about mathematics affect mathematics achievement, and whether this effect is mediated by learning strategies, interest in math, and students' placement in basic or advanced-level mathematics. Data were collected from 400 upper secondary school students in Germany. An 18-item questionnaire was devised to measure students' beliefs about mathematics on four dimensions: certain knowledge, simple knowledge, the constructivistic conception of mathematics knowledge, and the relevance of mathematics to solve problems in other domains. Students' use of elaboration and rehearsal strategies was assessed using the Learning and Study Strategies Inventory (LASSI; Weinstein, Palmer, Schulte, 1987). Achievement in mathematics was measured using students' scores on 65 items related to the course content. Students' domain specific epistemological beliefs were statistically significant predictors of achievement. Results from a path analysis showed a model with sufficient goodness of fit. Specifically, the effects were direct for certain knowledge dimension (B=-.09), direct and indirect for the relevance dimension (B=.23), indirect for the simple knowledge dimension (B=-.07), and indirect for the constructivistic dimension (B=.07). The indirect relation was detected through learning strategies. That is, simple knowledge related to rehearsal strategies (B=.19), and rehearsal strategies related to achievement (B=-.12). Also, a direct relationship was found between the relevance dimension and the use of elaboration strategies (B=.21), however no significant relationship was found between elaboration and achievement. Altogether, students who believed that mathematical knowledge was certain (unchanging) had lower achievement

scores than students who believed mathematical knowledge is changeable. Students who believed mathematical knowledge to be simple (isolated bits of information) reported using rehearsal strategies and had lower achievement scores than students who believed mathematical knowledge is interrelated. Moreover, students who held constructivist beliefs about mathematical knowledge had higher achievement scores than those who believed that knowledge is dualistic (either true or false). Furthermore, students who believed that mathematical knowledge was relevant to solving problems in other domains tended to use elaboration strategies and to achieve more on mathematics. Although these results were compelling, the reliability coefficients for all dimensions of the beliefs were insufficient except for the relevance dimension ($\alpha=.77$). This measurement error leads to underestimation of true associations.

Schreiber and Shinn (2003) investigated the relationship between students' beliefs and their learning processes. One hundred and ten college students completed the SEQ to assess students' beliefs on four dimensions: certain knowledge, innate ability, quick learning and seeking single answer. The Inventory of Learning Process-Revised (ILP-R; Schmeck & Geisler-Brenstein, 1995 as cited in Schreiber & Shinn, 2003) was used to assess students' approaches to learning on the following factors: deep processing, elaborative processing, and agentic processing. Deep processing indicates the students' tendency to extrapolate beyond the specific information (e.g. search out information, compare and contrast information, and evaluate and organize concepts). Elaborative processing concerns using one's prior knowledge as an information source and reference. The other approach to learning is agentic processing and includes serial processing and fact retention. Serial processors usually like to learn facts, and complete tasks in step by

step fashion. Results from a path analysis showed that a belief in fixed ability has a direct

negative effect on deep processing (B=-.34), and agentic processing (B=-.23). That is,

students who believe the ability to learn can improve were more likely to report they

would compare and contrast information and to process information in a serial fashion

than are students who believe that ability is fixed. Moreover, results showed that a belief

that knowledge is simple had a direct positive effect on agentic processing (B=.21). In

other words, students who see knowledge as isolated and unambiguous are more likely to

process information in a serial fashion, focusing on facts.

In another recent study, Cano (2005) investigated the effects of epistemological

beliefs on learning approaches, and on academic performance of 1600 Spanish secondary

students. Students responded to a Spanish version of SEQ. Factor analysis of data

obtained from this sample revealed three reliable beliefs factors: belief in quick effortless

learning, belief in simple knowledge, and belief in certain knowledge. The Learning

Process Questionnaire (LPQ; the Spanish version, Barca, 1999, as cited in Cano, 2005)

was administered to assess students' approaches to learning. While the LPQ includes six

subscales, the factor analysis performed in this study revealed only two reliable factors

labelled deep and surface approaches to learning. The average grades of all subjects were

taken as a measure of academic performance. Linear structural equation modelling

procedures were employed to evaluate a model that proposed that students' beliefs and

their approaches to learning affect their performance. The model accommodated the data

reasonably well. The squared multiple correlations indicated that the model explained

quite high proportions of the variance in each of the dependent variables: 10% of deep

approaches, 12% of surface approaches, and 17% of academic performance. Results

showed that academic achievement was predicted by approaches to learning, which in turn were predicted by beliefs about knowledge and learning. That is, the effect of students' beliefs on academic performance occurs in two ways: First, directly, through quick learning (B=-.20) and simple knowledge (B=-.09), and second, indirectly, through their influence on learning approaches. However, the indirect effect was statistically detectable only for beliefs about quick and effortless learning (B=-.09). Moreover, results showed that learning approaches also significantly influence academic performance. That is, students who study with a surface approach to learning tended to achieve poorer than those who study with a deep approach to learning. In sum, these results indicate that the more students believe learning occurs rapidly and without effort, the more they are likely to adopt a surface approach to learning, and the less they achieve. Also, the more students believe knowledge is simple, the poorer they perform academically.

3.1.3.1 Summary and Critique

Studies reviewed in this section provided some support for the link between students' beliefs and their use of learning and cognitive strategies. Specifically, students with naïve beliefs about the structure of knowledge (i.e., simple knowledge) tended to use fewer test-preparation strategies (Schommer et al, 1992), to use more rehearsal strategies (Koller, 2001), and to process information in a serial fashion (Schreiber & Shinn, 2003). Students with naïve beliefs that learning should occur quickly and without effort tended to use surface learning strategies (Cano, 2005), while students with naïve beliefs that ability to learn is fixed tended to use less deep and agentic strategies (Schreiber &Shinn, 2003). The assumption that the effects of students' beliefs were mediated by cognitive and learning strategies was tested in four studies (Canos, 2005; Kardash & Howell, 2000;

Koller, 2001; Schommer et al, 1992). Whereas results from three of these studies supported the mediation relationship, results from Kardash and Howell's study indicated no direct or indirect relationships among beliefs, strategic processing, and achievement. Studies that supported the mediation relationship showed that the indirect relationship between belief in simple knowledge and achievement was mediated by test-preparations (Schommer et al., 1992) and by the use of rehearsal strategies (Koller, 2001). Moreover, an indirect relationship between the naïve beliefs about the quick and effortless learning and achievement was mediated by students' use of surface learning strategies (Cano, 2005).

All studies tested the relationship between students' use of cognitive and learning strategies and their beliefs about knowledge and learning in general (i.e., at the abstract level) except Koller's (2001) study in which students' beliefs about mathematics knowledge and learning were assessed. Moreover, in all studies reviewed in this section, students' use of cognitive and learning strategies was measured using self-report measures, except Kardash and colleague's study that collected data about students' strategic processes using a think aloud protocol.

The effect of students' beliefs on their use of cognitive and learning strategies as a skill component of SRL is presented in the last section of this chapter.

3.1.4 Students' Beliefs about Knowledge and Learning Affect their Metacognitive Processes and Strategies

Studies reviewed in this section are studies that investigated the relationship between students' beliefs and their metacognitive processes and strategies, or

investigated whether the relationship between students' beliefs and their academic achievement is mediated by metacognitive processes and strategies.

In an attempt to explore the information-processing implication of Perry's basic epistemological beliefs model, Ryan (1984) used seven items from the original 46 item instrument used by Perry to classify students into either dualists or relativists. Ryan collected data from 85 undergraduate students about how they monitor their learning from a text. Specifically, students reported the criteria by which they determine whether they have understood the material. The comprehension monitoring criteria then were classified according to the epistemological standards they imply. Two groups emerged: students with knowledge standards that reflect their effort toward recalling the text information as it is, and those with comprehension standards that reflect students' effort to make sense of the text information and to establish relationships among the text ideas. Results showed that students' epistemological beliefs were associated with the nature of their comprehension standards and with their academic achievement (details provided under the general academic section). That is, dualists were more likely to report the use of knowledge standards (70% in comparison with 42% reported by relativists, $z=2.46$, $p<.01$), whereas relativists tended to report the use of comprehension standards to monitor their comprehension.

Ryan's findings motivated testing the relationship between students' beliefs and their metacomprehension in an actual learning sitting. In her study, Schommer (1990) collected 41 students' confidence ratings of their comprehension after they studied a chapter about regression. Schommer used the SEQ to assess students' beliefs on the five dimensions she proposed in her model (innate ability, simple knowledge, quick learning,

certain knowledge, and omniscient authority). Several regression analyses, controlling for verbal ability, prior knowledge, and sex, were performed to test the effect of students' beliefs on their ability to assess their understanding. Results showed that only quick learning predicted students' overestimation of their understanding of the passage, $F(1, 25) = 12.62$, $B=.81$, $MSe=.72$. . That is, students who believed that learning occurs quickly or not at all tended to overestimate their comprehension. Schommer thus concluded that students' beliefs affect how they monitor their comprehension.

In another study, Schommer and colleagues (Schommer, Crouse, & Rhodes, 1992) investigated the relationship between 138 students' beliefs on simple knowledge and their metacomprehension when they read a highly integrated statistical text. Researchers used the SEQ to assess students' beliefs and used students' confidence in understanding the passage to assess their metacomprehension. Regression analyses were conducted controlling for prior knowledge and sex. Students' belief in simple knowledge was a significant predictor of metacomprehension (Overconfidence). Specifically, the more students regarded knowledge as a collection of isolated facts, the more they overestimated their ability to comprehend the text. Schommer and colleagues concluded that students' belief on simple knowledge has a direct negative effect on students' metacomprehension.

Bendixen and Hartley (2003) examined the relationship between epistemological beliefs, metacognition, and students' achievement in a hypermedia environment. One hundred sixteen undergraduate teacher candidates responded to the EBI to assess their beliefs on five dimensions: certain knowledge, simple knowledge, omniscient authority, fixed ability, and quick learning. Students' metacognitive awareness was measured using

the Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994) which

measures two aspects of students' metacognition: knowledge of cognition and regulation

of cognition. Students studied a chapter using a hypermedia instructional tutorial for 30

minutes and wrote a test related to the chapter content. Hierarchical regression was

performed to examine whether epistemological beliefs and metacognitive awareness

would predict achievement after accounting for the variance associated with students'

logical reasoning, GPA, and reading ability. With all variables included, the model

explained 31% of the variance in the achievement test scores. Results showed that neither

of the two metacognition measures were significant predictors of achievement test.

Researchers explained the lack of the relationship among achievement, metacognition,

and students' beliefs, as due to the fact that reading for comprehension and recalling of

factual information is a well-defined problem. Well-defined problems can be solved

without epistemic assumptions, require less cognitive resources, and therefore would not

necessarily require students to tap into metacognitive skills.

3.1.4.1 Summary and Critique

The four studies that are reviewed in this section provided some, but inadequate,

support to the relationship between students' beliefs about knowledge and learning and

aspects of students' metacognition. That is, results from Ryan's (1984) study showed that

students' epistemological beliefs were associated with the nature of their comprehension

standards and with their academic achievement. However, the study did not attempt to

establish the relationship between students' standards and their actual learning practices.

It is crucial to provide an actual learning context to allow students to report their

standards with reference to it. Without providing a context it is possible that students

simply responded to the comprehension monitoring probe by supplying as many criteria as they could imagine and therefore the frequency and quality of monitoring criteria might be overestimated in this study.

On the other hand, the three other studies that assessed the relationship between these two constructs in an actual learning context, showed conflicting results. Results from Schommer's (1990) study supported the conclusion that the more students believe in quick, all-or-none learning, the more likely they are to overestimate their understanding when they learn from a text. Similarly, but detecting the relationship on a different belief dimension, Schommer et al (1992) reported that the more students regard knowledge as a collection of isolated facts the more they overestimate their ability to comprehend the text. Conversely, results from Bendixen and Hartley's (2003) study showed that students' metacognition (i.e., knowledge of cognition and regulation of cognition) was unrelated to their beliefs about knowledge.

The relationship of students' beliefs on their use of metacognitive strategies as a skill within SRL is presented in the next section.

3.1.5   Students' Beliefs about Knowledge and Learning Affect Their SRL

The previous findings suggest that particular dimensions of students' beliefs about knowledge and learning affect students' use of learning strategies, cognitive, and metacognitive strategies. Therefore, researchers found it plausible to investigate the role that beliefs about knowledge and learning play in self-regulated learning. The studies that are reviewed in this section investigated the relationship between students' beliefs and

either their use of self-regulatory strategies or their use of cognitive and metacognitive strategies as skill components of SRL.

