

PERSONAL EPISTEMOLOGY

- an empirical investigation of the relationship between epistemology and gender, topic knowledge and topic interest

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UNIVERSITETET I OSLO

Høst 2007

SAMMENDRAG AV MASTEROPPGAVEN I PEDAGOGIKK

TITTEL:

PERSONAL EPISTEMOLOGY: an empirical investigation of the relationship between epistemology and gender, topic knowledge and topic interest

AV:

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EKSAMEN:

Masteroppgave i pedagogisk-psykologisk rådgivning

SEMESTER:

Høst 2007

STIKKORD:

Personal Epistemology

Gender

Topic Interest

Topic Knowledge

Theoretical background

The concept of personal epistemology refers to beliefs about knowledge and knowing. Psychological research into the topic of personal epistemology has its roots in cognitive developmental psychology, where research started in the 1950's. The first major contribution to the field by educational-psychologists was by Schommer, in 1990. Since then researchers have linked personal epistemology to areas of education and learning including motivation, self-regulated learning, self-perception, meta-cognition and comprehension (Muis, 2007; Kuhn, 1999; Schommer, 1990). It is now generally accepted that personal epistemology consists of four dimensions that relate to source of knowledge, simplicity of knowledge, certainty of knowledge and justification for knowing. Each dimension is made up of a continuum of beliefs about knowledge that relate to relative sophistication or naivety. Research suggests that epistemological beliefs can be specifically related to domains of knowledge and to specific topics (Bråten et al, 2007; Hofer & Pintrich, 1997; Schommer, 1990).

Problem and methodology

Some of the main areas of research in personal epistemology thus far have included identifying developmental patterns (Baxter Magolda, 1986; Perry, 1970); the specificity of epistemological beliefs (Bråten et al, 2007; Buehl & Alexander, 2001); and possible predictors of epistemological beliefs (Muis, 2007; Mason, 2006). This dissertation investigates possible relations between the three variables of gender, topic interest and topic knowledge and dimensions of personal epistemology. The variables are chosen on the basis of previous research from the fields of epistemology, learning and motivation. The specific hypotheses concern a relation

between gender and certainty of knowledge; and topic knowledge and topic interest in relation to justification for knowing. The first of these hypotheses is that females are more likely to view knowledge as tentative and evolving and males are more likely to view knowledge as fixed and certain. The second states that students that have high scores on topic interest and topic knowledge will be more likely to have sophisticated beliefs about justification for knowing.

Data for the investigation is gathered from a group of law students at the University of Oslo, in connection with the project *Learning in a Knowledge Society:*

Constructing Meaning from Multiple Information Sources. A topic-specific epistemological questionnaire is used to find out about the sample group's views on epistemology in relation to the topic of climate change. Use of a topic-specific measure may help to obtain a more accurate approximation of epistemology, by reducing other issues that may be included in a domain-general measure.

Questionnaires are also used to gather other information about the group, including gender, topic interest and topic knowledge. Correlation analyses and multiple regression analyses are employed to investigate relations between the variables and the possibility that the chosen variables act as predictors for certainty of knowledge and justification for knowing.

Results and Conclusions

The results from the empirical analyses do not support the first hypothesis appertaining to a relationship between gender and certainty of knowledge. Although the results are not significant, the correlation suggests that given a larger sample group, the relation between gender and certainty of knowledge may have been the opposite of that I proposed, which means that the females in the sample group saw

knowledge as more certain. The second hypothesis is supported by the presence of significant correlations between topic interest, topic knowledge and justification for knowing. The three variables gender, topic knowledge and topic interest account for seventeen percent of the variance in the sample group's scores. This supports my hypothesis that individuals that are interested in a topic will also try to find out more about that topic, thus increasing their knowledge about it. Moreover, individuals with high topic knowledge and high topic interest are inclined to investigate the topic more fully and evaluate different knowledge sources in order to create their own idea of knowledge about the topic.

Results from the sample group also revealed relatively sophisticated views about knowledge on climate change in comparison to results based on another group of students. On the basis of results from the study and considerations based on other research, suggestions are made regarding the typicality of law students' beliefs about knowledge, specifically regarding gender-typical views. Given the relative sophistication of the law students' views, and assuming that their views on knowledge related to other topics are similarly sophisticated; I suggest that the principles of beliefs about knowledge that are communicated to students through the study of law may be used as a model for other subjects. Modifications will be necessary in light of the benefits that are shown to be gained by matching epistemological views to the epistemological make-up of a subject. Teaching students more sophisticated ways of viewing knowledge and knowing is particularly desirable in light of research suggesting links between sophisticated epistemological beliefs and self-regulated learning, critical thinking and motivation. It also seems that instruction in epistemology may affect these elements of learning, and vice versa (Muis, 2007; Kuhn, 1999). An amalgamation of recent research on links between epistemology and other aspects of learning with research on the specificity of personal epistemology may eventually lead to possibilities for the development of

topic-specific models of motivation and self-regulated learning that incorporate epistemological beliefs.

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1. Chapter 1: Introduction

1.1 Background

The term “epistemology” is derived from the Greek *episteme*, meaning knowledge, and *logos*, or explanation (Buehl & Alexander, 2001). It is an area that is encompassed by both the field of philosophy and that of psychology that is “concerned with the nature of knowledge and justification of human knowledge” (Hofer & Pintrich, 1997:88). Whilst engagement of theorists from the fields of philosophy and psychology creates opportunity for debate and variation in interpretation of research findings; it also creates potential for inconsistencies and poor oversight due to lack of a common theoretical language for communication of findings among interested parties, *inter alia* (ref. Kuhn, 1962).

The earliest psychological research in epistemology took place in the 1950’s and was rooted in cognitive development psychology (Hofer & Pintrich, 1997). The main focus of cognitive development psychologists within the field of epistemology was, and is, exploring its development and the factors that are responsible for maturation of students’ beliefs about knowledge (Perry, 1970). A subsequent growth in interest on the part of educational psychologists has seen research progress and extends its focus to concentrate on the effects of individuals’ epistemologies on learning and how different beliefs are structured and related (Schommer, 1990; King & Kitchener, 1984). Development of the separate, yet linked approaches of the cognitive and contextual perspectives has been “simultaneous and intersecting” (Hofer & Pintrich, 1997:89).

The relevance of personal epistemology for educational psychology has been demonstrated by studies linking the concept to factors such as comprehension, interpretation of information, learning and meta-cognition, how teachers instruct, and motivation (Schommer-Aikins, 2004; Schommer, 1990). Due to the wide range in possible educational consequences of individuals' epistemologies, investigation is needed to determine what factors affect students' epistemological perceptions and what can be done to alter them. In this way it may also be possible to match educational systems' approach to epistemology and students' actual views of the epistemic. Thus educators will be able to assist students in the journey to becoming "thoughtful, persistent and independent learners" (Schommer, 1990:504).

1.2 Problem

Whilst resulting theories from different backgrounds compliment each other on some points, they are not always entirely commensurable. From this situation stems a lack of consistency in concept definition and measurement and, ultimately, uncertainty as to whether researchers are indeed studying the same construct. This potentially confusing situation is reinforced in the field of educational psychology by the field's apparent inability to define its subject-area precisely (Dale, 2005). Despite this, Kuhn and Weinstock (2002) ascertain that the independent research that has taken place has "produced a broadly consistent picture of what it is that develops" (2002:122). It is my aim to present an overview of some recent findings and discussions in personal epistemology. The main area of focus for my study will be the area of educational psychology and works from the past twenty years. A further aim is to investigate selected factors that may affect students' patterns of epistemological beliefs. Although epistemology is a subject of philosophical discussion, that aspect will not be taken up since it is considered to lay out-with the remit of a dissertation in educational psychology.

Earlier studies have linked epistemological beliefs to length of period of study at an educational establishment, nature of study programme, method of instruction, age, gender and topic interest (Mason et al, 2006; Kuhn and Weinstock, 2002; Belenky et al, 1986; Perry, 1970). Through empirical investigation it is my aim to highlight a link between epistemological beliefs and gender, and between epistemology and topic interest and topic knowledge. It is my specific aim to analyse the predictability of gender, topic interest and topic knowledge on personal epistemology, based on the definition of personal epistemology developed by Hofer & Pintrich (1997).

The role of gender in epistemology was highlighted by Belenky et al (1986) in their study “Women’s Ways of Knowing”. It was the first study to depict the views that females held on knowledge and knowing. Baxter Magolda (1992) later set out to show a relation between gender and epistemology. Her findings suggested gender related patterns in ways of thinking about knowledge, though no direct relation between gender and epistemology was proven. The question that guided Belenky et al’s research was “How come so many smart women feel so dumb?” (Belenky et al, in Clinchy, 2002:63). This is, in part, the question that has led me to research a possible relation between gender and epistemology: The stereotypical notion that females are more uncertain and tentative, whereas males are assertive and confident in their approach to knowledge. With respect to a proposed relationship between gender and personal epistemology, I expect it will be possible to observe differences in beliefs about certainty of knowledge, with males having the more naïve perception that knowledge is certain.