Paulsen and Feldman (1999) examined relationships between four dimensions of epistemological beliefs—fixed ability, simple knowledge, quick learning, and certain knowledge—and eight skill components of SRL. The SEQ and the MSLQ were filled in by 246 undergraduate students. The MSLQ was used to collect data about eight skill components of SRL including students' use of cognitive strategies (rehearsal, organization and elaboration), metacognitive strategies and resource management strategies (time and study environment, effort regulation, peer learning, and help seeking). Each of the eight components of SRL was regressed separately on all four dimensions of students' beliefs. The highest R^2 among the eight regressions occurred in the equation for the elaboration strategies. That is, students' beliefs explained 21.6% of the variance in the use of elaboration strategies. Results showed statistically significant relationships between three dimensions of beliefs (fixed ability, simple knowledge, and quick learning) and from two to all eight skills of SRL. Specifically, the findings supported that students who hold naive beliefs in simple knowledge were more likely than others to report using rehearsal strategies (B=.21) which are essentially surface-level, short-term memorization techniques based on repetition. Moreover, students with naïve beliefs in fixed ability were less likely than others to report using deep-level organization strategies (B= -.40). Students with naïve beliefs fixed ability, quick learning, and simple knowledge were all less likely than others to report using the deeper-level processing strategy of elaboration (B= -.25,-.26,-.51, respectively). Results also showed that students with more sophisticated beliefs about fixed ability, and simple knowledge

were more likely than others to report engaging in metacognitive strategies (B= -.32, and -.25, respectively). Regarding resource management strategies, results showed that students who held naïve beliefs of fixed ability were less likely than others to report engaging in all four mentioned types of resource management strategies (B ranged from -.26 to -.38). Interestingly, beliefs about certain knowledge were not related to any of the eight skills of SRL.

In another attempt to investigate the link between epistemological beliefs and SRL strategies, Neber and Schommer-Aikins (2002) examined the effect of epistemological beliefs, epistemological intensions, and the learning environment on the reported use of SRL strategies among 133 gifted students in science learning. Researchers assessed students' general beliefs on six dimensions: innate ability, quick learning, certain knowledge, seeking single answer, and avoiding integration of knowledge. Data about SRL were collected using the Motivated Learning Strategies Questionnaire (MLSQ; Pintrich & DeGroot, 1990). The Personal Goals Scale was used to assess three goal orientations: task goal, ego goal, and work avoidance goal. Students' epistemological intention to acquire facts or usable and applicable knowledge in science was assessed using a questionnaire. A multivariate regression analysis was computed with regulatory strategy use as the criterion and eight variables including students' beliefs as possible predictors. A relatively high proportion of students' reported use of self-regulatory strategies could be explained (R^2 =.49). Interestingly, none of six beliefs dimensions was a statistically significant predictor of SRL strategies. However, specific epistemological intentions to acquire facts turned out as a statistically significant predictor (B=.31) of reports about using SRL strategies. Yet, the direction of this relation

was unexpected: the more students have the intension to acquire knowledge about facts in science, the more they tend to report using SRL strategies.

In a recent study, Dahl, Bals, and Turi (2005) investigated the relationship between students' beliefs about knowledge and learning and their self-reported use of SRL strategies when they study course material. The SEQ was used to assess 81 Norwegian undergraduate students' beliefs. The Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, & McKeachie, 1991) was used to collect data about students' reported use of five types of learning strategies: rehearsal, elaboration, critical thinking organization, and metacognitive self-regulation. Students filled SEQ and MSLQ without specifying any context. Five regression analyses were performed to test the power of the four beliefs (simple knowledge, certain knowledge, innate ability, and quick learning) to predict each of the five cognitive and metacognitive strategies measured by the MSLQ. Results showed that beliefs about simple knowledge contributed significantly to the prediction of students' report of rehearsal strategies (R^2=.11, F (4, 76) =2.33, t =-2.60, p<.01), organization strategies (R^2=25, F (4, 76) = 6.16, t=-3.64, p<.001), and metacognitive self-regulated strategies (R^2=5.65, F (4, 76) =5.65, t=-3.21, p<.01). Students' beliefs about how fixed is the ability to learn at birth contributed significantly to the prediction of reported use of elaboration strategies (R^2 =.22, F (4, 76) = 5.24, t=-3.37, p<.001), critical thinking strategies (R^2=25, F (4, 76) =6.22, t=-4.37, p<.001), and metacognitive self-regulated strategies (R^2=5.65, F (4, 76) =5.65, t=-2.16, p<.05). That is, the more students believe knowledge is simple the less they tend to report using rehearsal, organizational, and metacognitive self-regulated

strategies. In addition, the more students believe that ability is fixed at birth the less they use elaboration, critical thinking, and metacognitive self-regulated strategies.

3.1.5.1 Summary and Critique

Two of the studies reviewed in this section provided some support for the relationship between students' beliefs about knowledge and learning and their use of cognitive and metacognitive SRL strategies. For example, regarding students' use of metacognitive SRL strategies and using the same measurement tools, the MSLQ and the SEQ, beliefs about simple knowledge and fixed ability repeatedly associated with students' self-reported use of metacognitive SRL (Dahl et al., 2005; Paulsen & Feldman, 1999). Specifically, the two studies found that the more students held naïve beliefs about simple knowledge and fixed ability, the less they reported using metacognitive SRL strategies. Although these two studies provided consistent results about this relationship, Neber and Schommer (2002) using the same measurement tools found no relationship between students' beliefs and their use of metacognitive SRL strategies. Regarding students' use of cognitive strategies as skill components of SRL, Paulsen and Feldman (1999) found that the more students held naïve beliefs about simple knowledge the more they reported using rehearsal strategies. Moreover, the more students held naïve beliefs about fixed ability, quick learning, and simple knowledge, the less they reported using elaborating strategies. Furthermore, the more students believe in fixed ability the less they reported using resource management strategies. Similarly, Dahl and colleagues (2005) found that the more students held beliefs about fixed ability the less they reported using deep processing strategies, such as elaborating and critical thinking strategies.

Moreover, the more students held naïve beliefs in simple knowledge the less they reported using rehearsal and organizational strategies.

It is worth noticing that among the reviewed studies only one study (Neber & Schommer, 2002) investigated the relationship between students' beliefs and their use of metacognitive SRL strategies in a specific context (i.e., learning from a science text). However, students' beliefs about knowledge and learning were assessed at the general level in all studies including Neber and Schommer's study. It is possible that the conflicting results of these studies arise because knowledge is both multidimensional and multilayered. Therefore, it might be that beliefs about such knowledge are similarly multidimensional and multilayered. That is, individuals may possess general beliefs about knowledge but still hold distinct beliefs about more finely specified forms of knowledge (Buehl & Alexander, 2001). I argue it is important to specify a context for learners because when they respond to a general question about knowledge and learning beliefs, it is possible that beliefs about a specific knowledge domain are simultaneously evoked. It is plausible to provide a specific context for participants or ask whether students have specific instances in mind when the respond to these surveys.

Another reason behind the conflicting results of the above studies might be that the students were not accurate in assessing their use of the cognitive and metacognitive strategies. Therefore, other methods for collecting data about students' use of cognitive and SRL strategies are needed. Moreover, students' actual use of these strategies, along with the direct effect of the use of the strategies on learning in an actual learning context, should be examined to verify the relationships among students' beliefs, strategy use and their academic performance.

3.2 Research Questions and Hypotheses

The current study expands the work of several empirical studies (e.g., Ryan, 1984; Schommer, 1990; Schommer et al., 1992). That is, it investigated the relationship between university students' beliefs about knowledge and learning, and the standards they used to monitor and estimate their understanding as they studied a text (Ryan, 1984). However, in this study a specific learning context was provided for students to report their monitoring standards with reference to that context. This, I contend, may help students to be more accurate in reporting the frequency and type of their monitoring standards. Moreover, studying this relationship in context made it possible to investigate the direct relationship between students' beliefs and their learning outcomes as measured by achievement on a test related to the text they studied. I argue this method of measuring learning outcomes is more precise than using general academic achievement given the developmental nature of these beliefs over time. Further, the current study expands Schommer and colleagues' work. In the current study, students' beliefs about knowledge and learning were assessed at two levels: the abstract general level, and the contextual level (in relation to a specific area of inquiry). This approach made it possible to evaluate which of the students' beliefs is more related to their achievement. Moreover, the current study expands research that examined the relationship between students' beliefs about knowledge and learning, and their use of cognitive and metacognitive processes and strategies. Specifically, this study investigated the relationship between students' beliefs, their use of learning tactics, and their ability to estimate their understanding of the text materials. Students' use of learning tactics was collected using the traces method.

Specifically, the current study aimed at answering the following question: Are students' general beliefs about knowledge and learning different from their beliefs about knowledge and learning in a specific context? If differences exist, which type of beliefs is related to what they study in a text and how they study from a text? More specifically, is there a relationship between students' beliefs about knowledge and learning and their use of study tactics, the type and number of standards they use to monitor their understanding when they study, their high confidence about their understanding of the text materials, and their achievement on the knowledge test?

In the light of the theoretical accounts presented in the previous chapter, and results of the empirical studies reviewed in this chapter, one can reasonably hypothesize that students hold beliefs about knowledge and learning at different levels of specificity. Regarding the two levels under investigation in the current study, I hypothesize that students' beliefs that are related to a specific context predict students' achievement more than beliefs at the general level. Regarding the relationship among students' beliefs, their use of learning tactics, and their metacognitive practices, two main hypotheses were formed and tested. First, holding sophisticated beliefs about knowledge and learning would associate with (a) the use of generative study tactics that reflect deep processing (e.g., creating notes or summaries), (b) productive metacognitive practices (their use of comprehension standards for comprehension monitoring, and ability to accurately assess their understanding), and (c) desirable learning outcomes (achieving high on the knowledge test). Second, in contrast, holding naïve beliefs about knowledge and learning would associate with (a) the use of less-generative study tactics that reflect surface processing (e.g., highlighting), (b) less productive metacognitive processes (the use of

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knowledge to monitor their comprehension, high confidence about their understanding),

and (c) undesirable learning outcomes (low achievement on the knowledge test).

Chapter 4:
Methodology

4.1 Participants

A sample of 50 undergraduate students at Simon Fraser University volunteered to participate in the study. All participants were enrolled in an introductory Educational Psychology course during the Spring semester of 2005. Students who agreed to participate signed the university ethics approval form (see Consent Form, Appendix A). To compensate for their participation all students were paid $20.

Participants' ages were between 19 and 47 with a mean of 23.56 (SD=6.97), and % 84 of them were females. The average self-reported cumulative grade point average was 2.77 (SD=.47) with a range from 2 to 3.9. Of the 50 students, 15 reported that they learned English as a second language. The average reported age these students learned to read and write English was 7.1 (SD=3.49) with a range from 3 to15. Students declared their major and minor in different disciplines; 7 students did not declare their major and 26 students did not declare their minor. Participants' academic majors and minors are shown in Table 4.1. Four students were enrolled in their first year, 14 students in their second year, 16 in their third year, 10 in their fourth year, and 6 were graduated but enrolled in this course as a requirement for the Professional Development Program in the Faculty of Education.

Table 4.1: Participants' Academic Major and Minor

Academic Major	Frequency	Academic Minor	Frequency
Business	2	Counseling	1
Computing Sciences	1	Criminology	1
Education	2	Education	11
English	12	English	3
French	3	Fine art	1
History	4	French	1
Kinesiology	1	History	1
Linguistics	2	Humanities	1
Psychology	14	Linguistics	1
Science	1	Mathematics	1
Theatre	1	Politics	1
N/A	7	Psychology	1
		N/A	26

N/A: students did not declare an academic major or minor.

4.2   Materials and Instruments

4.2.1   Demographics Questionnaire

A questionnaire was designed to record various demographic characteristics of the participants: sex, age, cumulative grade point average, and academic major and minor. In addition, students were asked to report whether English is their first language, and if not, at what age they learned to read and write English. The demographics questionnaire is presented in Appendix B.

4.2.2   Epistemic Beliefs Inventory

The Epistemic Belief Inventory (EBI; Schraw, Bendixen & Dunkle, 2002) was used to measure students' beliefs about knowledge and learning. The inventory includes 28 self-report items designed to measure students' beliefs on the five dimensions proposed by Schommer (1990). These dimensions are: simple knowledge (i.e.,

knowledge consists of discrete facts), certain knowledge (i.e., absolute knowledge exists

and will eventually be known), omniscient authority (i.e., authorities have access to

inaccessible knowledge), innate ability (i.e., the ability to acquire knowledge is endowed

at birth), and quick learning (i.e., working on a problem with no quick solution is a waste

of time). Students rated each item on a five-point rating scale ranging from "strongly

disagree" (a rating of 1) to strongly agree (a rating of 5).

Research using the EBI has supported that it has better reliability in the contexts

where it was used, and provides a stronger foundation for the construct and predictive

validity of interpretations than Schommer's (1990) Epistemological Questionnaire

(Schraw et al., 2002). In Schraw et al.'s study, internal consistency coefficients for the

five subscales ranged from .58 to .68, and test-retest reliability estimates over a period of

one month ranged from .62 to .81. Factor analysis of the items revealed five factors. Each

of the factors was conceptually distinct and all items that loaded on individual factors

were related logically to the relevant construct. Four of the five EBI dimensions were

modestly, though significantly, related to the test of reading comprehension.

The internal consistency for EBI dimensions was calculated in the current study.

Table 4.2 shows the reliability coefficients.

Table 4.2: The Number of Items, Reliability Coefficients of EBI Dimensions calculated in the Current Study.