Topic knowledge and topic interest have been shown to be related to learning, text comprehension and strategy use (Bråten et al, 2007; Boscolo & Mason, 2003), which are all factors that have been linked to personal epistemology (Strømsø et al, in press;

Muis, 2007; Hofer & Pintrich, 1997). I expect there will be a high correlation between topic interest and topic knowledge, in that one who is interested in a topic will find out information about it and will learn more, and vice versa, that one who has a high level of knowledge about a topic is often interested in that topic. I predict that candidates with an interest in a topic will be more interested in delving for information, gaining information from different sources and evaluating knowledge in light of other sources to create their own picture of the topic. For this reason I believe that higher levels of topic knowledge and topic interest will correspond with more sophisticated beliefs regarding justification for knowing. Reasoning for my hypotheses and choice of research question will be expanded upon in chapter 2.

Another point of discussion in personal epistemology has been the degree to which the concept is a general one that applies to all areas of knowledge or more related to specific subject areas, called *domains* (Bråten et al., 2007; Muis et al, 2006; Buehl & Alexander, 2001). The question of domain-generality versus domain-specificity affects how personal epistemology is defined. The topic will, therefore, take up considerable place in the theoretical presentation and will be discussed with regards to the possible existence of a topic-specific notion of personal epistemology, following the argumentation of Bråten et al. (2007).

1.3 Layout

Chapter two will take the form of an overview and summary of important findings on personal epistemology by developmental psychologists and educational psychologists. This will include research by Perry (1970), King and Kitchener's Reflective Judgement Model (2004), Kuhn's argumentative reasoning (in Kuhn & Weinstock, 2002), and research by Schommer (1990) and Hofer and Pintrich (1997), inter alia. The question of domain-generality vs. domain-specificity will also be

presented. The chapter will be concluded with a short presentation of some factors that have been shown to affect students' beliefs about knowledge and knowing, with a focus on gender, topic knowledge and topic interest by way of justifying the hypotheses that this dissertation is based upon. Chapter three will describe and explain the empirical part of the study, which is based upon the results of a questionnaire administered to a sample of students from a class of law students attending the University of Oslo, in connection with the larger project *Learning in a Knowledge Society: Constructing Meaning from Multiple Information Sources*. Descriptive statistics, as well as results from correlation studies and multiple regression analyses based on students' responses to the questionnaire will be set out in chapter four. In chapter five, I will discuss possible reasons behind the results that are set out in chapter four; regarding, in particular the nature of the study and the sample group and the possible effects on the results. I will go on to discuss in further detail some of the issues of contention that have come to my attention during my study of personal epistemology; and finally, I will present some possible implications of the findings. Chapter six consists of a summary of the main points from the dissertation.

2. Chapter 2: Theory and prior research

The aim of this chapter is to present an overview of some important works in the field of personal epistemology. A primary definition of personal epistemology will serve as an introduction before going on to account for some important works within the fields of cognitive development psychology and educational psychology. There will also be a short presentation of the relevance of personal epistemology for educational psychology and an investigation into literature on the debate of domain-general versus domain-specific epistemic beliefs. The chapter will be completed by an overview of some of the main factors that have been empirically linked to personal epistemology and an elaboration upon the research questions and hypotheses set forth in this study.

2.1 Defining personal epistemology in contemporary terms

A simple definition of epistemology that is often cited is “the theory of knowledge and knowing” (Honderich, in Muis et al, 2006). Hofer and Pintrich (1997) propose this consists of the following elements: “how individuals come to know, the theories and beliefs they hold about knowing, and the manner in which such epistemological premises are part of and an influence on the cognitive processes of thinking and reasoning” (1997:88). Hofer (2004) states that epistemology is “a field that examines what individuals believe about how knowing occurs, what counts as knowledge and where it resides, and how knowledge is constructed and evaluated” (2004:1). It cannot be consternated that these are concise definitions of epistemology, due, in part, to the volumes of philosophical discussion that have been written on the matter and to the intangible nature of the concept. They can, though, help provide an insight to how the concept is viewed today and an understanding of its applications. As Hofer points out, this may be as simple as how students approach tasks in the

classroom. "...students regularly encounter new information and may approach the learning process quite differently depending on whether they view knowledge as a set of accumulated facts or an integrated set of constructs, or whether they view themselves as passive receptors or active constructors of knowledge" (Hofer in Hofer and Pintrich, 2002:3). The current paradigmatic consensus among educational psychologists is that personal epistemology consists of four distinct dimensions that can be measured and evaluated to reveal patterns in epistemological views: These are the structure of knowledge, certainty of knowledge, source of knowledge, and justification for knowing (Hofer & Pintrich, 1997).

2.2 Early research: Cognitive developmental psychologists

The tradition of psychological research in epistemology began with cognitive development psychologists (Baxter Magolda, 2004). The main focus of cognitive developmentalists' work at that time involved identifying phases of epistemological evolution in individuals. It was not the study of epistemology, per se. but individuals' beliefs about knowledge were considered as part of the greater investigation into individuals' experiences and cognition (Buehl & Alexander, 2001). Research was mostly reliant upon use of interviews to gather data and thick descriptions of students' responses that were then analysed and categorised (Schommer-Aikins, 2004). Epistemology was viewed as an area of cognition, like speech and intelligence that develops in a stage-like manner and follows a general pattern. This is known as the uni-dimensional view of epistemological development, also known as the developmental paradigmatic approach (Bråten et al. 2007).

2.2.1 Perry

Perry (1970) is generally accredited with responsibility for the beginnings of

psychological research in epistemology. Although his original goal was “to illustrate the variety of students’ responses to the impact of intellectual and moral relativism”, Perry’s work has provided the basis for work on epistemological development (1970:7). He was the first researcher to suggest that the way in which college students made meaning of their educational experiences was not a reflection of their personality but an *evolving developmental process*. Perry conducted in-depth longitudinal studies of students at Harvard and Radcliffe colleges in the early nineteen-sixties. Based upon students’ responses to the *Checklist of Educational Values*, Perry identified a developmental pathway consisting of nine *positions* said to reflect individuals’ outlook on knowledge. The scheme represents the “abstract structural aspects of knowing and valuing” (Hofer & Pintrich, 1997:90). Progression through the various stages sees students gravitate from a position of “dualism”, via “multiplicity” and “relativism” to “commitment in relativism” (Perry, 1970).

To summarise, the model describes a journey from the dualistic nature of the new student’s early thoughts that gradually develop, through continual experience with conflicting opinions and a gradual realisation that there need not always be a single, correct answer; to a pluralistic view. Recognition of the impact that interpretation and context have on so-called truths is something that forces the individual to consider their views on the nature of knowledge, though this consideration may well occur sub-consciously. The next important step in the student’s epistemological pathway is “beyond simple diversity into the disciplines of relativity of thought” (Perry, 1970:35). At this point the student is able to utilise different sources of information and relate them to one another, which results in formation of own views. Realisation of the world of knowledge’s diverse nature is, however, insufficient if the student is to progress to the most advanced position of epistemological maturity. In order to achieve this level of thinking the individual must take responsibility for his opinions. Perry claims students must be introduced to “education for independence of mind” if this level of thinking is to be achieved (Perry, 1970:36). At this level the spirit learns

to stop being an obedient “conformist” and the individual is in a position to commit to own points of view on knowledge. Finally, the author explains episodes of “delay, deflection and regression” (Perry, 1970:10) that refer to temporary devolutions in development of personal epistemology. These states are a natural part of the process of epistemological development.

Although Perry’s influential work has been recognised for its ground-breaking nature and for uncovering a new aspect of learning and cognition, the author has been criticised for the way that the study focuses on white, middle-class young males (Baxter Magolda, 1992; Belenky et al, 1986). The study’s failure to select a representative sample of the population represents a limitation in transferability of findings to other populations. Subsequent studies have produced results relating to alternative sample groups: Belenky et al’s study of an all female group resulted in a model of the maturation of thought based on “moments of epistemic transformation”. The researchers describe women’s perspectives on knowledge, truth and authority. The model focuses mainly on women’s relations to epistemology and their self-perceptions based on these beliefs. Baxter Magolda’s study is based on a mixed sample and the author introduces the concept of “epistemic voice”. Kuhn’s (1999) concept of the development of epistemological meta-knowing is a further example of a model from this paradigmatic view of the development of personal epistemology. Such theories refer to a social-contextual influence on individuals’ views of knowledge and offer alternatives to Perry’s model; though the characteristic stages of development follow a similar general pattern. Models that are developed in a social-contextual tradition view epistemological beliefs as something that develops as a result of the individual’s interaction with the external world. Educational establishments are often attributed as an influential factor in students’ lives.

2.2.2 Applications of epistemic thinking in cognitive development psychology

As Hofer (2002) explains, “Perry’s work was the starting point for several other meticulous, longitudinal, qualitative studies that have furthered [sic] enhanced our knowledge of the role that personal epistemology plays in intellectual development” (Hofer, 2002:5). This section will set forward some of the important contributions to research in this field:

King and Kitchener’s Reflective Judgement Model (RJM) describes development “of complex reasoning in late adolescents and adults. The model also shows how the epistemological assumptions people hold are related to the way they make judgements about controversial (*ill-structured*) issues” (2004:5). Ill-structured issues are defined as “[c]ontroversial problems...about which reasonable people reasonably disagree” (2004:5). Problems in original interviews were concerned with subjects of the accuracy of news reporting, the creation of human beings, the safety of chemical additives to foods, and the building of the Egyptian pyramids; all of which are topics that are likely to gain different responses from different people. For example, “Can you say that one view of the creation is right and one is wrong?” (King & Kitchener, 2002:6). The researchers’ work is based on that of Dewey (1933), “who argued that reflective judgments are initiated when an individual recognises that there is controversy or doubt about a problem that cannot be answered by formal logic alone, and involve careful consideration of one’s beliefs in light of supporting evidence” (in King & Kitchener, 2004:6). This is an example of the application of epistemological views. The subjects of King and Kitchener’s research were then asked more probing questions around their responses to the first round of interviews, for example, “Can you say that one point of view is better and another worse?”, “Can you say that one is more accurate than the other?”. And finally participants were asked to explain how they arrived at their answers. This information was used to uncover how participants went about considering information and drawing conclusions.