Dimension	Number of Items	Cronbach Alpha
Simple Knowledge	7	.53
Certain Knowledge	7	*
Omniscient Authority	4	.71
Innate ability	6	.55
Quick Knowledge	4	.66
All EBI items	28	.76

N =50, * small value approaches zero.

4.2.3 Contextualized EBI

For the purpose of this study, the contextualized version of the EBI (Schraw et al., 2002) was developed and used to assess students' beliefs related to the topic of the chapter. It included 28 self-report items designed to measure students' beliefs on the five dimensions measured by the original EBI. Twenty-three items were taken from the original EBI, and 5 new items were added to the instrument. The new items and the dimension each item intended to reflect are shown in Table 4.3.

Table 4.3: The New Items Added to the Contextualized EBI.

Item	Dimension
If social psychologists work hard, they will find the best way to control these harmful behaviors.	Omniscient Authority
Social psychologists know the reason of why people behave in a certain way	Omniscient Authority
There are only a fixed number of causes for these harmful behaviors.	Certain Knowledge
In the future, people might discover other motives for harmful behaviors.	Certain Knowledge
There is always one best method for changing harmful behaviors.	Certain Knowledge

The topic of harmful behaviors is referenced within 23 items of the questionnaire, for example, "What is true about the causes of these behaviors today will remain true in

the future." The remaining 5 items were taken literally from the original EBI because they are related to the innate ability dimension, and contextualizing those items is not appropriate. For example, "People's intellectual potential is fixed at birth." The contextualized version instructed the students to keep harmful behaviors like aggression and bullying in mind: "Please think about harmful behaviors like aggression and bullying when you respond to this questionnaire." Furthermore, respondents were provided with a definition of aggression and bullying: "Aggression is intentional infliction of some type of harm upon others. Bullying is a pattern of behavior in which one individual is chosen as the target of repeated aggression by one or more others; the target person (the victim) generally has less power than those who engage in aggression." Students respond on a Likert scale ranging from 1 strongly disagree to 5 strongly agree.

Two experts in the field (educational psychology professors) tested the face validity of the contextualized EBI. The experts commented on the clarity of each item and it's relation to the measured dimension. The experts' comments were taken into consideration when the final version of the measure was prepared. The internal reliability was calculated for items composing each dimension and for the whole instrument. Examination of Cronbach alpha indicated that deleting four items (2, 3, 22, 26), from the instrument would improve the internal reliability. All four items were taken from the original EBI and were referenced to harmful behaviors. The contextualized EBI is shown in appendix C. The internal reliability coefficients after the four items were omitted from the instrument are shown in Table 4.4.

Table 4.4: **The Number of Items, Reliability Coefficients of the Contextualized Dimensions.**

Contextualized EBI Dimensions	The Number of Items	Cronbach Alpha
Simple Knowledge	5	.66
Certain Knowledge	7	.64
Omniscient Authority	3	.73
Innate ability	6	.74
Quick Learning	3	.74
All items	24	.83

4.2.4   Nelson Denny Test

Vocabulary and reading comprehension tests often have been used by researchers in text-processing studies as rough indicators of participants' verbal ability. The Nelson Denny test was administered in the present study to determine whether subsequent differences in achievement scores or strategy use could be attributed to pre-existing differences in verbal ability. This test consists of two parts. Part I, the vocabulary test, consists of 80 items. Each item presents an opening statement. The respondent selects from five vocabulary items to complete the statement. Part II, the comprehension test, consists of seven reading passages with a total of 38 questions. Due to time limitations in the current study, only 40 items from the vocabulary test and four passages (with 20 questions) from the comprehension test were used. When the Nelson Denny test is used to assess reading rate, participants are limited to 15 minutes to complete the vocabulary test and 20 minutes to complete the comprehension test. In the current study, students were given 25 minutes to complete the test because reading rate was not considered and a subset (not the whole test) was used.

Students responded to the test items using separate answer sheets. The maximum possible score on the vocabulary test was 40 and on the comprehension test was 20. The minimum score was zero for each test.

4.2.5   Prior Knowledge Test

A test of 15 items was devised to measure students' prior knowledge related to aggression, the topic they would study. Eight items related directly to the chapter content and seven items related to other social psychology topics to avoid cuing students to the topic of the study chapter. The statements for the prior knowledge test were based on an introductory social psychology textbook. For each of the fifteen items students indicated whether the statement is "true," "false" or, "I do not know." The score on the prior knowledge test was computed by the number of correct responses. Incorrect responses and "I do not know" responses were considered as lack of knowledge of the topic. The prior knowledge test is shown in Appendix D. The maximum possible score on the prior knowledge test is 15 (i.e., one point for each correct response). The 15 items had an internal consistency coefficient (alpha) of .68. The 8 items related to aggression had an internal consistency of .62.

4.2.6   Study Chapter

A 2000 word chapter from an introductory social psychology book (Baron, Byrne, & Watson, 2005) was used as study material. The chapter was organized into two sections; the first section presented four possible theories that explain the causes of aggression with the underlying theme being that a plausible theory of aggression requires the integration of aspects of all four theories. The content presenting this resolution was

omitted from this section for the purpose of the current study. The second section presented four methods to control aggression. This section implicitly showed that none of these methods could be determined as the best method for preventing and controlling aggression.

The rationale for using this text which includes controversial theories about the causes of aggression is that the structure of the learning task may play a critical role in determining the effect of students' beliefs on their performance. It has been argued that students can intentionally bring these beliefs to bear on the process of learning difficult controversial topics. Specifically, these beliefs may lead learners to weigh evidence, compare ideas, and integrate view points in order to understand the topic (Sinatra, Southerland, McConaughy, Demastes, 2003). Thus, previous research that aimed at investigating the effect of students' beliefs on their learning from a text consistently used texts that required the learner to draw conclusion from mixed, inconclusive information about a controversial topic (e.g., Kardash & Scholes, 1996; Schommer at el. 1992).

4.2.7   Interest, Difficulty and Familiarity Ratings

All participants rated the text in terms of its interest, difficulty, and familiarity on a 5-point scale (1 =very boring, very difficult, and completely unfamiliar, respectively; 5 =very interesting, very easy, completely familiar, respectively).

4.2.8   Comprehension Monitoring Survey

To assess comprehension monitoring, students were asked to respond to one item to rate how well they understood the chapter. The 5-point rating scale ranged from 1 (did not understand at all) to 5 (completely understood the chapter). These comprehension

ratings were used to measure the level of students' calibration, that is, the relation between learners' judgement of understanding the text and their performance as measured by the knowledge test). Following a procedure used by Schommer et al.(1992), the level of understanding reported by students was regressed on their knowledge test scores to obtain an estimate of normative calibration. The resulting model was used to compute predicted test scores for participants (predicted test score = 9.367 + 1.565*level of understanding). The predicted test score was subtracted from the actual test score for each participant (actual knowledge test score - predicted test score). The resulting values were positive for students who provided a relatively high estimate of understanding (high confidence), and negative for students who provided a relatively low estimate (low confidence).

The instances in which students showed high confidence about their comprehension were the focus of this analysis because, if students underestimated their comprehension and did well on the knowledge test, that is not a problem. On the other hand, high confidence might, in theory, make students stop studying before they fully comprehend the material. For this reason, a new dichotomous variable named high confidence (0, 1) was created as follows: High confidence =1, if the difference between the actual test score and the test score predicted by regression is > =1; and high confidence = 0, if the difference between the actual test score and the test score predicted by regression is <1.

4.2.8.1 Comprehension Monitoring Standards Type

Students responded to a question: "What criteria did you use to determine your level of understanding?" to collect data about criteria (standards) they used to determine

their level of understanding when they studied the chapter. Students were given some examples of these standards (e.g., I spent considerable time studying, I could recite the important points in the chapter, and I could apply the new information to real life settings). In addition, students were instructed that they could list as many additional standards as they wished to describe how they monitored their comprehension. The reported standards were analyzed using Ryan's (1984) dichotomy of analyzing comprehension monitoring standards into knowledge and comprehension standards. However, because some participants in the current study reported standards that reflect time, a third category (i.e., time standards) was defined in analyzing students' reported standards. Two graduate students from the Faculty of Education at Simon Fraser University worked individually in coding the standards into three types: knowledge standards, which reflect recitation of the important points presented in the chapter (e.g., I could recall the concept); application standards, which reflect constructing conceptual relationships, manipulating and applying the material to previous or new situations (e.g., The amount of examples and concepts I can relate and come up with in relation to the material); time standards, which reflect time spent on studying (e.g., The time I spent studying was long). The inter-rater agreement between coders was calculated to determine whether the coders were consistent in their coding by computing the percent of agreement between the coders (the number of agreements between the coders divided by the total number of standards reported by students). The agreement percentage was .93. The coders discussed and resolved disagreements.

4.2.8.2 Comprehension Monitoring Standards Numbers

The number of comprehension monitoring standards reported by students was counted. The maximum number of standards reported by a student was 5 and the minimum was 1. The Interest, Difficulty, Familiarity Ratings, and Comprehension Monitoring Survey are shown in Appendix E.

4.2.9 Knowledge Test

A knowledge test was prepared for the aggression chapter. The test was composed of 10 multiple-choice items and 3 essay questions. Seven multiple-choice items were selected from the study guide associated with the social psychology textbook. Three multiple-choice items and three essay questions were written for the purpose of the current study. All multiple-choice items required recall of factual information. The essay questions required applying and synthesizing main ideas in the chapter. The knowledge test is shown in Appendix F. The maximum possible score on the knowledge test was 20; 10 points for the 10 multiple-choice items, and 10 points for the three essay questions. The alpha internal consistency of the multiple-choice items was .71.

4.2.10 WebQuestionnaire

WebQuestionnaire (Hadwin, Murphy, Nesbit & Winne, 2004) is an online tool that was used to collect participants' responses on the Demographics Questionnaire, Original EBI, Contextualized EBI, and Prior Knowledge Test. Participants were provided with passwords that allowed them to access the WebQuestionnaire and fill in the questionnaires. This online tool was used to allow the participants to respond to the questionnaires at a convenient time and place.

4.2.11 gStudy

gStudy (Winne, Hadwin, Nesbit, Kumar, & Beaudoin, 2005) is a software tool for researching learning. Researchers can assemble content (hyperlinked text, graphics, and video) into kits displayed in the web browser. Researchers can manipulate the structure and behavior of a kit's elements to operationalize experimental variables corresponding to research hypotheses (Hadwin, Nesbit, Jamieson, Winne, & Kumar, 2005). When students use gStudy to study a text, they can use different study tools, including: making notes based on a choice of template (e.g., question and answer, summary, etc.), a "quicknote" feature that classifies information by properties (e.g., important, don't understand, review this, etc), construct new glossary entries, and make links to assemble information within and across elements of the content. As students perform actions on the content, the software builds log files that trace and timestamp every instance of the students' active engagement with content. The log files are saved on the server at the end of the study session. In the present study, gStudy was used by students to study the aggression chapter.

4.2.12 LogReader

LogReader (Hadwin, Winne, Nesbit, & Murphy, 2005) is a tool kit for analyzing gStudy log data. LogReader was used to compile and analyze students' log files (i.e., the data generated by students as they studied the chapter using gstudy).

The result of analyzing the log files is a detailed description of the studying session including the type, the duration, and the sequence of study events, plus the actual data that was input by the users. To examine if the students engaged in deep processing of the material or remained at the surface level, both the type of events (i.e., study tactics

such as highlighting or creating a note) and the students' input (i.e., the content of the note) were considered. Data organized by the LogReader software about the type and the frequency of the tactics students used during the study session were used to classify study tactics into generative and less generative tactics. Also, the content of the notes generated by participants as they studied were compared with the text they studied to differentiate instances where students summarized, paraphrased and elaborated on the content, and other instances where students merely copied text from the chapter to create a note. Specifically, study tactics were classified into two types:

1. *Less-Generative tactics that encourage surface level of processing*: the use of this type of tactics was operationally defined as the number of times students used highlight, quick note, or verbatim copy of a text to a note when they study. However, I found that in some cases when students used the *quicknote* feature they actually input a detailed note there. Because of these instances, the content of the q*uicknotes* were checked to determine if the participant generate a quicknote that is just a label given to a specific proportion of the text (e.g., important, reread...), or she input information that can be considered as a generative note (i.e., summarizing, elaborating, or paraphrasing).

2. *Generative tactics that encourage deep level of processing*: the use of this type of tactic was operationally defined as the number of times students created a note in which they summarized, paraphrased, or elaborated on the text content. To count these instances, the content of the notes, name link, concept link, and quick note were reviewed to identify instances that matched the above definition. The content of these notes was compared with the actual text

4.3   Procedure

Students who enrolled in the Educational Psychology course received passwords and usernames to access WebQuestionnaire. They used this tool to complete some educational psychology questionnaires including EBI. As part of the course requirements, students received a 50-minute training session on how to use gStudy. Later, students used gStudy to study a chapter from the course textbook to complete a course assignment. After experience using both tools (i.e., WebQuestionnaire, and gStudy) students were invited to participate in this study. Students who agreed to participate signed a consent form and chose a 2-hour time slot to participate in a study session. One day before the study session, students received an e-mail instructing them to access WebQuestionnaire and to complete the demographics questionnaire, the prior knowledge test, and the contextualized form of EBI. Students participated in the study session in groups of three to 12 students at a time. Before starting the study session, participants completed the Nelson Denny test. After that, participants were instructed that they have up to 50 minutes to study the aggression chapter and were informed that after studying the chapter they would take a test related to the chapter. Following the study session, participants rated the chapter in terms of its interest, difficulty, and familiarity. Students also responded to the Comprehension Monitoring Survey and the Comprehension Monitoring Standards Survey. After a 10-minute break, participants completed the knowledge test. Upon completing all the research activities students received $20 compensation.