King and Kitchener identified ways that individuals' responses to ill-structured problems and their reasoning vary in accordance with their underlying epistemological views. The authors propose a set of seven steps that are organised in three "levels of thinking": Pre-reflective, quasi-reflective and reflective. Each step describes a "qualitatively different epistemological perspective" (2004:6). Pre-reflective thinkers, at the least advanced level of the scale, employ most basic techniques of argumentation, which involve reliance on unsubstantiated statements. Quasi-reflective thinkers are aware of the uncertainty of knowledge and are, therefore, more likely to make use of a variety of sources and to consider the credibility of these sources of information whilst making judgements. When individuals reach the level of *reflective thinking* they are able to draw reasoned judgements based on evaluations of information and own ideas. Reflective thinkers remain open to re-evaluating conclusions based on new or contextual information. King and Kitchener provide evidence in the form of citations by reflective thinkers that demonstrate a tendency to read more widely and exercise a higher degree of wariness in evaluations by these individuals.

King and Kitchener's longitudinal research has produced three important findings regarding epistemology and ill-structured problems: "(a) there are striking differences in people's underlying assumptions about knowledge, or epistemic assumptions; (b) these differences in assumptions are related to the way people make and justify their own judgments about ill-structured problems; and (c) there is a developmental sequence in the patterns of responses and judgements about such problems". The authors claim that these observations can be understood using the RJM as a theoretical framework. Hofer and Pintrich also summarise some other important findings by King and Kitchener: their results show that "(a) higher-stage reasoning [is] more evident, and lower-stage reasoning less evident, over time; (b) higher educational attainment [is] correlated with higher stages of reflective judgement; developmental spurts [coincide] with college attendance; and a strong linear

relationship exist[s] between age and stage (King & Kitchener in Hofer & Pintrich, 1997:101). These findings suggest links between epistemological thinking and education, age and tentative links to topic knowledge, which is relevant for my hypothesis regarding a relation between topic knowledge and justification of knowledge. They also suggest a link between personal epistemology and aspects of learning. Although King and Kitchener's research is rooted in cognitive development psychology and development is presented in stages, the authors were also interested in factors that affect the development of personal epistemology.

Finally, Kuhn's hypothesis of thinking as *argumentative reasoning* also sheds light on how individuals' epistemological perspectives affect how they see the world (Kuhn & Weinstock 2002; Kuhn, 2000, in Mason et al 2006; Hofer and Pintrich, 1997). Participants in her survey were encouraged to explain how it was they came to hold views on certain phenomena; and to justify their views. The study is commended for the age span represented in the sample group. Kuhn extracted information about participants' epistemic beliefs from their responses. Participants were shown pairs of statements by two individuals and asked "Can only one of their views be right, or could both have some rightness?" and, secondly whether one response could be more right than the other (Kuhn, in Mason and Scitica, 2006:497). They were then asked some explicit questions concerning epistemic thinking behind their answers during interviews. Kuhn categorised participants according to their *absolutist*, *multiplist* or *evaluative* ways of thinking (ibid). Kuhn's measure of epistemic thinking was based on a concept of epistemology consisting of proof, expertise, certainty of knowledge and some other factors that were not directly related to knowledge. Categorisation was based purely on questions regarding expertise (Hofer & Pintrich, 1997). In summary; *Absolutists* see knowledge as something that is based on certain facts, whereas *multiplists* see uncertainty and inconsistencies as proof that certain knowledge and expertise do not exist; they believe all views are of equal value and that their own ideas about the world are as valid as those of experts.

Evaluative epistemic thinkers are also sceptical to the idea of certain knowledge, but they are able to assess the merits of different sources of knowledge and relate different opinions and judge their legitimacy.

The foregoing, research-based models are representations of how the researchers perceived epistemological considerations in subjects. The majority of participants, however, did not achieve the highest level of epistemological thinking (Kuhn & Weinstock, 2002). Although this is considered to be optimal development that a few individuals are able to achieve, it is seldom observed or reported in these studies. At a first reading it may seem that the lack of sophistication observed in the foregoing studies is due to them being based on students, and not experts. However, Weinstock (in Kuhn & Weinstock, 2002) has shown, experts are also likely to hold less sophisticated beliefs. Based on a sample group of 173 jurors that responded to fictional, text-based problems and re-enactments from court trials, 47% of participants were classified as absolutist thinkers, a further 39% as multiplists and only 14% as evaluativists. It has also been shown that candidates with different academic backgrounds may display different levels of epistemological beliefs (Mason et al, 2006), which may suggest that different patterns of beliefs are more suited to specific subject areas, or domains. Furthermore, Clinchy (2002) discusses the merits of some of the traditionally less-sophisticated views of the epistemic, for example that individuals with poorly developed epistemological views may be more receptive to knowledge than those who have specific opinions about the source and justification of knowledge. These topics will be taken up later in a presentation of the domain-specificity of personal epistemologies and in discussion of the results of this study, appertaining to law students.

2.3 Educational psychologists

A major turning point for epistemological research occurred around 1990.

Researchers began to question the validity of a uni-dimensional concept of personal epistemology and the parallel development of elements of personal epistemology that this entails. Use of stage-like models also presented problems for defining “cut-offs” between one stage and the next, and where epistemological development progresses to the next stage (Kuhn & Weinstock, 2002). Instead of being concerned with how individuals develop personal epistemologies and when their line of thinking matures, educational psychologists are primarily concerned with what it is that develops and how this affects learning outcomes. The underlying assumption is that personal epistemology consists of a set of beliefs, rather than a reflection of “a coherent developmental structure” (Schommer in Hofer, 2000). Research at this time also saw the introduction of quantitative empirical investigations as a way of measuring personal epistemology (Schommer, 1990). The thesis of psychological epistemology states that an empirical understanding of the knowing process is necessary for complete comprehension of epistemological issues (Royce, in Muis et al, 2006:11). Use of quantitative assessment techniques allows for speedy administration to large groups and provides data that is simpler to analyse due to the standardisation of questions and answers used (Bråten et al, 2007; Lund, 2002). Schommer and subsequent researchers with a background in educational psychology have also been concerned with the issue of domain-specificity in epistemology, that is, whether personal epistemology is a general concept and applies to knowledge as a whole or is area-specific. This issue will also be discussed in this chapter.

2.3.1 Schommer: Empirical investigation into individuals' belief systems

Schommer set out to investigate the impact of students' personal epistemologies on academic performance, specifically, on comprehension performance. Based on earlier

studies by Perry and Dweck, Schommer suggested that personal epistemology was not a one-dimensional concept, but a “belief system that is composed of several more or less independent dimensions” (Schommer 1990:498). Schommer’s initial proposition was that results would suggest a five-fold composition of personal epistemology, pertaining to “the structure, certainty, and source of knowledge, and the control and speed of knowledge acquisition” (Schommer, 1990:498). She tested her hypotheses using a 63-item Epistemological Questionnaire. A number of the items in this questionnaire were taken from Perry’s Checklist of Educational Values, which shows the influence of the developmental psychologist on Schommer’s work (Hofer, 2000).

Schommer’s proposition that “epistemology can be characterized as a system of more or less independent beliefs” changed the way epistemology was viewed and studied and opened for new lines of investigation into the various elements of personal epistemology. Her findings also made it possible to contemplate how different epistemological beliefs are affected by various factors and the relations between epistemology and other aspects of learning and education. Results from preliminary studies were organised on a continuum of beliefs ranging from naïve to sophisticated. From a naive view, Schommer proposed the following dimensions of epistemic beliefs: Simple knowledge (*knowledge is simple rather than complex*. It consists of a number separate portions of knowledge rather than related information that must be inter-connected); Omniscient Authority (*knowledge is handed down by authority rather than derived from one’s own reasoning*); Certain knowledge (*knowledge is certain rather than tentative*, it is something that is absolute that does not change over time); Innate knowledge (*the ability to learn is innate rather than something that can be acquired through hard work*); and Quick learning (*learning is something that happens quickly or not at all*) (Schommer, 1990). A person holding sophisticated views of epistemology would maintain the opposite points of view on the cited elements, and individuals may find themselves on any point on this continuum,

between naïve and sophisticated views. Factor analyses of Schommer's results did not support the proposed *source of knowledge* factor (i.e. Omniscient Authority). It should also be explained here that Schommer's use of the term epistemic beliefs differs from earlier work. Use of the word epistemic, instead of epistemological, is meant to reflect its reference to a more general understanding of knowledge, and "the conditions for acquiring it" (Hofer, 2002:4), whereas the term epistemology is more anchored in philosophy.

Subsequent researchers have documented results that are in accordance with Schommer's work using similar methods of investigation, though categorisation of beliefs has varied somewhat. Other elements of personal epistemology that have been suggested include incremental learning, integrative thinking and certain knowledge 1 and 2 (Schraw, Bendixen & Dunkle in Bråten et al, 2007). Jehng, Johnson and Anderson also reported factors such as orderly learning, and Wood and Kardash focused on knowledge construction and modification (in Bråten et al, 2007).

On the basis of her studies Schommer presented a number of notions that affect the way epistemology is viewed by the research community today. Firstly, Schommer proposes epistemological beliefs have "distinct effects on comprehension and learning", which means that such beliefs should be taken into consideration in school curricula and in classroom planning. Schommer claims epistemological beliefs seem to affect students' processing of information and monitoring their own comprehension. In addition, Schommer ascertains that these effects are independent of other variables that affect comprehension and learning. Schommer's notion that the dimensions of epistemological beliefs were more or less independent furthermore implies that development of the various dimensions may be asynchronous, which means that the dimensions can develop at different paces and be at different levels of sophistication at any one time (Schommer, 2004). Finally, epistemology is said to be

influenced by home and educational background, which suggests that such beliefs are not static and may become more sophisticated through instruction and other environmental influences, such as stimulation from home environment.

2.3.2 Hofer and Pintrich

A notable contribution to the field of personal epistemology was presented in the form of an overview article of the field since its beginnings with Perry in 1970 (Hofer & Pintrich, 1997). The authors presented critique of previous findings and theories that were heavily inspired by notions of intelligence (including Dweck's theory of intelligence) and learning; elements they regarded as separate from knowledge. At the same time they acknowledged the significance Schommer's contribution to research. They also identified issues of concern for theory and methodology related to epistemology at that time. Finally they suggested a refined method for defining and measuring beliefs about knowledge based on a concept of epistemology consisting of individuals' views on four factors: certainty of knowledge, simplicity of knowledge, source of knowledge and justification for knowing. These four factors are now generally accepted as the core aspects of personal epistemology (Bendixen & Rule, 2004).

Although taking place within the same tradition at around the same time, Hofer and Pintrich's work differs from Schommer's on a number of points. Hofer and Pintrich suggest that "beliefs about the nature of knowledge" (the simplicity and certainty of knowledge) and the "nature or process of knowing" (source of knowledge and justification for knowing) make up the "core structure of individuals' epistemological theories" (Hofer & Pintrich, 1997:119). "Considering the four dimensions to be aspects of an individual's personal theory of epistemology does suggest that the dimensions are related to each other in coherent and internally consistent ways...Only

with better identification of these dimensions can we proceed to establish the relations among them and their impact on other cognitive processes” (Hofer, 2000:382). The researchers’ use of the word “theories” is meant to suggest a more related group of beliefs with more synchronic development than the “more or less separate” beliefs that Schommer refers to (Hofer, 2002). In addition, Hofer and Pintrich’s system refers to *source of knowledge*, which is defined as ranging from the belief that knowledge is actively generated by the individual (sophisticated belief), to a belief in an omniscient external source of knowledge. *Justification for knowing* is the term used by Hofer and Pintrich to describe the way in which individuals evaluate information and knowledge claims, based on, for example, gut-feeling or on inquiry, evaluation and integration of knowledge and expertise (Hofer & Pintrich, 1997; Hofer, 2000). The other two dimensions of epistemology in Hofer and Pintrich’s model, *simplicity of knowledge* and *certainty of knowledge*, correspond with Schommer’s definitions of these dimensions. Hofer and Pintrich claim, furthermore that other factors concerning learning and teaching, for example, are “developmental precursors to the core ideas about epistemology” (Hofer & Pintrich, 1997: 119), but they are not a defining part of epistemology.

The primary research method employed by Hofer and Pintrich is the Discipline-Focused Epistemological Beliefs Questionnaire (DFEBQ) (Hofer, 2000). This questionnaire is developed to assess domain-specific beliefs based on Hofer and Pintrich’s four-factor model of epistemology. It is based on tools developed by Schommer and Perry, inter alia. These factors have not, however, been clearly verified by factor analysis (Bråten et al, 2007).

2.4 The study of epistemology's relevance for educational psychology

Apart from re-defining the concept and study of personal epistemology, educational psychologists have made contributions by demonstrating the relevance of epistemology by relating it to education and learning. Studies have shown that personal epistemology is related to strategy use, comprehension, academic performance and text comprehension (Bråten et al, 2007; Muis, 2007; Buehl & Alexander, 2001). Schommer refers to developments within the field of human learning with regard to the concepts of schemata and meta-cognition and claims that findings regarding epistemology may help advance knowledge in such areas where questions remain unanswered (Schommer, 1990). Ryan was also concerned with the relation between epistemology, information processing strategies and comprehension. In this case, a naïve view of the acquisition of knowledge was shown to lead to “oversimplified conclusions, low test scores, and overconfidence” (Ryan in Hofer & Pintrich, 1997:108). Other studies that have investigated factors that affect individuals' belief patterns can be incorporated with these findings to explain how to help students develop the most rewarding patterns of personal epistemologies. Schommer has, for example, shown relations between length of educational-experience and epistemic beliefs, and how advanced students are in their views of epistemology (Schommer in Hofer & Pintrich, 1997).

Personal epistemology is an important factor in the process of learning and performing in an educational context, not an abstract philosophical term (Schommer, 2004). Without educational psychological research on this matter, educators and parents may be unaware of the relevance and early impressionability of such an important set of beliefs. The task of finding out how students respond to direct instruction on epistemology remains to be solved (Schommer, 2004). Although the concept of personal epistemology does not strictly concern theories of learning it is clear that the belief system affects how students perform and how they approach

knowledge and learning. A further possibility is that by uncovering factors that influence epistemological beliefs, and finding out about the optimal pattern of epistemological beliefs, we will be able to combine the results and ultimately be able to help students develop these beliefs. To exemplify, if research suggests that females have more sophisticated epistemological views than males, then by looking at the ways females view the epistemic, and what factors cause them to think in this way, it may be possible to break these findings down into teachable theories of epistemology, that could also be taught to males. Further contemplation of how students' epistemological beliefs affect cognition and learning will be presented later in this dissertation (chapter 5: Discussion).

2.5 Defining personal epistemology continued: The specificity of knowledge beliefs

2.5.1 Domain specificity vs. domain generality

The term domain refers to “recognized fields of study associated with academic realms”, which can vary in terms of structure (Buehl & Alexander, 2001:401); or more foundational bodies of knowledge to which domain knowledge relates (Alexander et al in Buehl & Alexander, 2001). It is also said to encompass “declarative, procedural, and conditional knowing” (Alexander, in Hofer & Pintrich, 1997). To say that personal epistemology is truly “domain general” is to say that the same beliefs about knowledge hold for every area and subject, rather than being specifically connected to the area of study in question (Buehl & Alexander, 2001). Early studies shared a common assumption that personal epistemology was something that developed as a whole, and that was, therefore, a generalised concept (for example Perry, 1970). This underlying assumption of domain generality has affected development of research tools that have since been used and, subsequently, findings appertaining to domain-specificity (Hofer, 2000). Researchers have since

found differences in students' epistemologies regarding different areas of study (Buehl & Alexander, 2001; Hofer, 2000). Hofer found an "underlying dimensionality to epistemological theories that cuts across disciplinary domains, but that students...discriminate as to how these theories differ by discipline" (Hofer, 2000:378). Though, as Hofer points out, it is unclear whether such findings are the result of the educational programs' influence, or of the students' personal beliefs.

The main issue of contention pertains to whether beliefs about knowledge are universal or whether they are limited to subject area. A subject-specific concept would mean that individuals could, for example, view the humanities as a diffuse subject area where one is required to read from a variety of sources and draw conclusions, where information sources are uncertain and changing; at the same time regarding mathematics and physics as a set of "hard facts" that one is required to "accept and learn". Buehl and Alexander (2001) review a sample of studies that investigate whether individuals with different backgrounds vary in epistemological approach and whether certain epistemological patterns are more common to particular populations. Buehl and Alexander's initial stand-point is that beliefs concerning epistemology are "multidimensional and multi-layered", that "individuals possess general beliefs about knowledge, as well as beliefs about more specific forms of knowledge" (Buehl & Alexander, 2001:385). Other researchers view epistemology as context-specific and interrelated (Bendixen & Rule, 2004). Although Buehl and Alexander's presentation of results point towards domain-specificity, they also supply information to support the theory that "individuals develop in the same way along various dimensions across different domains", which bears some resemblance to a more domain-general approach. In short, they suggest that epistemology may be a set of beliefs that are domain-specific, but that each domain also has an underlying set of general beliefs (Buehl & Alexander, 2001).

This theory is supported to some extent by Sternberg's claim that classification of epistemology as *either* domain-general *or* domain-specific creates a "false dichotomy" (Sternberg in Muis et al, 2006:5). Sternberg's belief is that the two terms are "not opposed but complimentary, developing in an interactive fashion: Development has elements that are both domain general and domain specific" (Sternberg, in Hofer & Pintrich, 1997:126). Perkin and Salomon compare the concept of predominantly domain-general personal epistemology to that of a hand: "As you reach for an object...you shape your hand to assure a good grip...Likewise general cognitive skills can be thought of as general gripping devices for retrieving and wielding domain-specific knowledge" (in Schommer & Walker, 1995). Whilst Hofer's opinion leans more towards a domain-specific view: "increasing work on the nature of knowledge and knowing within different disciplines suggest that epistemological differences do exist". She further states that differences "are a part of the defining nature of the disciplines, and that these differences increase as expertise develops" (Hofer, 2000:383).