LogReader was used to analyze the data collected during the gStudy session (students' log files). SPSS was used to analyze the data collected in this study. The results are presented in Chapter 5.

Chapter 5:
Results

The first purpose of this study was to examine if students' general beliefs about

knowledge and learning are different from their beliefs about knowledge and learning

that are related to a specific context. Further, if differences exist (i.e., there are two

distinguishable levels of beliefs, general and specific), then which level of beliefs is more

related to students' learning? The second purpose of this study was to investigate whether

students' beliefs about learning and knowledge are related to how they self-regulate their

studying. Specifically, this study was aimed at investigating the relationship of students'

use of learning tactics, their metacognition, and achievement to a multidimensional

measure of their beliefs about learning and knowledge.

Results are presented in two main sections. The first section reports results for the

first question, which asked: Are students' general beliefs about knowledge and learning

different from their beliefs about knowledge and learning related to a specific subject

(i.e., the causes and preventions of harmful behaviours)?" The second section reports

results relevant to answering the general question: Is there a relationship between

students' beliefs about knowledge and achievement, and what and how they study from a

text? To answer this question, answers to the following questions are reported: First, is

there a direct relationship between students' beliefs about knowledge and learning and

their achievement on the knowledge test? Second, are students' use of learning tactics

(i.e., generative tactics that reflect deep processing, less-generative tactics that reflect

surface processing) related to their beliefs about knowledge and learning, and to their achievement on the knowledge test? Third, are standards students use to monitor their achievement on the knowledge test related to their beliefs about knowledge and learning, their use of study tactics, and their achievement on the knowledge test? Fourth, is students' high confidence about their understanding related to their beliefs about knowledge and learning, their use of learning tactics, and their achievement on the knowledge test?

For each section, the research question is presented as a subtitle followed by the related results. Results are not interpreted or discussed in this chapter. Discussion and interpretation of results are presented in chapter 6.

Before reporting the study results, it is important to highlight some issues that might affect the interpretation and generalization of these results. The limited number of participants constrained the capacity to test certain hypotheses using quantitatively more revealing methods. For example, a sample size of 50 participants precluded using factor analysis techniques to determine the number and nature of the contextualized EBI and the original EBI dimensions.

Moreover, on some occasions in the current study, a single hypothesis of no relationship was tested using several tests. In order to be able to reject the null hypothesis (if one of the tests was statistically detectable at $p \leq .05$), the alpha value was lowered to account for the number of tests being performed. This is to ensure that the overall chance of making a type I error is still less than the traditional .05. According to Bonferroni's correction method, if k is the number of independent significance tests at the x level, the probability p that no significant differences will be found in all these tests is the product

of the individual probabilities: $(1 - x)^k$. In the current study, a maximum of 20 statistical tests was used to determine the similarity between the contextualized and the original form of EBI, with $\alpha= 0.05$, $p = 0.95^{20} =.36$. This means that there is a 64% chance that one of these 20 tests will be classified as statistically detectably different from zero despite each individual test being at $p \leq 05$. To guarantee the overall significance test is still at the desired x level, the significance level α' of the individual test was adapted according to the following formula: $x' = x/\, k$. The adjusted x according to Bonferroni's correction for these tests $(x'= .0025)$ is used to avoid the overall chance of making a type one error (Curtin & Schulz, 1998). However, because Bonferroni's correction is very conservative and there is a trade off between avoiding type one errors and making type two errors, I also included the unadjusted criterion ($p< .05$, $p< .01$) when reporting results.

5.1 Are Students' General Beliefs about Knowledge and Learning Different from their Beliefs' about a Specific Subject?

Several methods were used to answer this question. First, differences between students' responses to the original EBI that assessed students' beliefs at the general level, and the subject specific or "contextualized" form of EBI were evaluated. Second, the consistencies of the level of sophistication across the two forms of the EBI were examined. Third, the differences between the forms of EBI (i.e., the original and the contextualized) as predictors of achievement on the knowledge test were tested.

It is important to note that none of these methods when used individually is sufficient to answer the question. However, the aggregate of results from these methods

provides an adequate technique for testing the possible existence of the two different levels of beliefs about knowledge and learning.

5.1.1 Preliminary Analyses

Prior to data analysis, a check on accuracy of data entry and missing data for the data set was done through SPSS Frequencies.

Before calculating the dimension (subscale) scores for both EBI forms, scores on positively worded items were reversed. Items (2, 6, 19, 22, and 28; items are presented in Appendix C) from the original EBI and items (2, 6, 9, 22, 26, and 28) from the contextualized EBI were reversed. Means and standard deviations are presented in Table 5.1 for the five dimensions of the original and the contextualized EBI.

Table 5.1: Means and Standard Deviations of EBI Dimensions

Dimension	Original EBI		Contextualized EBI	
	Mean	SD	Mean	SD
Simple Knowledge	2.76	.52	2.75	.65
Certain Knowledge	2.54	.43	1.97	.48
Omniscient Authority	3.07	.52	2.70	.71
Innate Ability	2.79	.57	2.89	.67
Quick Knowledge	1.93	.68	1.63	.60

The mean values on simple knowledge and innate ability dimensions are fairly close across the two assessment forms. The relatively low mean values on the quick knowledge dimension suggest a tendency towards more sophisticated beliefs on this dimension across assessment forms. In contrast, the comparatively high mean values of simple knowledge, omniscient authority, and innate ability suggest a tendency towards

more naïve beliefs on these dimensions across assessment forms. The mean value on the certain knowledge dimension reflects more sophisticated beliefs on the contextualized EBI form than on the original EBI form.

Means and standard deviations for the knowledge test, and the prior knowledge test are presented in Table 5.2.

Table 5.2: Means and Standard Deviations of the Prior Knowledge and the Knowledge Test

Test	Mean	SD
Knowledge Test	15.72	2.63
Prior Knowledge About Aggression	2.16	1.28
Prior knowledge	4.78	2.13

Participants =50

As mentioned in chapter 4, the highest possible score on the prior knowledge test is 8 for the items related to aggression, and 15 for the whole prior knowledge test (the 8 aggression items and 7 items related to social psychology topics). The mean value of students' scores on the prior knowledge test suggests that students have low prior knowledge related to the topic of aggression and social psychology topics in general.

5.1.1 Differences in Students' Responses on the Dimensions of the Original and the Contextualized EBI

The differences between students' responses on the original EBI dimensions and the contextualized EBI were tested as follows. To check the pattern of internal relationships between dimensions within each form of assessment, Pearson's correlations between the Original EBI dimensions and between the Contextualized EBI dimensions were calculated. Table 5.3 shows the correlation coefficients and the p-level of these correlations.

Table 5.3: Correlation Coefficients Among the Five Dimensions of the Original EBI, and the Contextualized EBI

Dimensions	Simple Knowledge		Certain Knowledge		Omniscient Authority		Innate Ability	
	Original	Contextual	Original	Contextual	Original	Contextual	Original	Contextual
Simple knowledge								
Certain knowledge	.12	.35						
Omniscient Authority	.37 [b]	.25	-.06	.29				
Innate ability	.28 [a]	.20	.30 [a]	.30 [a]	.12	.19		
Quick Learning	.58 [c]	.47 [c]	.09*	.61 c*	.49 [c]	.31 [a]	.40 [b]	.35 [a]

Annotated correlations were statistically detected as greater than zero: [a] $p < .05$, [b] $p < .01$, [c] $p < 0.0025$. The % 95 confidence interval around the corresponding dimensions does not overlap *

To evaluate if the two forms of assessment possess similar patterns of internal relationships among their dimensions, confidence intervals around each correlation were computed. Overlaps between the confidence intervals around the corresponding correlation coefficients were used as an indication of no differences between the two correlation coefficients. All the confidence intervals around the corresponding correlation coefficients overlapped, except for the correlations between quick learning and certain knowledge. The confidence interval around the correlation coefficient of the original dimensions was ($-.20 \leq r \geq .37$), whereas the confidence interval around the correlation coefficient of the contextualized dimensions was ($.40 \leq r \leq .77$). Overall, this indicates that the pattern of correlation among EBI dimensions is quite similar to that of the contextualized form; however, they are not identical.

To test if the corresponding pairs of dimensions from both forms of assessments are equivalents, Pearson correlations were performed between dimensions of the original EBI and their correspondent contextualized EBI dimensions. Table 5.4 shows the results.

Table 5.4: Correlations between the Original and the Contextualized EBI Dimensions

Dimensions	Correlation Coefficients
Simple Knowledge	.57 [c]
Certain Knowledge	.21
Omniscient Authority	.24
Innate Ability	.51 [c]
Quick Learning	.40 [b]

Annotated correlations were statistically detected as greater than zero: [b]$p < .01$, [c]$p < 0.0025$.

As shown in the above table, the correlations between three corresponding pairs of dimensions were statistically detectable, i.e., simple knowledge, innate ability, and quick learning. Although these correlations were substantial, they were not as strong as test-retest correlations. Moreover, the correlations between two corresponding pairs of dimensions were not statistically detectable, i.e., the certain knowledge and omniscient authority dimensions.

Although these results provided some support that the contextualized and the original forms of EBI are similar, it did not support that they can be used alternatively to measure students' beliefs.

5.1.2 Consistency between Levels of Sophistication across the Corresponding Domains of the Two Assessment Forms

To test if the levels of sophistication between the corresponding pairs of domains (i.e., of the original and the contextualized) were consistent, paired samples t-tests were performed. The t-tests revealed statistically detectable differences on three dimensions:

certain knowledge, t (49) = 6.97, p=.001, omniscient authority, t (49) = 3.33, p=.002, and

quick learning, t (49) =3.06, p=.004. However, no statistically detectable differences were

found between simple knowledge and innate ability dimensions across the two forms of

EBI.

5.1.3 Differences between the Two Forms of Assessment in Predicting Achievement

To test which of the two forms of assessment (i.e., the original EBI and the

contextualized) is better in predicting students' knowledge test scores, sequential

regressions were performed. In sequential regression, independent variables (IVs) are

given priorities and entered into the regression equation either by themselves or in blocks

according to some practical or theoretical rationale. The degree of relationship between

the dependent variable (DV) and IVs is reassessed at each step to see if prediction of DV

is enhanced after adjusted for variables entered in the previous step. In other words, this

technique makes it possible to assess each IV in terms of what it adds to the prediction of

DV at its own point of entry (Tabachnick & Fidell, 2001).

For each EBI dimension, a sequential regression was performed by entering the

original EBI dimension first followed by the contextualized dimension. The practical

rationale for this approach was to test the predictive power of each contextualized EBI

dimension after eliminating the original EBI dimension from the equation. The regression

results are shown in Table 5.4.

Table 5.4   **Sequential Regression of the Contextual and Original Beliefs Dimensions on Knowledge Test Scores**

Dimension	Predictors	F Model	B
Simple Knowledge:			
Step1	Original EBI	4.62 [a]	-.30 [a]
Step2	Original EBI		-.28 [a]
	Contextualized	2.28	-.03
Certain Knowledge:			
Step1	Original EBI	.001	*
Step2	Original EBI		-.08
	Contextualized	3.91 [a]	-.39 [b]
Omniscient Authority:			
Step1	Original EBI	6.34 [b]	-.34 [a]
Step2	Original EBI		-.27
	Contextualized	6.18 [b]	-.31 [a]
Innate Ability:			
Step1	Original EBI	.44	-.10
Step2	Original EBI		-.22
	Contextualized	1.32	-.24
Quick Learning:			
Step1	Original EBI	4.22 [a]	-.28 [a]
Step2	Original EBI		-.14
	Contextualized	5.29 [b]	-.35 [b]

Note. Separate regressions were carried out to determine model significance for each dimension. [a] $p < .05$, [b] $p < .01$. * A very small value approaches zero.

As shown in the table above, statistically detectable models formed when the contextualized dimension of Certain Knowledge, Omniscient Authority, and Quick Learning were entered. The increments in R^2 were statistically detectable at ($p < .05$, or, $p < .01$) for these models. In other words, the contextualized Certain Knowledge, Omniscient Authority, and Quick Learning dimensions are better predictors of achievement than the original EBI equivalent dimensions. However, the use of the contextualized assessment of Simple Knowledge did not improve the prediction of achievement. Consequently, the original Simple Knowledge dimension was a better

predictor of achievement than the contextualized dimension. Yet, results showed that both forms of assessment (i.e., the contextualized and the original EBI) for the Innate Ability dimension failed to predict knowledge test scores significantly.