Muis et al (2006) present a review article including a meta-survey of 19 empirical studies concerned with domain-specificity versus domain-generality in personal epistemology. Based on their review of relevant articles the authors also draw the conclusion that epistemological beliefs are both domain-specific and domain-general. The authors propose a theoretical framework based on the study, The Theory of Integrated Domains in Epistemology (TIDE) framework, which describes the evolution of epistemic beliefs that are both specific and general and that influence one another over time. This model is developed within the socio-cultural tradition, which says that beliefs are a construction developed in interaction with socio-cultural surroundings and are context bound (Muis et al, 2006). According to the TIDE framework, development of epistemological beliefs occurs on several levels at one time. Not only do general beliefs become more sophisticated, but these developing beliefs also become more specific and context-bound. In a summary of the results

from the study Muis et al surmise that support can be shown for domain-specificity across “varying levels of education” both in between-subject studies and in within-subject studies (2006). The authors further underline that different results (on the question of domain-specificity versus domain-generality) have previously been concluded on the basis of different analytical approaches.

2.5.3 Topic Specific Epistemic Beliefs

Based on the foregone summary it seems that the majority of researchers in the educational psychology tradition now agree that individuals differentiate beliefs about knowledge depending upon domain. The above debate has recently been taken a step further in a cross-cultural study by Bråten, Gil, Strømsø and Vidal-Abarca “Dimensionality in Topic-Specific Personal Epistemology: A Cross-Cultural Study” (2007). The researchers argue that it is possible to identify a set of epistemological beliefs at a topic-level. Topic-specific epistemology is beliefs about knowledge and knowing with respect to particular topics within a domain (Bråten et al, 2007). The study in question identifies students’ epistemological beliefs specifically in connection to the topic of climate change. The researchers’ stated reasons for choosing the topic of climate change concern the likely facts that it is a topic about which participants are likely to have some, but not extensive, prior knowledge; it was possible to access and use texts that represent different kinds of authentic materials that are typically encountered by students; and it was considered to be a topic that would evoke interest because of the current media focus on the topic and the implications that it has for individuals and for other citizens (Strømsø et al, in press).

The method of focussing on a specific topic not only has the potential to advance research regarding the specificity of personal epistemology, but it allows for a more accurate exploration of the effects of other factors on personal epistemology by

controlling for the fact that different populations have been shown to consider their epistemological beliefs on different areas of knowledge when responding to more general questions on epistemology. Furthermore, the article is notable in that it reveals links from epistemology to Bandura's concept of self-efficacy. The concept of self-efficacy refers to an individual's "task specific self-concept" or their personal judgement of their capabilities for a specific learning outcome (Bandura in Pintrich & Schunk 2002). This research therefore presents an example of the amalgamation of two topics of investigation that can affect students' learning outcomes and motivation and may have direct effects for student learning, and again underlines the importance of personal epistemology's place within the area of educational psychology (ref Bandura and Bråten et al, 2007). This is a fairly new area of study in personal epistemology, where some tentative suggestions have been made (Muis, 2007; Hofer, 2002). The possibility of a relation between personal epistemology and other aspects of learning will therefore be taken up for discussion in chapter 5.

2.6 Factors that have been related to students' epistemological beliefs

Based on research showing that different patterns of epistemological beliefs affect students' learning, processing of information and comprehension (Muis, 2007), it is, therefore, desirable to uncover the various factors that are antecedents to these beliefs. In this way, home and educational environments can be optimised in order to encourage beneficial epistemological patterns in students. Schommer found age to be a predictor of beliefs appertaining to innate ability; and that the number of higher education classes a student attends predicts beliefs relating to certain knowledge; she also showed that home factors, such as *encouragement towards independence* and parents' education affect simple knowledge and quick learning beliefs (Schommer, 1990). Gender; cognitive functioning, including verbal activity level; educative atmosphere and opportunity; the individual's level of adherence to rules/ guidelines

have also been suggested as possible predictors of epistemological beliefs (Muis, 2007; Schommer, 1990). Mason et al (2006) have also shown that academic background affects students' beliefs about knowledge and knowing. Based on the above findings, it may be assumed that students' epistemological beliefs can be affected by a number of factors, social and innate. By discovering factors that enhance epistemological development, it may be possible to understand more about epistemological beliefs, and how to alter them.

2.6.1 Studies appertaining to gender and personal epistemology

Many of the early studies of personal epistemology can be used to highlight the discussion as to whether an individual's gender affects the way they view questions of an epistemic nature (Baxter Magolda, 1992; Belenky et al, 1986; Perry, 1970). The relevance of gender in the study of personal epistemology at that time may be attributed to a number of factors. Two possibilities include that gender was considered a significant factor in the make-up of individuals' epistemic beliefs, and the political climate at that time was influenced by feminism. Feminism refers to a perspective on research, politics and the world in general that stresses females' perspectives on phenomena, and was a precursor to many studies taking a female perspective (Alvesson & Sköldbberg, 1994). Due to the concurrent nature of these factors (beginnings of psychological research in epistemology and the epoch of feminism) gender may have been a variable that was explored more often during this time. The vast attention that gender has received in epistemological research and the equally great lack of conclusive evidence on the matter is what has drawn my interest to the topic. This reasoning lies close to that of Mason et al's (2006), but whereas they chose to omit to formulate a hypothesis appertaining to gender, I aim to look for evidence to support a view that males have a more certain view of knowledge, in line with the thinking of Baxter Magolda, for example. When making generalisations about groups in this way it is important to remember the existence of significant intra-group differences in later application of theories. Making generalisations is, therefore,

problematic, but this does not preclude the description of trends that can be seen (Pintrich & Schunk, 2002).

Gender is a topic that has continued to attract attention within the field of epistemology (Clinchy, 2002; Baxter Magolda, 1992; Belenky et al, 1986), partly due to the fact that developmental studies that go out from a male population (for example Perry) and are generalised to a larger population are often unfitting for women and have resulted in women being judged as “deficient” (Hofer & Pintrich, 1997). Two independent, but related studies that have impacted the nature of investigation into gender and personal epistemology are those of Belenky et al, 1986 and Baxter Magolda, 1992. The authors of these studies claimed that foregone works had failed to recognise the individual nature of women.

Belenky et al: Women’s ways of knowing

Belenky et al’s (1986) goal was to find out whether there was a mismatch between women and their patterns of thinking and higher educational establishments; and more specifically, “How come so many smart women feel so dumb?” (Belenky in Clinchy, 2002:63). The researchers’ goals were to consider the dimensions of women’s self-concepts, moral judgements, relationships and educational experiences. During research, however, Belenky et al became more aware of the importance of epistemological views for women’s self-concepts and world views, and this became a central part of their investigation (Clinchy, 2002). Using Perry’s scheme as a rough outline for the section of their research, they found that many of the women’s answers did not fit the scheme. The researchers developed an alternative description of the perspectives from which women view “the world of truth, knowledge and authority” (2002:64). As can be seen from the foregone description, the researchers attributed a great deal of how women considered the world and their place in it, to their underlying epistemological perspectives. Clinchy (2002) underlines that the

researchers' findings do not constitute a theoretical developmental framework since the sample upon which findings are based is too small. It is possible, however, that the model is representative of the different ways that women think at different periods of their life.

The model is made up of five epistemological perspectives. The lowest level of development identified by Belenky et al is *silence*, “a failure to develop” epistemological views, “a position of not knowing”, at which stage the women are uncertain about knowledge and about their place in the world, and feel muted as a result (Goldberger, in Clinchy, 2002:65). *Received knowledge* represents the stage of believing that is often represented as a dualistic perspective. Truth is something that lies out-with the self and is observable. It is handed down from authority to learner. The women are open to receiving knowledge and they do not question what they are told. The stage of knowing that is characterised by multiplicity in Belenky et al's model is called *subjectivism*. All opinions are of equal value for women who adopt this way of knowing. This means that many can be sceptical to the teachings of others and only rely on own observations. The researchers provide examples of women who may fall into this category, including those who have been mistreated. A position of scepticism to what others say is thus natural and beneficial for these women. The next level of knowing is that of *procedural knowing*. Knowledge is something that is developed by working with different interpretations and “requires the application of procedures for comparing and contrasting interpretations” (Clinchy, 2002:73). It is at this stage that one is aware of differing perspectives and can connect knowledge to contexts. One is required to take a stance on knowledge and views. This stage is further split into *separate* and *connected* knowing, which refers to ones attachment to the knowledge. Finally, *constructed knowledge* is the most complex and sophisticated view of knowledge. Again, few women belonged to this group. Knowledge at this stage seems to represent a mass of “organised confusion”, where knowers know and accept that there are several sources of knowledge, and that some merit more

consideration than others. Like Perry, the researchers underline that the thinkers must ultimately take responsibility for their knowledge and beliefs.

Although this model is developed to suit *women's* ways of knowing, clear similarities can be seen between these descriptions of how women think and the ways described in Perry's model that focused solely on men. The main difference is the way that it is tailored to how women think and the ways in which this affects their whole lives, as opposed to their academic life only. From Clinchy's (2002) description of the model, it is also clear that the women's epistemological assumptions are based on their life experiences, in other areas of their lives, so that the relationship between life experience and epistemological assumption is reciprocal: The women's perceptions of truth, knowledge and the world are based on their experiences, which in turn affect how they perceive new occurrences and incorporate them in their epistemological beliefs. In addition, the model was developed by four female researchers, who may have been able to identify more easily with the descriptions of knowledge, and world perspectives described by the women that they interviewed.

Baxter Magolda's Epistemological Reflection Model

Baxter Magolda's work comprised a longitudinal study of both sexes, partly as a reaction to works that were exclusively male (Perry, 1970) and exclusively female (Belenky et al, 1986). The author refers to *epistemological reflection* as "assumptions about the nature, limits, and certainty of knowledge, and how those epistemological assumptions evolve during young adulthood"; and to *epistemological transformation* as "a shift to a more complex set of epistemological assumptions" (Baxter Magolda, 2004). The researcher's work uncovered two "qualitatively different approaches" to ways of knowing that she discovered were related to gender (2004:34). By ways of knowing she was referring to *absolute knowledge*, or knowledge that is "certain and known by authorities"; *transitional knowledge*, which refers to knowledge that is

“absolute in some arenas, but uncertain in others” (2004:34); *independent knowing*, where most knowledge is viewed as uncertain, and *contextual knowing*, “characterized by the belief that knowledge exists in a context and is judged on evidence relevant to that context” (2004:37). Ways of knowing, Baxter Magolda concluded, are not segregated by gender, but there are patterns of epistemological thinking that are more typical for males and for females.

The model represents the same general progression in the development of epistemological beliefs in both genders, but different aspects are emphasised for each gender during the first three stages. At the absolute knowing stage, both genders view knowledge as something that is certain, but whereas a female’s approach is centred round listening and receiving knowledge at this time, the more male pattern is to actively seek to *master* knowledge. Of the 101 students Baxter Magolda interviewed in the first year of her study, two thirds held this view of knowledge. One third of the first year students viewed knowledge as *transitional*. At this stage the genders split on the basis that women are more likely to engage *interpersonal* aspects of knowing and men more *impersonal*. Whereas interpersonal knowers are more likely to share their views with others and try to connect the way they view matters to that of others; impersonal knowers focus on their own beliefs and are less likely to try to engage with others on the matter of their perspectives or to try to integrate others’ points of views. *Independent knowing* sees women and men divided by their patterns of *inter-individualism* and *individualism* respectively. At this stage all knowledge is uncertain and individuals have to look to themselves to determine their beliefs. Earlier stages in the model refer to women who listen to others and integrate their views, whereas men have concentrated on their own views. It follows, then that females experience a degree of tension at this stage and are still inclined to compare their ways of knowing with others, whilst males “focus on thinking for themselves” (Baxter Magolda, 2004:37). The author’s hypothesis is that patterns converge in the final stage of epistemological development, contextual knowledge, though only 2 out of the 80

participants who completed the whole study reached this level. At this stage students solidify their beliefs about knowledge, whilst at the same time being able to integrate new and contextual information to their beliefs. In likeness with other theorists (Perry, 1970) Baxter Magolda describes this as being the stage at which individuals take responsibility for their beliefs and for their identity (Baxter Magolda, 2004).

Baxter Magolda calls for more research on how gender-related patterns develop with regards to whether modes of knowing are socialised, and the influence of schooling on development. Investigations into links between epistemology and gender have yielded varying results. It can be imagined that such differences may be a result of factors such as researchers' interests in the topic, differences in research methodology, traditions, concept operationalizations, the wording of questions (that could be more suited to one gender than the other) or different considerations by males and by females when answering questions appertaining to epistemology, or answering research-related questionnaires. This would suggest that gender differences could be more noticeable when epistemology is studied as a domain general phenomenon, as suggested by Buehl et al (2002). Bråten et al (2007) suggest that measuring epistemology at a topic-specific level eliminates a number of the problems that are related to measuring relations between gender and epistemology.

Other important findings on gender

Hofer (2000) found variances regarding gender on the certainty and simplicity aspects of epistemology and on source of knowledge. Men saw knowledge as a more certain and fixed entity, whereas women were more inclined to view knowledge as something that is uncertain and changeable. Men were also more likely to believe in authority and expertise as the source of knowledge. Hofer does not elaborate on the results as to what women viewed as source of knowledge, but, based on other literature it can be assumed that women saw knowledge as something that individuals

arrive at via reasoning, based on a number of sources. These findings suggest the epistemic beliefs of first year students are more sophisticated in females than in males (Hofer, 2000). Hofer relates these findings to earlier research by Baxter Magolda (1992) and suggests that her findings may provides further evidence for the claim that there may be gender related patterns in ways of knowing.

Mason et al (2006) carried out a study of 881 Italian students from elementary, middle and high school. Based on Kuhn's (2000) model of the development of epistemological understanding, Mason found that boys exhibited a more absolutist position than girls, where epistemological development is viewed as a progression from absolutism, to multiplism, to evaluativism. Contrary to Kuhn's finding, boys were more likely than girls to see knowledge as "absolute, certain, non-problematic, right or wrong, and does not need to be justified since it is based on observations from reality or authority (prevalence of the objective dimension)" (Mason et al, 2006:44). Males, then, believe in certain data and certain, observable facts. They are less likely to consider that an alternative opinion or point of view may be correct. Moreover, girls were quicker to advance from absolutist views on knowledge to multiplist, but the transition from multiplism to evaluativism was no different.

Previous findings seem to suggest that there is some relation between gender and how individuals view knowledge and knowing, though results are inconclusive (Mason et al, 2006; Baxter Magolda, 1992). Belenky et al's (1986) model demonstrates a differentiation between *connected knowing* and *separate knowing*, that is reflected in women and men. Connected knowing seems to require more effort and is a skill to be learned. It is also a type of knowing that acknowledges context dependent knowledge. It has been suggested, in later studies (Galotti et al, in Clinchy, 2002) that these two ways of thinking are representative of women and men respectively, since females have "consistently rated connected knowing statements higher than separate

knowing statements, whilst males' ratings of the two models did not differ." The theorists underline, however, that the two ways of thinking are merely *different*, not superior or inferior to one another. Paradoxically, it seems that women's uncertainty is the factor that makes them more sophisticated in their epistemological views. This element of uncertainty, however, corresponds to other research in, for example, motivation, where females have been shown to have lower self-perceptions (Pintrich & Schunk, 2002), which demonstrates that male and female thinking differs in other related areas. This topic will be re-visited in the discussion chapter.

2.6.2 Topic knowledge and topic interest

Topic knowledge refers to the level of expertise an individual has about a specific issue, it can also be termed prior knowledge. Topic knowledge has been shown to have effects on text comprehension (Bråten et al, 2007; and Alexander et al, in Boscolo & Mason, 2003) and can thus be implied to have effects on subsequent learning also. Topic interest is defined here as the degree to which a student shows a certain level of attention and an active engagement for an issue. Interest is another variable that has been shown to affect learning (Boscolo & Mason, 2003). Boscolo and Mason (2003) explain interest is something that is "generated by certain conditions, environmental stimuli, or both – such as novelty and intensity". They also inform "Individual interest is a relatively stable evaluative orientation toward certain domains" (2003:128). Interest is said to include two components related to value that involve feelings associated with an object [or topic] and an attribution of personal significance to the object (Schiefele in Boscolo & Mason, 2003). Boscolo and Mason go on to explain that *topic interest* is used in literature to describe "a specific form of individual interest, focused on knowledge domains" and "a form of situational interest" (2003:129). These two forms of interest have different underlying reasons and responses. In the first case a person values a topic and is keen to find out more information on it, and in the second, a cognitive response is triggered in the person by

the topic (Boscolo & Mason, 2003). The link between the two concepts of topic knowledge and topic interest is further exemplified in Renninger's conceptualisation of interest (Renninger in Pintrich & Schunk, 2002). According to Renninger, a high level of interest without a corresponding high level of knowledge merely constitutes an attraction. In order to say that an individual is truly interested in a topic there has to be evidence that the individual has a high value for this topic and high stored knowledge.

The issue at hand in this study is climate change. This is a topic that can be seen to be both of personal interest and of situational interest to students. It is a developing area of knowledge that also affects our lives and those of coming generations. My choice of topic knowledge and topic interest as factors for investigation is based upon a combination of factors from Bråten et al's (2007) and Buehl et al's (2001) studies. More specifically, by focussing on one topic, the investigation will uncover a more specific measure of personal epistemology, as opposed to a vague one that relates to different subjects by different candidates. Furthermore it will help ensure that any relations that are discovered between personal epistemology and gender, topic knowledge or topic interest will not be affected by irrelevant factors that may otherwise have been included in a less specific measure of epistemology. This is based on the assumption that by focussing on a specific topic, other issues such as the possibility that males and females may consider different domains when asked to consider "general knowledge", will be eliminated. It has also been shown, on numerous occasions that development of personal epistemology is related to students' age and/or academic progression (Mason et al, 2006; King & Kitchener 2004; Kuhn, 2000; Perry, 1970). I believe that individual's knowledge for certain topics increase with age, although there are exceptions to this, I believe that climate change is one such topic. Kintsch (in Boscolo & Mason, 2003) proposed that "an optimal level of topic knowledge, neither too high nor too low, is a necessary condition for triggering interest. Boscolo and Mason also cite research by Alexander, Kulikowich and Schulze (1994a) that show students with more knowledge, especially in the form of

domain knowledge, obtain higher recall scores and give higher ratings to their interest in the content of texts they read (Boscolo & Mason, 2003).