Altogether, results of all the above sections did not support the assumption that the two forms of assessment are equivalent. On the contrary, the compilation of evidence generated by the above testing methods gave more support to the assumption that there is some hierarchical multilevel structure of beliefs. In other words, the results differentiated between two levels of students' beliefs: beliefs about knowledge and learning related to the context under investigation, and beliefs about knowledge and learning in general. The results also supported the assumption that students' beliefs that are related to a specific context predict students' achievement more than beliefs at the general level. Accordingly, a decision has been made to continue using the contextualized form of EBI to answer the other research questions.

5.2 Is there a Relationship between Students' Beliefs about Knowledge and Learning and What and How they Study from a Text?

The second purpose of this study was to investigate whether students' beliefs about knowledge and learning are related to how they self-regulate their studying. Particularly, the relationships between students' beliefs about knowledge and learning, their use of learning tactics, their metacognitive processes, and their achievement on the knowledge test when they study a text were all tested. Results are reported as answers for the following questions. First, is there a direct relationship between students' beliefs about knowledge and learning, and their achievement on the knowledge test? Second, are students' use of learning tactics (generative and less-generative tactics) related to their

beliefs about knowledge and learning, and to their achievement on the knowledge test? Third, are students' standards for monitoring their achievement on the knowledge test related to their beliefs about knowledge and learning, and to their achievement on the knowledge test? Fourth, is students' high confidence about their level of understanding related to their beliefs about knowledge and learning, and to their achievement on the knowledge test?

3.2.1 Is there a Direct Relationship between Students' Beliefs about Knowledge and Learning and their Achievement on the Knowledge Test?

To answer this question, a set of background variables that might theoretically account for students' achievement on the knowledge test was defined and entered into the equation as a block before the five contextualized dimensions of students' beliefs about learning and knowledge were entered. The rationale for using this hierarchical method was to examine if one or more of the beliefs dimensions contribute to predicting knowledge test scores beyond the contribution made by the other predictors (i.e., the background variables). The set of background variables included prior knowledge as measured by items related to the aggression topic, verbal ability as measured by vocabulary and comprehension tests, and the levels of familiarity, interest, and difficulty of the chapter measured by one item with a five-point rating scale.

Prior to analysis, all variables were examined through SPSS Frequencies for accuracy of entry and missing values. SPSS Regression and Residual Scatterplots were used to examine the assumptions of multiple regression (Tabachnick & Fidell, 2001). Preliminary screening of all variables through Frequencies and residuals indicated no

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violating of multiple regression assumptions. The multiple regression results are shown in Table 5.5.

Table 5.5: Sequential Regression of the Dimensions of Students' Beliefs about Knowledge and Learning and Background Variables on the Knowledge Test Scores

Criterion	Predictors	R^2	F	B	t
Achievement on the Knowledge Test	Model 1:	.41	6.10 [b]		
	Level of Familiarity			-.53	
	Level of Difficulty			-.26	
	Level of Interest			.13	
	Prior Knowledge			-.11	
	Verbal Ability			.49	
	Model 2:	0.50	3.91 [b]		
	Level of Familiarity			-.04	-.28
	Level of Difficulty			-.28	-2.17[a]
	Level of Interest			.08	.62
	Prior Knowledge			-.09	-.77
	Verbal Ability			.45	3.46[b]
	Simple Knowledge			.19	1.36
	Certain Knowledge			*	*
	Omniscient Authority			-.10	-.43
	Innate Ability			.01	.06
	Quick Learning			-.33	-2.10[a]

Annotated values were statistically detected as greater than zero: [a] $p < .05$, [b] $p < .01$.
* Very small value approaches zero.

The regression results showed that R was significantly different from zero after each step. At the end of the first step, the background variables in the equation, the model could explain 41% of the variance in the knowledge test scores $R^2 = .41$, F (5, 44) =6.1, p<.02. At the end of the second step with all variables (the background variables, and the five dimensions of beliefs) in the equation, 50% of the variance in the knowledge test scores could be explained, $R^2 = .50$, F (10, 39) =3.91, p<.001. The results revealed that

only quick learning, level of difficulty and verbal ability made statistically detectable contributions to the prediction of knowledge test scores.

In sum, the results supported that there is a direct relationship between achievement on the knowledge test and beliefs about quick learning. This relationship between beliefs about quick learning and achievement on the knowledge test was moderate and negative with r = -.41, p=.003. This indicates that the more students believed in quick learning the more likely they achieved low grades on the knowledge tests.

5.2.2 Are Students' Use of Learning Tactics Related to Their Beliefs about Knowledge and Learning, and to Their Achievement on the Knowledge Test?

To answer this question, the relationship was tested between students' contextualized beliefs about knowledge and learning and their use of learning tactics, generative tactics that reflect deep processing, and less-generative tactics that reflect surface processing. Further, the relationship between students' use of learning tactics and their scores on the knowledge test was examined. In addition, the relationship among students' beliefs, their use of learning tactics, and their achievement on the knowledge test was also tested.

Pearson correlations were calculated to test the relationship between the five beliefs' dimensions and the two types of tactics used by students as they studied. Results showed statistically detectable positive correlations between the innate ability dimension and the use of the less-generative tactics, r= .37, p=.008. Moreover, a statistically detectable negative correlation was found between Innate Ability and the use of the generative tactics, r= -.28, p<.05. Correlation results are shown in table 5.6.

Table 5.6: Pearson's Correlations among the Use of Learning tactics, Beliefs Dimensions and the Knowledge Test

Variables	Correlation Coefficients Generative tactics	Correlation Coefficients Less-Generative Tactics
Simple Knowledge	.02	-.07
Certain Knowledge	-.04	.06
Omniscient Authority	-.15	.12
Innate Ability	-.28 [a]	.37 [b]
Quick Learning	-.10	.23
Knowledge Test	.33 [a]	-.15

Annotated correlations were statistically detected as greater than zero: [a]$p<.05$, [b]$p <.01$.

Correlations between students' scores on the knowledge test and their use of generative and less-generative tactics showed statistically detectable results only between achievement and the use of generative tactics, $r=.33$, $p=.02$. The relationship between the use of the less generative tactics and achievement was not statistically detectable, however.

Sequential regression was performed to examine if the use of learning tactics would improve the prediction of achievement on the knowledge test after differences in students' beliefs about knowledge and learning were accounted for statistically. Results are shown in table 5.7.

Table 5.7: **Sequential Regression of the Dimensions of Beliefs about Knowledge and Learning and the Use of Learning Tactics on the Knowledge Test Scores**

Criterion	Predictors	R²	F	R² Change	B	T
Achievement on the Knowledge Test						
	Model 1:	.25	3 [a]	.25 [a]		
	Simple Knowledge				.05	.35
	Certain Knowledge				-.16	-.98
	Omniscient Authority				-.27	-1.92
	Innate Ability				.05	.38
	Quick Learning				-.27	-1.50
	Model 2:	.33	3 [b]	.08		
	Simple Knowledge				.02	.13
	Certain Knowledge				-.19	-1.13
	Omniscient Authority				-.23	-1.71
	Innate Ability				.13	.89
	Quick Learning				-.25	-1.42
	Generative Tactics				.31	2.18 [a]
	Less-Generative Tactics				.03	.196

Annotated values were statistically detected as greater than zero: [a] $p < .05$, [b] $p < .01$.

The regression results showed that R was statistically significantly different from zero after adding the two types of learning tactics. At the end of the first step, with the five dimensions of beliefs in the equation, the model could explain 25% of the variance in the knowledge test scores $R^2 = .25$, F (5, 44) =3.00, p=.02. At the end of the second step with all variables (the five dimensions of beliefs, and the use of learning tactics) in the equation, 33% of the variance in the scores on the knowledge test could be explained, $R^2 = .33$, F (7, 42) =3.0, p=.09. Only Generative tactics contributed to the regression model, t = 2.18, p<.05.

The results revealed that the use of Generative tactics contributed to the prediction of the knowledge test scores after controlling for students' beliefs.

5.2.3 Are Students' Monitoring Standards Related to Their Beliefs About Knowledge and Learning, Their Use of Learning Tactics, and to Their Achievement on the Knowledge Test?

In the current study, participants self-reported the standards they used to monitor their understanding as they studied the chapter. Standards were analyzed and used as an indication of students' metacognitive awareness. Both the number and the type of standards (i.e., knowledge standards, comprehension standards, a combination of knowledge and comprehension standards, and time standards) were used in this analysis. (For more details about how these standards were classified, refer to chapter 4, p.76)

Pearson's correlations were calculated between the number of standards students used to monitor their understanding, the five dimensions of beliefs about knowledge and learning, achievement on the knowledge test, and the use of learning tactics. Results showed statistically detectable results between the number of standards, and the omniscient authority dimension ($r = -.42$, $p < .002$), achievement on the knowledge test ($r = .43$, $p < .002$), and the use of generative tactics ($r = .37$, $p < .01$).

Results suggest that students who believed in omniscient authorities tended to use fewer numbers of standards to monitor their understanding, and they tended to achieve lower scores on the knowledge test. Also, the results suggest that the greater the number of standards students used to monitor their understanding, the more generative tactics they deployed.

Biserial correlations were computed between the types of standards students used to monitor their understanding (i.e., knowledge, comprehension, knowledge and comprehension, and time) and the five dimensions of beliefs about knowledge and learning, achievement on the knowledge test, and the use of learning tactics. Biserial correlation is usually used to examine the relationship between a normally distributed

variable (e.g., dimensions of beliefs, achievement on the knowledge test, and the use of learning tactics) and a dichotomous variable which is not a true dichotomy (e.g., the use of knowledge standards and comprehension standards, which take values of either 0 or 1). What is meant by "not true dichotomy" is that with a more refined measure, the two categories (0 and 1) could be replaced by continuous scores.

It is important to emphasize that the biserial correlation (r_{bis}) is a projected estimate of (r) since the individual differences among students within the same group are ignored. Moreover, the biserial correlation should be treated with caution in the following cases: If the sample size is small (n<100), if the scores on the continuous variable (Y) are not normally distributed, and if the scores underlying the dichotomy are not normally distributed (Glass & Hopkins, 1984). Previous testing of the variables used in these analyses revealed no violation of normality. However, the small sample size remains a main concern when these results were reported and interpreted. Biserial correlations were computed using the following equation:

$$r_{bis} = \frac{\overline{Y_1} - \overline{Y_0}}{s_Y} \left(\frac{n_1 n_0}{u n_{\bullet}^2} \right)$$

$\overline{Y_1}$ is the mean of scores on Y of those who scored 1 on X; $\overline{Y_0}$ is the mean on Y of those who scored 0 on X; n_1 is the number of students scoring 1 on X; n_0 is the number of students scoring 0 on X; and $n_{\bullet} = n_1 + n_0$. Where u is the ordinate of the unit normal distribution at p, and p is the proportion of cases in group 1 (i.e., p=$n_1/n_{\bullet}$), s_Y is the standard deviation of all n scores on Y (Glass & Hopkins, 1984).

Results of the biserial correlations between the type of standards that students use to monitor their understanding and their beliefs about knowledge and learning are shown in Table 5.8.

Table 5.8: Biserial Correlations between the Types of Standards, the Five Dimensions of Beliefs about Knowledge and Learning

| Type of standard | Beliefs Dimensions | | | | |
	Simple Knowledge	Certain Knowledge	Omniscient Authority	Innate Ability	Quick Learning
Knowledge Standards	.31 [a]	-.03	-.16	.27	.12
Comprehension Standards	-.23	-.10	-.10	-.44 [b]	.02
Knowledge and Comprehension	.04	.07	-.30 [a]	.03	.17
Time Standards	.11	.13	-.31 [a]	.12	-.10

Annotated correlations were statistically detected as greater than zero: [a] $p < .05$, [b] $p < .01$.

Results showed a statistically detectable positive correlation between beliefs in simple knowledge and the use of knowledge standards. This indicates that students who believed in simple knowledge used knowledge standards to monitor their understanding when they studied the chapter. Moreover, the results showed a statistically detectable negative correlation between beliefs in innate ability and the use of comprehension standards. This indicates that students who believed in innate ability used comprehension standards to monitor their understanding when they studied the chapter. Another statistically detectable negative correlation was found between beliefs in omniscient authority, the use of a mixture of knowledge and comprehension standards, and the use of time standards. This indicates that students who believed in omniscient authority did not use a combination of knowledge and comprehension standards, or time standards to monitor their understanding when they studied the chapter.

In conclusion, these results indicate there is a relationship between students' beliefs about knowledge and learning and their metacognition measured by the type of standards students used to monitor their understanding.

Biserial correlations were also employed to further examine the relationship between the type of standards students used to monitor their understanding and students' achievement on the knowledge test and their use of learning tactics. Results are shown in Table 5.9.