Many early studies identify educational experience as a factor that affects development of more sophisticated epistemological beliefs (Perry 1970, King & Kitchener 1994). The question here is whether this educational experience provides students more specific and in-depth topic knowledge, or a more generally sophisticated ways of thinking, which the students are then able to apply to other areas. The two alternative hypotheses put forward by Bråten et al concerning topic interest suggest that either (1) students that show an interest in a specific topic are “more likely to hold sophisticated beliefs about knowledge and knowing”, or (2) that interested students are “more likely to attach values and feelings to it”, and would, therefore “display some kind of one-sidedness or my-position bias with respect to epistemic beliefs”. This, would result in more naïve epistemic beliefs; a kind of idolisation of the “greats” within a subject area, according to Bråten et al. Based on these hypotheses and the definitions of interest supplied by Boscolo and Masson and Renninger, I believe that an individual with an interest in a topic is likely to want to find out more about the topic to satisfy his interest and gain cognitive and affective stimulation. This seems to be equivalent with one who is interested in finding out about different sides of a topic to justify their curiosity. This should lead to sophisticated views of the epistemic in relation to justification for knowing. This hypothesis is further supported by Scheifele’s findings that high-interest readers “developed a representation of the text’s meanings, whereas low-interest readers assimilated the text superficially” (Scheifele in Boscolo & Mason, 2003:129) and furthermore, that topic interest was significantly related to “recall of idea units, elaborations, and main ideas, independent of pre-existing knowledge” (Schiefele & Krapp, in Boscolo & Mason, 2003:129).

All of the above findings exemplify techniques that may be employed by individuals with sophisticated beliefs about justification for knowing. This leads me to believe that it may be possible to demonstrate a relation between topic interest and justification for knowing. It may, however, be the case that there is no such general pattern here, and that how much one tends to investigate a topic and try to find out more about it is a personal issue that depends on other matters, such as time, cognitive resources and access to knowledge. Furthermore, it may be that individuals with a particularly vast knowledge have, in some way, lost interest for a topic and have no desire to find out more about the topic. This may be true, for example, if a student learns a lot about a topic at school which he is in no way pre-disposed to liking, which drives him to take distance from it, for example compulsory religious studies. In this case a great deal of knowledge would not lead to more sophisticated views on justification for knowing. On the matter of topic knowledge, Bråten et al propose “more knowledgeable students would also display more sophisticated epistemic beliefs concerning knowledge and knowing in the area” (2007:15). It is my hypothesis that topic knowledge and topic interest are highly correlated, and that these two factors together will predict students’ degree of sophistication regarding justification for knowing. These hypotheses will be discussed in light of my findings in a later section within this dissertation (chapter 5: Discussion).

3. Chapter 3: Methodology

3.1 Introduction to methodology

Through use of questionnaires and empirical analysis as a method of investigation I wish to explore possible statistical relations between the independent variables gender, topic interest and topic knowledge with specific dimensions of personal epistemology. Demonstrating correlations between two or more variables is a method that is commonly employed in research as evidence of some kind of relation between variables (Lund & Christophersen, 1999). With respect to proposed relations between gender, topic interest and topic knowledge and dimensions of epistemology, I expect it will be possible to observe relations with certainty of knowledge and with justification for knowing. As stated, regarding gender, I expect that males will view knowledge as something that is more certain and fixed, whereas women will be more likely to believe that knowledge is tentative and evolving. On the matters of topic knowledge and topic interest, I predict that candidates with a greater interest in a particular topic will be more interested in finding out information about a topic and creating their own picture of what constitutes knowledge; and that interest and knowledge on a specific topic will be closely related. This is a relation I believe to be true irrespective of gender. I therefore believe that high levels of topic knowledge and topic interest will act as predictors of a more sophisticated view of the justification for knowing dimension of personal epistemology. I will also be interested to see if there are further correlations between the independent variables and the other dimensions of personal epistemology, i.e. the source of knowledge and the simplicity of knowledge.

In order to investigate the above hypotheses I will use data collected in connection with the project *Learning in a Knowledge Society: Constructing Meaning from*

Multiple Information Sources (Bråten et al, 2007). This section will rely on the descriptions of the authors of the forenamed project that have developed the questionnaire due to their exclusive knowledge on the questionnaire. Making use of data from a larger project also affords the opportunity to make comparisons with other sample groups.

3.2 Methodological issues

When making use of empirical research methods it is important to underline some issues that affect the credibility of the study and any tentative conclusions. The first of these issues that has already been mentioned briefly is drawing conclusions based on the existence of statistical correlation. “A correlation describes the relationship between two equal-interval numeric variables” (Aron et al, 2006:444). It is important that a correlation between two variables is not interpreted as proof of a causal relation without further investigation. As Aron et al (2006) explain when two variables are related by a significant linear correlation, we normally assume there is something causing them to go together. In order to make a claim about cause and effect, it is necessary to fulfil three conditions: “the cause must precede the effect, the cause must covary with the effect, and no plausible threats to validity [should be] present” (Muis, 2007:186). “However, you can’t know the *direction of causality* (what is causing what) just from the fact that the two variables are correlated” (Aron et al, 2006: 466). There are three possible ways of looking at correlations regarding causality. Given two factors, X and Y, it may be the case that X is causing Y, that Y is causing X, or that some third factor, Z is directly or indirectly affecting both factors. Even when researchers feel they are confident that X is the cause of Y, X will not be the *only* cause of Y, since examining two factors alone in isolation would not only be difficult, but would represent an artificial representation of the world (Aron et al, 2006). However, with help of multiple regression analysis we are able to control for this

third factor, Z, and examine the unique prediction ability of specified variables (Lund, 2002).

Another noteworthy factor on this issue is that correlation coefficients direction and strength can be “drastically distorted by one or more individual’s scores on the two variables if each pair of scores is a very unusual combination” (Aron et al, 2006: 472). This phenomenon, which is also known as the influence of outliers serves as a reminder to the fragility of the statistical tools used in research, and the possible influences on conclusions that are based on statistical relations. When making use of non-experimental design method researchers are required to evaluate alternative interpretations of statistical results in order to investigate a possible causal relation, which can be done using, for example, rational argumentation, based on foregone research findings and literature (Lund, 2002).

Cook and Campbell’s validity system (referred to in Lund, 2002) identifies four issues of validity that must be satisfied in empirical research. The system refers specifically to: statistical conclusion validity, internal validity, construct validity and external validity. Each type of validity is subject to a number of *threats* that put at risk the overall validity of empirical research (Lund, 2002). Statistical validity requires a relation to be *statistically significant and relatively strong*. Statistical errors and random errors in calculation or measurement are two factors that can negatively influence the validity of statistical significance. Internal validity refers to the degree to which we can say that one operationalized variable (the independent variable) is affecting another (the dependent variable). Threats to internal validity include factors such as maturation of participants, the effects of testing and other historical factors that may affect participants’ performance. Construct validity describes the level to which each operationalized variable measures the actual variable it aims to measure. It refers to problems related to operationalising theoretical terms so they can be

measured in empirical research. The most common threats are that irrelevant factors are included in the definition of dependent or independent factors, so that some extra element is included in the measurement, or that some important element of the factors is excluded by the way a factor is defined and measured by the research tool. Finally, external validity is concerned with the degree to which empirical results can be generalised to other populations, situations and times and how far generalisations can be extended. The research problem and design are vital indicators of the directions in which generalisations can be made and should, therefore, be as representative as possible (Lund, 2002). The external validity of an experiment may be threatened by an abnormal sample group that may not present a good representation of the rest of the population, making generalisations inaccurate (Lund, 2002). Due to the size and nature of this group of law students, who voluntarily took part in a two hour survey, it is unlikely that the results can be generalised to all law students, let alone students from other faculties or at other universities. The most relevant form of validity for this study is construct validity, with regards to operationalisation of the term *personal epistemology*. The validity of the study therefore relies upon the how the term is defined by the authors of the questionnaire (Bråten, Strømsø and Samuelstuen, 2007) and the degree to which the statements measure what the researchers have intended. As Aron et al (2006) highlight, measures such as questionnaires that are often employed in educational-psychology research, are rarely consistent or stable over time.

The merits and disadvantages of use of questionnaires as a research method are discussed by a number of authors (Dyer, 2006; Lund, 2002). In short, administration of questionnaires is speedy, unobtrusive, can be carried out at any time and allows the researchers to gather information on many topics for a large population at the same time. Another major advantage of using questionnaires to gather data is that it can be modified to meet the exact requirements of the researcher (Dyer, 2006). The anonymity afforded by questionnaires may be a way of eliciting more truthful

answers, when participants are free to answer questions as they will, without fear of being judged by an interviewer. Their answers will not be swayed by interviewers' subtle responses or body-language either. However, it is difficult for researchers to assess the credibility of individuals' answer when they do not meet on a one-to-one basis. Questions that are open to interpretation or in some way leading may also affect whether participants interpret questions in the way intended by the researchers, which may affect the validity of design method. This issue is less relevant when measuring topic knowledge, but for topic interest and epistemology, where candidates are required to grade statements on a Likert-type scale, based on their understanding of what is written, the validity of questionnaires as a method of investigation may be brought into question.