Table 5.9: **Biserial Correlations between the Types of Standards, Achievement on the Knowledge Test and the Use of Learning Tactics**

Types of Standards	Knowledge Test	Less-Generative Tactics	Generative tactics
Knowledge Standards	-.10	.35[b]	-.55[c]
Comprehension Standards	.41[b]	-.40[b]	.82[c]
Knowledge and Comprehension Standards	.13	-.08	.34[a]
Time Standards	.36[b]	-.14	.23

Annotated correlations were statistically detected as greater than zero: [a] $p < .05$, [b] $p < .01$, [c] $p < 0.0025$

The results in Table 5.9 show a statistically detectable positive relationship between the use of comprehension standards and time standards and achievement on the knowledge test. This indicates that students who used these types of standards to monitor their understanding when they studied from the text tended to achieve high scores on the knowledge test. Moreover, there was a statistically detectable positive correlation between the use of knowledge standards and the use of less-generative learning tactics, and a statistically detectable negative correlation with the use of generative learning tactics. These results indicate that students who used knowledge standards to monitor their understanding tended to use more less-generative tactics and to use less generative

strategies. Results showed a strong positive relationship between the use of

comprehension standards and the use of generative tactics. On the other hand, results

show a moderate negative relationship between the use of comprehension standards and

the use of less-generative tactics. These relationships indicate that students who used

comprehension standards to monitor their comprehension tended to use more generative

tactics and fewer less-generative tactics. Also, results showed that students who used both

comprehension and knowledge standards tended to use generative tactics.

In conclusion, the above results revealed a moderate to strong relationship

between students' metacognition as measured by the use of standards to monitor

understanding, students' use of learning tactics, and their achievement on the knowledge

test.

Sequential regression was performed to examine if the students' metacognition

would add to the prediction of achievement on the knowledge test after differences in the

students' beliefs about knowledge and learning were accounted for. Results are shown in

Table 5.10.

Table 5.10: Sequential Regression of the Dimensions of Beliefs about Knowledge and Learning, Type and Number of Standards, and High confidence, on the Knowledge Test Scores

Criterion	Predictors	R^2	F	R^2 Change	B	t
Achievement on the Knowledge Test						
	Model 1:	.25	3.0[a]	.25[a]		
	Simple Knowledge				.05	.35
	Certain Knowledge				-.16	-.98
	Omniscient Authority				-.27	-1.92
	Innate Ability				.05	.38
	Quick Learning				-.27	-1.50
	Model 2:	.49	3.7[b]	.23[b]		
	Simple Knowledge				.08	.56
	Certain Knowledge				-.10	-.64
	Omniscient Authority				-.13	-90
	Innate Ability				.12	.90
	Quick Learning				-.38	-2.20[a]
	Number of Standards				.21	.89
	Knowledge standards				.53	.196
	Comprehension Standards				.81	2.39[a]
	Comprehension and Knowledge Standards				-.58	-2.13[a]
	Time Standards				.14	.72

Annotated values were statistically detected as greater than zero: [a] $p < .05$, [b] $p < .01$

The regression results show that R was significantly different from zero after adding the number and types of standards students use to monitor their understanding. At the end of the first step, with the five dimensions of beliefs in the equation, the model could explain 25% of the variance in the knowledge test scores $R^2 = .25$, F (5, 44) =3.00, p=.02. At the end of the second step with all variables in the equation, 49% of the variance in the scores on the knowledge test could be explained, $R^2 = .49$, F (10, 39) =3.7, p=.001. Three variables contributed significantly to regression, beliefs on quick learning,

the use of comprehension standards, and the use of both comprehension and knowledge standards.

In conclusion, the type of standard that students used to monitor their understanding contributed significantly to the prediction of the knowledge test scores after controlling for their beliefs.

5.2.4 Is Students' High Confidence about Their Understanding Related to their Beliefs about Knowledge and Learning, Use of Learning Tactics, and Achievement on the Knowledge Test?

The second method used to test the relationship between students' beliefs about knowledge and learning and their metacognition, was to use students' confidence level about their understanding as an indication of their metacognitive awareness. (For more information about how the high confidence variable was computed, please refer to chapter 4, p.75).

Biserial correlations were computed between high confidence (a dichotomous variable of 0 or 1 value) and the dimensions of beliefs about knowledge and learning, the use of learning tactics, and achievement on the knowledge test. Results are shown in Table 5.11.

Table 5.11: Biserial Correlations between High Confidence, Dimensions of Beliefs about Knowledge and Learning, and the Use of Learning Tactics

Variables	High confidence
Simple Knowledge	-.02
Certain Knowledge	.31 [a]
Omniscient Authority	.39 [b]
Innate Ability	.14
Quick Learning	.34 [a]
Generative Tactics	-.41 [b]
Less Generative Tactics	.02

Annotated correlations were statistically detected as greater than zero: [a] $p < .05$, [b] $p < .01$

The above results showed statistically detectable positive relationships between high confidence and three beliefs dimensions: certain knowledge, omniscient authority, and quick learning. These results indicate that students who believed in certain knowledge, omniscient authority, and/or quick learning tended to be high confident about their understanding when they studied the chapter. On the other hand, the negative detectable relationship between generative tactics and high confidence indicates that students who used generative tactics did not show high confident about their understanding.

Tetrachoric correlations were performed using SYSTAT 11 to examine the relationship between two dichotomous variables with underlying normal distribution. All types of standards variables and the high confidence variable are not true dichotomous variables. Correlation coefficient values are shown in Table 5.12.

Table 5.12: Tetrachoric Correlations between High Confidence and the Types of Standards

The Type of Standards	Correlation Coefficients r_{tet}
Knowledge Standards	.39 [b]
Comprehension Standards	-.60 [c]
Comprehension and Knowledge	-.10
Time Standards	-.31 [a]

Annotated correlations were statistically detected as greater than zero: [a] $p < .05$, [b] $p < .01$, [c] $p < 0.0025$

Results show that high confidence correlated positively with the use of knowledge, and negatively with the use of comprehension and time standards. The statistically detectable correlations indicate that high confidence is associated with the use of knowledge standards, i.e., students who use knowledge standards tended to show high confidence about their understanding. On the other hand, students who used comprehension and time standards did not show high confidence about their understanding when they studied the chapter.

Chapter 6:
Discussion

This section discusses the results of the current study in the light of the theoretical accounts presented in chapter 2 and the relevant empirical research presented in chapter 3. The discussion is organized under two main sections; the first section discusses the results from answering the first research question, are students' general beliefs about knowledge and learning different from their beliefs' about knowledge and learning that related to a specific context? The second section discusses the results from answering the second question, is there a relationship between students' beliefs about knowledge and learning and what and how they study form a text? Specifically, this section discusses the answers to four specific questions about the relationship between students' beliefs, their use of learning tactics, the type and number of standards they used to monitor their understanding, their high confidence about their understanding the text materials, and their achievement on the knowledge test.

6.1 The Contextual Character of Beliefs about Knowledge and Learning

The cognitive perspective of personal epistemology theorizes that there is a specific number of dimensions of epistemological thinking which are activated in all contexts, but the individual's position on any of these dimensions could vary as a function of situational and contextual features (Hofer, 2000; Pintrich, 2002). Similarly, Buehl and Alexander (2001) proposed that beliefs about knowledge and learning might be

multifaceted and multilayered with different forms and different levels. That is, students might hold sophisticated beliefs that knowledge in general is uncertain and changeable but, at the same time, they might think that knowledge related to a specific field or topic is certain and unchangeable. Likewise, Pintrich (2002) hypothesized there is some hierarchical multilevel structure of beliefs with more contextual beliefs at the bottom, followed by more general domain beliefs, and finally at the top of the hierarchy are some abstract higher-level general beliefs.

The current study tested these hypotheses, specifically whether beliefs about knowledge and learning have a contextual character (Hofer, 2000). That is, does an individual's profile of beliefs vary as a function of situational and contextual features? This study also provided some testing of the hierarchical, multileveled structure of beliefs and the applicability of these levels (Pintrich, 2002). That is, it tested students' beliefs at two different levels, the context-specific level and the general abstract level, and then examined which of these levels related to students' learning in a specific context.

In the current study, it was predicted that students' beliefs about knowledge and learning in general are different from their beliefs about knowledge and learning as related a specific topic. And, it was hypothesized that students' beliefs that related to a specific context would predict students' achievement more than their beliefs at the general level. Results from this study provide some support for all the above hypotheses.

First, results showed differences between students' responses to the original EBI that assessed students' beliefs at the general level and their responses to the contextualized form of EBI that assessed students' beliefs at the specific context level. Differences as a function of level (i.e., general and contextual) were detected between the

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patterns of internal relationships among the dimensions of beliefs. That is, while there was no relationship between students' beliefs on quick learning and certain knowledge assessed at the general level, a strong relationship was detected between the same two beliefs assessed at the contextual level. Moreover, correlations between beliefs dimensions measured at the general level and their corresponding contextual dimensions were detectable for three dimensions: simple knowledge, innate ability and quick learning. However, the correlation coefficients were moderate and were not as strong as typical test-retest correlations. These results indicate that students who believe knowledge-in general- is simple, the ability to learn is fixed at birth, and learning occurs quickly or not at all, also tend to believe the same about knowledge and learning related to a specific context (i.e., causes of and preventions from harmful behaviours). On the contrary, students who believed in general that knowledge is certain and emanated from authority did not hold the same beliefs in a specific context. That is, although students might hold naïve beliefs that knowledge in general is certain and that knowledge emanates from authority , it is not necessarily the case that they hold naïve beliefs about the certainty of knowledge related to the causes and controls of the harmful behaviour and that only experts have access to this knowledge.

Second, results showed inconsistency in sophistication across the general and the contextual levels with respect to beliefs about certain knowledge, omniscient authority, and quick learning. This indicates that students who held naïve beliefs about the certainty of knowledge, omniscient authority, and quick learning in general might hold more sophisticated beliefs about knowledge in specific domains. On the other hand, levels of

sophistication were consistent across general and specific domains for two corresponding

pairs of dimensions: innate ability and the simple knowledge.

Third, results showed differences between general and contextual beliefs as

predictors of achievement on the knowledge test. Students' scores on three contextualized

dimensions—certain knowledge, omniscient authority, and quick learning dimensions—

predicted students' scores on the knowledge test. Students' beliefs on two of these

contextualized dimensions—certain knowledge and quick learning—were better

predictors than the corresponding general dimensions of beliefs.

Taken together, these results provide some support to viewing beliefs about

knowledge and learning as multilayered (Buehl, Patricia & Alexander, 2001) or as a

hierarchical construct (Pintrich, 2002). This finding provides a plausible explanation for

some conflicting results from studies that have tested this assumption. Some studies that

used domain specific measures found evidence for the specific character of beliefs

(Buehle, Alexander, & Murphy, 2002; Hofer, 2000; Mori, 1999), while studies that used

general measures found evidence for the general character of beliefs (Schommer &

Walker, 1995). Moreover, the current research results provide some support for the

contextuality of beliefs about knowledge (Hofer, 2000). That is, students' positions on

some of the tested dimensions were shown to vary as a function of context. Further,

results also reflect the applicability of general and contextual beliefs. Contextual beliefs

seemed to affect students' learning more than general beliefs.

6.2 The Relationship between Students' Beliefs about Knowledge and Learning, and What and How They Study

Theoretically, there is a causal relationship between students' beliefs about knowledge and learning, and their academic achievement. The effect of beliefs is mediated by the use of self-regulatory strategies including the use of cognitive and metacognitive strategies (Pintrich & Hofer, 1997). According to Winne and Hadwin's (1998) Self-regulated Studying Model, beliefs about knowledge and learning are one of the factors that influence learners' perception of the learning task. Consequently, this perception affects learners' planning goal setting, and enacting specific tactics and strategies to perform the task. Beliefs also might serve as standards used by learners to evaluate their understanding. Previous theoretical accounts hypothesized that students' sophisticated beliefs about knowledge and learning enhance productive learning activities. What is meant by "productive learning activities" is tactics and strategies that encourage deep processing of study materials as well as awareness of productive metacognitive processes. Altogether, these theoretical models propose that students' beliefs about knowledge and learning influence what and how students learn.

This study tested these assumptions. Specifically, it tested the relationship between students' beliefs about knowledge and learning and their use of learning tactics, the type and number of standards they used to monitor their understanding, their high confidence about their understanding the text materials, and their achievement on the knowledge test.

6.2.1 Students' Beliefs about Knowledge and Learning and their Achievement on the Knowledge Test

It was hypothesized that beliefs about knowledge and learning affect what students learn from a text as measured by the knowledge test. Specifically, while holding

sophisticated beliefs was predicted to associate with high achievement on the knowledge test, holding naïve beliefs about knowledge and learning was predicted to associate with low achievement on the test. To test these hypotheses, the relationship between students' beliefs about knowledge and learning and their achievement on the knowledge test was examined after the effect of factors that might affect students' learning was eliminated statistically. Before controlling for the factors that might affect students' learning from a text, results showed that naïve beliefs about quick learning, certain knowledge, and omniscient authority were associated with low achievement on the test. However, after controlling for verbal ability, prior knowledge, the level of difficulty, interest, and familiarity of the study material, results showed that only a belief about quick learning was associated with achievement on the knowledge test. Students who held naïve beliefs that learning occurs quickly or not at all tended to achieve lower on the knowledge test than students who held more sophisticated beliefs about quick learning. These findings support that researchers need to consider factors that might affect students' achievement when they investigate the effect of students' beliefs on their learning. Moreover, among the investigated types of beliefs only beliefs about quick learning were found to associate with achievement. This might be because beliefs about learning affect students' learning differently than beliefs about knowledge. This result is consistent with Schommer's (1990) study in which she found that belief about quick learning was the only dimension of beliefs to associate with learning from a text. This result is consistent in part with Quian and Alvermann's (1995) findings that quick learning and beliefs about simple/certain knowledge were related to students' achievement. On the other hand, this result is inconsistent with the findings of several studies that tested the relationship

between students' beliefs and their achievement when they learn from a text (Schommer et al., 1992; Schommer & Walker, 1995; Rukavina & Daneman, 1996; Kardash & Howell, 2000; Lin, 2002; Bendixen & Hartley, 2003). However, in these studies either no efforts were made to control for factors that are known to affect learning from a text or students' beliefs were assessed at a general level which might have masked the actual effect of the specific beliefs on the context under investigation.

6.2.2 Students' Beliefs about Knowledge and Learning, and Their Use of Learning Tactics

As mentioned before, models of epistemological beliefs (Hofer & Pintrich, 1997) and SRL (Winne & Hadwin, 1998) posit that beliefs about knowledge and learning affect how people learn. Specifically, holding sophisticated beliefs about knowledge and learning would enhance productive learning activities by shaping which tactics and strategies students use to study. Study tactics and strategies involve more effortful processing related to better performance. Following this reasoning, it was hypothesized that sophisticated beliefs would associate with the use of deep productive tactics that encourage generative processing of the material and result in higher achievement. On the other hand, naïve beliefs were hypothesized to associate with the use of surface reproductive tactics that encourage less-generative processing and result in lower achievement.

Traces of students' actual use of learning tactics were collected to test these hypotheses. The traced tactics were categorized as either deep generative tactics (e.g., summarizing, paraphrasing, elaborating) or surface less-generative tactics (e.g., underlining and verbatim copying of selected words). Results supported the above

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hypotheses. Specifically, innate ability was found to positively relate to the use of surface less-generative tactics, and negatively with the use of deep generative tactics. Moreover, the use of deep generative tactics was found to positively relate to achievement on the knowledge test. It is worth noticing that no direct relationship was found between beliefs in innate ability and achievement (Please see the previous section.). However, after detecting a relationship between students' beliefs and their use of study tactics, and a relationship between the use of study tactics and achievement, one could expect that innate ability beliefs affected achievement indirectly through their effect on students' selection of study tactics. Specifically, students who held sophisticated beliefs that the ability to learn is incremental tended to use summarizing, paraphrasing, and elaborating tactics when they studied the chapter, and they tended to achieve high grades on the knowledge test. In contrast, students who held naïve beliefs that the ability to learn is fixed tended to use highlighting and verbatim copying of specific words in their notes as they studied the chapter. These interpretations of the results are consistent with how beliefs about knowledge and learning affect learning in Self-Regulated Studying Model (Winne & Hadwin, 1998). According to this model, beliefs might affect students' perception of the learning task and this perception might affect enacting specific tactics to perform the task. These results are consistent with previous empirical findings, which suggested that most of the effects of beliefs on students' learning were indirect through learning strategies (Cano, 2005; Koller, 2001; Schommer et al., 1992). It is worth noticing here that among all the types of beliefs investigated in this study, only beliefs about the ability to learn (learning beliefs) associated with the use of study tactics. This emphasises the importance of investigating beliefs about learning among other types of

beliefs studying research on how students learn. These results are consistent with previous findings that students' beliefs are related to their use of learning strategies (Cano, 2005; Dahl at al., 2005; Koller, 2001; Paulsen & Feldman, 1999; Schommer et al., 1992; Schreiber & Shinn, 2003). Specifically, these results are consistent with studies that found naïve beliefs about innate ability were associated with the use of surface less elaborative strategies (Dahl at el, 2005; Paulsen & Feldman, 1999; Schreiber & Shinn, 2003).

6.2.3 Students' Beliefs' about Knowledge and Learning and Their Monitoring Standards

According to epistemological beliefs models, beliefs affect students' learning through their effect on metacognitive monitoring and metacognitive control, key components of SRL (Hofer & Pintrich, 1997; Hofer, 2004). This effect is explained in a Self-Regulated Studying Model (Winne & Hadwin, 1998). When learners monitor their understanding and evaluate their progress, these beliefs might work alone or with other factors to create standards to evaluate their learning. As a result of this evaluation, learners take critical decisions such as to terminate studying.

The current study provided some testing of these ideas. Specifically, it tested the relationship between students' beliefs and the nature of the standards they use to judge understanding when they study from the text. The standards each student reported when he or she studied the chapter were analyzed according to their content as: knowledge standards (standards that reflect recitation of the text information), comprehension standards (standards that reflect application and understanding of the text material), and time standards (standards that reflect the time spent on studying). It was predicted that

students with sophisticated beliefs would report using comprehension standards and would achieve higher than students with less sophisticated beliefs who would report using knowledge standards. The correlations supported these hypotheses. Students who believed that knowledge about harmful behaviour is simple, (i.e., organized as separated theories) reported using knowledge standards. Students who believed that the ability to learn is fixed at birth reported using knowledge standards. Students who believed that only experts or social psychologists know about the causes and control of harmful behaviours (omniscient authority) reported using a few of a combination of knowledge and comprehension standards. It is worth noting that beliefs in omniscient authority and beliefs about simple knowledge that related to the type of standards students used are beliefs about the nature of knowledge and the process of knowing. The data indicate that students intentionally brought these beliefs to bear when they monitored and evaluated their understanding of a difficult controversial topic. This suggests that beliefs about the nature of knowledge and knowing function at the metacognitive level when students study difficult and ill-structured materials.

Regression analyses supported the relationship between the nature of the monitoring standards and achievement, however, with only one dimension, that is, quick learning. Students who held sophisticated beliefs that learning requires time reported using comprehension monitoring standards or a combination of comprehension and knowledge standards. This result is consistent with Ryan's (1984) results that relativists who held sophisticated views about knowledge reported using comprehension standards and achieved higher GPA than dualists who reported using knowledge standards and achieved low GPA.

The current study also provided some support to Ryan's (1984) speculation that the nature of monitoring standards influences achievement indirectly through controlling the level at which text information is processed. Results showed that students who used less-generative surface tactics reported using knowledge standards, and students who used generative tactics reported using comprehension standards or a combination of knowledge and comprehension standards.

The current findings replicated Ryan's findings that the greater the number of standards students used to monitor their understanding, the more generative tactics they deployed and the higher they achieved. This effect of the number of standards on learning could be explained as the learner attending to various aspects of the material to satisfy multiple standards.

6.2.4 Students' Beliefs about Knowledge and Learning and Their High Confidence about their Understanding

The relationship between students' beliefs and their metacognitive awareness was assessed through students' judgments of their understanding. High confidence, measured by the positive difference between students' estimation of their level of understanding and their actual score on the achievement test, was used as an indication of students' lack of metacognitive awareness. When students show high confidence about their understanding of the learning material they might take a wrong decision to terminate studying. Models of SRL predict that learners who can accurately monitor and evaluate their learning learn better (Winne & Jamieson-Noel, 2002).

Results showed positive relationships between high confidence and certain knowledge, omniscient authority, and quick learning. These results were consistent with

Schommer et al.'s (1992) findings that students who believed in quick learning overestimated their understanding when they learn from the text.

These results also support the contention that students' high confidence about their knowledge affects how they regulate their learning (Stone, 2000). Specifically, students who show high confident about their understanding used fewer generative and deep processing tactics when they studied the chapter, and reported using knowledge standards to monitor their understanding. On the other hand students who did not show high confidence in their understanding reported using comprehension standards and time standards.

6.3   Conclusion

The first purpose of this study was to examine if students' general beliefs about knowledge and learning are different from their beliefs about knowledge and learning related to a specific context. Results support the contextual multileveled character of students' beliefs. Specifically, differences were found between students' responses on some corresponding dimensions of the general and the contextual EBI. A plausible interpretation of these findings is that there are at least two different levels of beliefs that can be identified and assessed: general beliefs and contextual beliefs. When no specific domain or context is identified in a self-report inventory, students' responses reflect their beliefs about knowledge and learning at the abstract general level. Similarities found between students' responses on some dimensions could be explained as an indication of overarching general beliefs that manifested in students' beliefs about a specific context. Further, results support that students' contextual beliefs are more related to their learning than their general beliefs. These findings provide some direction to future research, that

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is, the need to specify a context when investigating relationships between students' beliefs and aspects of their learning.

The second purpose of the current study was to investigate whether students' beliefs about knowledge and learning are related to how they self-regulate studying. Specifically, the current study detected links between students' beliefs about knowledge and learning, their use of learning tactics, their ability to judge their understanding, the nature of standards they use to monitor their understanding, and their achievement on the knowledge test. Regarding the relationship between students' beliefs and their achievement on the knowledge test, results showed that students who held naïve beliefs that learning occurs quickly or not at all, tended to achieve lower on the knowledge test than students who held more sophisticated beliefs about learning. This result was sustained after controlling statistically for the effects of verbal ability, prior knowledge, and the level of difficulty, interest, and familiarity of the study material.

Regarding the relationship between students' beliefs and their use of learning tactics, results showed that students who held sophisticated beliefs that the ability to learn is incremental tended to use summarizing, paraphrasing, and elaborating tactics when they studied the chapter, and they tended to achieve high grades on the knowledge test. In contrast, students who held naïve beliefs that the ability to learn is fixed tended to use highlighting and verbatim copying of specific words in their notes as they studied the chapter.

Regarding relationships between the nature and the number of monitoring standards, and achievement on the knowledge test, results showed that students who held sophisticated beliefs that learning needs time, reported using comprehension monitoring

standards or a combination of comprehension and knowledge standards and tended to achieve highly on the knowledge test. Moreover, results supported that the greater the number of standards students used to monitor their understanding, the more generative tactics they deployed and the higher they achieved.

Regarding the relationship between students' beliefs and their high confidence about their understanding, results showed that students who held naïve beliefs that knowledge is certain, that only experts or authorities have access to knowledge and/or that learning should occur quickly or not at all tended to show high confidence about their understanding when they studied the chapter. Further, students who showed high confidence about their understanding used fewer generative and deep tactics when they studied the chapter, and reported using knowledge standards to monitor their understanding. On the other hand, students who did not show high confidence in their understanding reported using comprehension standards.

Altogether, results support that students' beliefs about knowledge and learning play a powerful role in their knowledge acquisition and academic performance either directly or through their effect on cognitive and metacognitive processes and strategies. The findings of this study together with previous empirical findings serve to emphasize the importance of making students' beliefs an explicit issue in teaching at the university level.

6.4   Limitations

It is important to highlight some issues that might affect the interpretation and generalization of this study's findings. First, studies that investigated the relationship

between students' beliefs about knowledge and learning and their academic performance frequently lack statistical power (e.g., Kardash & Howell, 2000; Schommer, 1990; Schommer & Dunel, 1995); the current study is no exception. Testing hypotheses from a quantitative perspective was restricted to the small sample size of 50 participants. For example, the number and nature of the contextualized EBI and the original EBI dimensions were tested only by computing the internal consistency coefficients of these dimensions, and without performing factor analyses to confirm their structure. Moreover, analyses could not be performed to test the relationship between students' beliefs about knowledge and learning to their achievement as potentially mediated by their use of learning tactics and metacognitive processes.

Second, the correlational nature of the current study limits the interpretation of the study findings. That is, detectable relationships between variables do not imply a causal relationship between them.

Third, students studied the chapter using computer software (*gStudy*). The study findings may not generalize to studying in a traditional setting where students use hardcopy books and notebooks to study.

Fourth, data regarding students' beliefs about knowledge and learning were collected using self-report measures. Given that self-report measures have been criticized for a number of technical and methodological issues (Winne at al., 2002), the study would have been stronger had another technique to capture the complexity of students' beliefs, such as interviews along with questionnaires.

Fifth, the primary goal of the current study was to link students' beliefs about knowledge and learning with their SRL. However, collecting data about metacognitive

self-regulatory strategies (planning, monitoring, and regulating cognitive activities) was not possible given that *gStudy* (the software used to record students' study events) was in its preliminary stage of development and collecting data about these events was not then available.

Replications of the current study in other contexts and with large sample sizes would be important contributions since our knowledge about how these beliefs affect academic performance is still tentative.

Appendices

Appendix A: Consent Form

I am investigating students' perceptions about knowledge and learning. If you would like to participate in the study, you should spend about 2 and half hours of your time in various research activities:
   a) I will ask you for some basic information about yourself (e.g. your age, sex, major, GPA, first language, ...)
   b) You will respond to a questionnaire about how you perceive knowledge and learning.
   c) You will answer 18 multiple-choice items about general information.
   d) You will take a standardized reading test.
   e) Study a 2000 word chapter using gstudy (about 4 pages).
   f) Answer some test questions related to the chapter.

After participating in <u>ALL</u> the above research activities, you will be paid $20.

None of the information from this study will be known to your professor, and it will have absolutely no effect on your grade in the course. Only I will see your answers. There are no risks to participate in this research. The benefits of participating in this study include gaining a helpful introduction on improving learning from text.

This research is being conducted with permission of the Simon Fraser Research Ethics Board. The chief concern of the board is for the health, safety and psychological well-being of research participants.

Should you wish to obtain information about your rights as a participant in research, or about the responsibilities of the researchers, or if you have any questions, concerns, or complaints about the manner in which you are treated in this study, please contact the Director Office of Research Ethics by e-mail at <u>hweinber@sfu.ca</u> or phone at 604-268-6593.

Your participation is completely voluntary. As soon as all information for the research has been gathered, your personal information (e.g. name) will be erased in the research file and replaced with a random number to ensure all information about you remains anonymous. If at any time you don't want to continue participating in this research, please feel free to contact me and all information about you will be eliminated from the research file.

Any information that is obtained during this study will be kept confidential to the full extent permitted by the law. Materials will be maintained in a secure location.

If you want to participate in this research, please sign below to indicate that you understand the voluntary nature of your participation. Your signature on this form will signify that you have received information describing the procedures, possible risks, and benefits of this project, and that you have received an adequate opportunity to consider the information in the description.

Please return this form to your TA, or to Randa Almahasneh next class.

If you would like to receive a brief report on this research after it is completed, please provide the address (below) to which it can be mailed. If at any time you have questions about this project, please contact Randa Almahasneh at 604-630-6189 or e-mail randaa@sfu.ca.

Your participation is greatly appreciated.

Thank you.

Randa Almahasneh

Having been asked to participate in a research study, I clarify that I have read the procedures specified in the paragraphs above describing the project. I understand the procedures to be used in this experiment and the personal risks to me in taking part in the project.

I understand that I may withdraw my participation at any time. I also understand that I may register any complaints with the Director of the Office Research Ethics, Randa Almahasneh, or with the Dean of Education, Dr. Paul Shaker, 8888 University Drive, Simon Fraser University, Burnaby, B.C., V5A 1S6.

Signature: _____

Name (please Print): _____

E-mail: _____

Phone: _____

Mail address (optional): _____

If you agree to participate, you will receive the questionnaire on WQ. Please indicate your availability by checking as many time slots as possible, so that I can plan for the study and the test sessions (check at least 2 time slots).

	Monday	Tuesday	Wednesday	Thursday	Friday
9:30-10:20					
10:30-11:20					
11:30-12:20					
12:30-1:20					
1:30-2:20					
2:30-3:20					
3:30-4:20					

Appendix B: Demographics Questionnaire

Please answer the following questions. All responses are completely confidential.

Name: _____

_____ Age (in years)

_____ Sex (F or M)

_____ Grade Point Average in all your post-secondary studies (0-4.33, or %)

_____ Academic major

_____ Academic minor

_____ Year of study (e.g. 1st, 2nd, 3rd, or 4th year of study)

_____ Was English the first language you learned to speak? (Yes or No)
If No, how old were you when you learned to speak English? _____

_____ Was English the first language you learned to read and write? (Yes or No)
If No, how old were you when you learned to read and write English? _____

Appendix C: Contextualized EBI

Please think about harmful behaviors like aggression and bullying when you respond to this questionnaire. Aggression is the intentional inflection of some type of harm upon others. Bullying is a pattern of behavior in which one individual is chosen as the target of repeated aggression by one or more others; the target person (the victim) generally has less power than those who engage in aggression.

For each statement, please indicate your personal agreement or disagreement by circling a number on the rating scale below to rate each statement.
If you strongly disagree with the statement, circle 1.
If you strongly agree with the statement, circle 5.
If you more or less agree or disagree, circle the number between 2 and 4 that best describes your agreement.

1 Strongly disagree	2	3	4	5 Strongly agree
1	Most things worth knowing about these topics are easy to know.			1 2 3 4 5
2*	What is true about these behaviors is a matter of opinion.			1 2 3 4 5
3*	Students who learn things quickly are the most successful.			1 2 3 4 5
4	There are only a fixed number of causes for these harmful behaviors.			1 2 3 4 5
5	People's intellectual potential is fixed at birth.			1 2 3 4 5
6	Absolute truth about the causes and the control of these behaviors does not exist.			1 2 3 4 5
7	Social psychologists know the reason of why people behave in a certain way.			1 2 3 4 5
8	Smart readers do not have to work as hard to understand a chapter about these kinds of behaviors.			1 2 3 4 5
9	In the future, people might discover other motives for the harmful behaviors.			1 2 3 4 5
10	Too many theories about the causes of these behaviors just complicate understanding them.			1 2 3 4 5
11	The best explanation about the causes and the preventions of these behaviors are the simplest ones.			1 2 3 4 5
12	When reading a chapter about harmful behaviors it will be easier to understand it, if the chapter includes facts instead of theories.			1 2 3 4 5
13	Some people are born with special gift and talents.			1 2 3 4 5
14	How well you will do in school depends on how smart you are.			1 2 3 4 5
15	If you do not learn something quickly about these behaviors from the chapter, you will not ever learn it.			1 2 3 4 5
16	Some people just have a knack for learning and others do not.			1 2 3 4 5
17	In most cases, the causes of harmful behaviors are simpler than the theorists would have you believe.			1 2 3 4 5

1 Strongly disagree	2	3	4	5 Strongly agree
18	If two people are arguing about what motivates this behavior for a specific case, at least one of them must be wrong.			1 2 3 4 5
19	There is not one best method for changing harmful behaviors.			1 2 3 4 5
20	If you have not understood a chapter about these kinds of behaviors the first time, going back over it will not help.			1 2 3 4 5
21	If social psychologists work hard, they will find the best ways to control these kinds of behaviors.			1 2 3 4 5
22*	The more you know about harmful behaviors the more there is to know.			1 2 3 4 5
23	What is true about the causes of these behaviors today will remain true tomorrow.			1 2 3 4 5
24	Smart people are born that way.			1 2 3 4 5
25	If an expert (e.g., Counsellor, Psychologist) suggested a method to control these behaviors it almost certainly will work.			1 2 3 4 5
26*	If you have a chance to re-read an article about these types of behaviors, you will get a lot more out of it.			1 2 3 4 5
27	Working on a problem with no quick solution is a waste of time.			1 2 3 4 5
28	For harmful behaviors, in some cases there is no right answer to what is the main cause of them.			1 2 3 4 5

* Items were deleted to improve the internal consistency

Appendix D: Prior Knowledge

Name:

The following questions are not meant to test your intelligent in anyway. They are strictly for research purposes. Therefore, please use your current knowledge to answer them, and do not refer to any outside resources (e.g., a person setting beside you, a book...). Please indicate whether the following statements are true or false by choosing: True, False or "I do not know".

1-	Mental representations of what we might become, or should become, in the future are referred to as possible selves. a. True b. False c. I do not know
2-	Lorenz could be credited for developing the concept of instrumental aggression. a. True b. False c. I do not know
3-	Prejudice refers to any kind of bias or inclination towards anything or anyone that may be considered inherently irrational. a. True b. False c. I do not know
4-	The Catharsis hypothesis stated that providing the angry persons with an opportunity to engage in vigorous but non-injurious activities will lower their tendency to aggression. a. True b. False c. I do not know
5-	According to Schachter's two-factor theory, whether we experience fear or excitement is determined by how aroused we are. a. True b. False c. I do not know
6-	The Frustration-aggression hypothesis is one of the most famous instinct theories. a. True b. False c. I do not know
7-	Deliberately seeking and attending to information that supports our attitudes is called selective exposure. a. True b. False c. I do not know
8-	According to Freud, people are aggressive because they have a death wish. a. True b. False c. I do not know
9-	The BSRI is developed by Bem to measure whether people are masculine, feminine, androgynous, and undifferentiated. a. True b. False c. I do not know
10-	Social learning theory emphasizes culture as an important factor affecting how people express aggression. a. True b. False c. I do not know
11-	Self-serving bias refers to our tendency to use internal attributions for good outcomes, and external attributions for our bad outcomes. a. True b. False c. I do not know

12-	Drive theory postulates that internal forces, free of any external influence, determine aggression. a. True b. False c. I do not know
13-	The Instinct theory of aggression suggests that people fear aggression by instinct. a. True b. False c. I do not know
14-	Social interaction generally arouses positive affect. a. True b. False c. I do not know
15-	Social skills training programs to prevent aggression are based on social learning theory. a. True b. False c. I do not know

Appendix E:
Familiarity, Difficulty, Interest and Comprehension
Monitoring Surveys

Name:

After studying the chapter, please answer the questions

Familiarity:

To what degree were you familiar with the information in this chapter before reading it?
Circle a number below to indicate your level of familiarity:
1 - Completely unfamiliar
2
3
4
5 - Completely familiar

Difficulty:

How would you rate the difficulty of this chapter?
Circle a number below to indicate the degree of difficulty:
1 - Very difficult
2
3
4
5 - Very easy

Interesting:

To what degree the information in this chapter was interesting for you?
1-Very boring
2
3
4
5- Very interesting

Understanding:
How well do you understand this chapter, now that you have read it?
Circle a number below to indicate your level of understanding:
1 - I do not understand at all
2
3
4
5 - I completely understand

Standards for understanding
What criteria did you use to determine your level of understanding?
Examples:
- I spent considerable time studying
- I could recite the important points in the chapter
- I could apply the new information to real life settings

Please write your criteria ....

Appendix F: Knowledge Test

Name:
Question (1)-Circle the letter of the best answer for every item.

1- The Instinct theory of aggression suggests that people
   a. are unlikely to engage in aggression.   c. are programmed for aggression.
   b. fear aggression by instinct.   d. are primed to learn aggression.

2- Freud believed
   a. aggression results from the death instinct.
   b. aggression is learned.
   c. people always direct destruction toward the self.
   d. aggression is determined by external factors.

3- The Drive theory proposes that
   a. aggression is determined completely by the genes.
   b. external conditions arouse strong internal motives.
   c. aggression is practiced because it has been adaptive in the history of the species.
   d. the internal forces, free of any external influences, determine aggression.

4- The Frustration-aggression hypothesis is one of the most famous
   a. drive theories.   c. social learning theories.
   b. instinct theories.   d. attribution theories.

5- Lorenz could be credited for which concept?
   a. death instinct.   c. instrumental aggression.
   b. fighting instinct.   d. Punishment.

6- The theory that emphasizes culture is an important factor affecting how people express aggression is
   a. social learning theory.   c. instinct theory.
   b. drive theory.   e. attribution theory.

7- Statistics prove the frequency of aggression in societies around the world
   a. varies tremendously.
   b. varies by a factor of approximately 3 to 5.
   c. is in relation to how much advertising is shown to the population.
   d. is in proportion to the society's level of economic development.

8- One of the following is not required for punishment to be effective?
   a. It must be delivered by a person perceived as having authority.
   b. It must be delivered immediately.
   c. It must be intense.
   e. It must be make sense to the person punished.

9- A good predictor of aggression is
   a. level of social skills.
   b. age.
   c. whether the person is right-handed or left-handed.
   d. presence or absence of a father in the family.

10- With respect to reducing aggression, research indicates that the old saying, "Count to 10 before you act."

a. is effective.
b. is ineffective.
c. varies in effectiveness depending on the person's sex.
d. varies in effectiveness in reducing depending on the person's age.

11. All of the following theories are among those that argue aggression is inborn or "genetically determined," except one. Which is the exception?

a. Socio-biology.   c. Freudian theory.
b. Social learning theory. d. Lorenz's theory.

12. Catharsis is:
    a. turning inward.   c. irrelevant to aggression.
    b. "doing your thing".   d. "blowing off steam".

13. Social skills training to prevent aggression is based on
    a. Freudian theory.   c. Social learning theory.
    b. Lorenz's theory.   d. Sociobiology.

14. International comparison of homicide rates shows Canada has
    a. the lowest homicide rate on the world.
    b. higher homicide rate than United State.
    c. the same homicide rate as Sweden.
    d. higher homicide rate than Netherlands.

15. A characteristic of a culture of honour is that it
    a. approves of aggression.
    b. prefers to hide instances of aggression.
    c. allows aggression for justified causes.
    e. punishes aggression.

Question (2) - Please read the following scenario and answer and the question that follows:
"Sarah is walking down a hallway with her books getting ready for her next class. She is wary of her 3 girls standing by their lockers. These girls have a history of calling her names and Sarah knows this time will not be any different. When she is called names Sarah feels very upset because she has never done anything to these girls to cause this type of behavior towards her.
    - What motivates the aggression in this case?

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Question (3)- Compare and contrast between instinct theories and social learning theory in terms of sources of aggression, and the possibility for preventing or controlling aggression).

Instinct theories	Social learning theory
1- Sources of aggression	1- Sources of aggression
2-The possibility for prevention or control	2-The possibility for prevention or control

Question (4) - What do you think is the best intervention or control technique(s) for aggression? Explain why?

((Please use the back of the page if you need more space))

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