With regards to assessing personal epistemology, Hofer (2000) explains "[t]here are several written questionnaires that tap certain aspects of personal epistemology as initially outlined by Perry (1970) , such as the Measure of Epistemological Reflection, a set of essay stems related to classroom learning (Baxter Magolda, 1992); the Measure of Intellectual Development (MID), a production task instrument with essay stems; and the Learning Environment Preferences (LEP), a recognition-task instrument with forced-choice items". She continues "[w]hile each of these instruments has value in particular, none tap all of the dimensions of epistemological beliefs suggested throughout the literature. Nor do they provide appropriate means for assessing disciplinary differences of beliefs across these dimensions." (Hofer, 2000:385). On reading this critique of currently available assessment techniques, it seems that Hofer has high demands for assessment of epistemology; though her preference seems to be for a more broad assessment of epistemological beliefs. She indicates that this is best achieved by Schommer's Epistemological Belief Questionnaire (Schommer, 1990), which she points out is widely used, particularly in studies on the correlation of epistemological beliefs and student learning. She does, however, highlight a number of limitations too, including items which leave room for

interpretation by respondents; the way in which some statements refer to individual views and some to others' perceptions of knowledge and knowing; and she reminds us that there has never been research to show that factors are loaded on the individual items (Hofer, 2000). Perhaps one way of circumnavigating this problem is to focus, as Bråten et al (2007) have done, on individuals' personal epistemologies regarding one topic. By concentrating on one topic and carefully wording the statements so as to stick to individual epistemological views, researchers may be able to gain a more accurate measurement of epistemology.

The term *reliability* refers to an instrument's ability to test consistently over time. Reliability refers to the degree to which experimental results are influenced by random errors in measurement (my translation, Lund, 2002). Lund names a number of measures that can be employed to increase the reliability of an experimental design. Such measures include standardisation of measurements procedures (in this case the questionnaire and the way in which it was administered) and increasing the number of questions in the questionnaire and the sample size. The reliabilities of the instruments used in this study were tested using two measures: Pearson's r and Cronbach's alpha.

3.3 Participants and setting

The sample group upon which the data for this investigation focuses was made up of 49 law students. These students were part of a larger class following a Masters degree Program (MA) in Law at the University of Oslo (UiO). The questionnaire was administered in the spring semester of 2007 at a time when the students were normally gathered for a lecture. The MA in The Science of Law (MA i rettsvitenskap) is a five year course consisting of 300 ECTS (European Credit Transfer and Accumulation System) credits. In order to embark upon the Masters

program in Law, students are required to achieve “General Study Competence” (generell studiekompetanse). This means that they have completed 12 years of schooling including Norwegian High School and achieved pass grades. Each grade is awarded a number of points, which are then summed together and students can be compared based on scores, which can further be affected by students’ age and relevant experience. The maximum number of students accepted each autumn semester for this MA is 295, which means that competition for a place on the course is fierce, and the average entrance requirement is relatively high.

The participating students were in their fourth semester studying a 50 ECTS course in International Human Rights, which is mandatory for students following the science of law degree programme. The course spans over the third and fourth semesters of a total of ten semesters. A full-time workload for one academic year at Norwegian universities consists of 60 ECTS credits. During the fourth semester students are also required to study “examen facultatum” at the same time (information from homepage for course in International Human Rights

<http://www.uio.no/studier/emner/jus/jus/JUR2000/>). The vast majority of students from the sample (n=40) had previous academic experience at university level. Approximately 40 percent (38.8%) of the sample group had studied for more than two years at a post high school (videregående) level.

Throughout the course of the study, students enrolled in the MA course are required to participate in classes such as family law, property law, legal methodology, tax law and civil law. The various forms of examination during the five years of study include school-based exams, take-home exams, oral examination and a dissertation in a chosen area of law. Students graduating from this Masters degree can typically expect to find employment as lawyers, judges or in the Norwegian Police Force (<http://www.uio.no/studier/program/jus/om/jobb-og-studiemuligheter.xml>).

The sample group was made up of 79.6% females and 20.4% males. The overall mean age of the sample group was 24.5 years ($SD=6.0$). The sample consisted mainly of Norwegian students that had Norwegian as their first language, with the exception of 6 students that had a first language other than Norwegian. Participation in the survey was voluntary and students were encouraged to participate by the incentive of the possibility of winning a travel gift-voucher. Not all of the students in the class chose to complete the survey, though with 49 students choosing to participate, the group possibly large enough to be able to make some tentative suggestions as to the nature of the epistemological beliefs of law students at a university in Norway, and to be able to make comparisons with other sample groups that took part in the larger survey.

3.4 Materials

Candidates were provided with a folder containing three files. The first file contained a questionnaire that was designed to gather data on students' background information, previous knowledge, topic interest and personal epistemology. File number two contained seven texts on the topic climate change. Finally, file number three focussed on extraction of information of texts and on how students valued different sources and were able to integrate information from multiple sources. Using a questionnaire in this way to gather data is a *non-experimental* research design. In non-experimental designs experimental conditions are not altered by the researcher. The goal of the design is to describe the situation as it actually exists (Lund, 2002). Strictly then, use of non-experimental design excludes the possibility of drawing conclusions with respect to causal-relations. This is because the method's technique of *natural investigation*, which precludes control of one variable, prevents researchers from being able to study one variable's affect on another. It is, however,

common practice to try to investigate and make tentative conclusions on a possible relation between variables, this including causal relations (Lund, 2002), and see previous discussion on investigating causal relations in empirical research.

3.4.1 Texts

Each file contained 7 separate and randomly organised texts that could be read in order of personal choice. The author, source and date of publication of each text were printed at the top of each sheet. The texts were taken from a wide variety of sources and were on average 250-300 words long. The seven texts presented partly conflicting information on the topic of climate change: two texts presented information on the possible causes of climate change (man-made vs. natural causes); two texts focussed on the possible consequences of climate change (negative vs. positive); two presented different views on solutions to global warming (international agreements vs. technology); finally, there was a fairly unbiased text from a school textbook (Strømsø et al, in press).

Specifically, the texts related the following views on climate change: Text number one was published by the Centre for International Climate and Environmental Research at the University of Oslo. The text's main focus was on the causes of the manmade greenhouse effect and their contribution to climate changes. Text number two was taken from a research magazine. In this article a professor of theoretical astrophysics presented the idea that climate changes are largely steered by astronomical factors and are therefore not due to factors introduced by humans, but to natural causes. The third text was written by a journalist in a Norwegian daily newspaper that is known for being liberal. The newspaper article described the negative consequences of global warming in its potential to weaken ocean currents in the North Atlantic and melt ice around the poles. The fourth text was also a

newspaper article, this time from a Norwegian conservative daily. The article described the positive consequences of a warmer climate in northern regions. The main focus in this article was an ice-free sea route through the Northwest Passage and the access to natural resources that are currently concealed under Arctic ice. The fifth text was published by the Norwegian Pollution Control Authority, discussing international cooperation within the framework of the UN as a way to reduce the discharges of climate gases. The sixth text was a project presentation published by a large Norwegian oil company. The text described new technology that could reduce the discharges of carbon dioxide into the atmosphere. The seventh and final text was extracted from a school textbook in natural sciences at a level suited to upper secondary. It explained natural and man-made greenhouses effects in somewhat neutral terms (Strømsø et al, in press).

3.4.2 The questionnaires

The questionnaires are designed to assess elements of students' *prior knowledge*, *topic interest and personal epistemology* within the topic of climate change. The section appertaining to topic knowledge consists of 17 items referring to central issues on the topic of climate change, including questions of a scientific nature and a political nature (Bråten et al, 2007). Questions designed to assess students' topic-knowledge include statements and five possible answers that participants have to choose between, for example: "The greenhouse effect is caused by...", 1) a hole in the ozone layer, 2) increased use of atomic energy, 3) increased levels of acid precipitation, 4) radiation that is not released through the atmosphere, or 5) pollution of the world's oceans. Another example of a question appertains to the Kyoto Protocol: "The Kyoto Protocol is...." and five possible answers here. The candidate's score is calculated by the number of questions he answers correctly out of the possible seventeen (examples taken from a test protocol, Bråten et al, 2007). The reliability of the measure of topic knowledge was measured using a test-retest

method. The questionnaire was administered to a control group of first year students ($n=56$) at the University in Trondheim (Norges teknisk-naturvitenskapelig universitet). The sample group was tested again after a period of two weeks. Reliability was estimated at .77 (Pearson's r), which indicates a high level of reliability (Bråten et al, 2007). Pearson's r is the term used to describe the linear correlation between two variables. The value of r indicates the type of correlation between two variables (negative or positive) and the strength of the correlation (Lund & Christophersen, 1999). In this study, Cronbach's alpha was also used to measure the reliability of the questionnaire appertaining to topic knowledge. This resulted in a measure of .63 (Cronbach's alpha).

The procedure for assessing topic interest and personal epistemology varies slightly in that in these cases it is not possible to answer questions "correctly" or "incorrectly". *Interest* in the topic of climate change was assessed using a 12-item assessment. Half of this section of questions was designed to measure passive *interest* and half were to assess candidates' active *involvement* in the issue. Level of passive and active engagement was indicated by candidate's response to statements indicating interest and engagement on the basis of ratings on a 10-point Likert-type scale (10 = strongly agree with statement, 1 = strongly disagree) (Bråten et al, 2007). Statements designed to assess candidates' level of topic interest included the following: "Global warming is an issue that interests me", which is indicative of the student's level of passive interest in the topic; and "I try to convince others that we must reduce the amount of harmful gas-emissions into the atmosphere", this statement indicates that the student is actively involved in issues surrounding climate change. Bråten et al (2007) demonstrated that the measured phenomenon was a uni-dimensional construct, i.e. that all twelve items loaded on only one factor. In this study the measure of topic interest had a reliability estimate of 0.94 (Cronbach's alpha), which constitutes a high reliability estimate.

The method of investigation used to measure personal epistemology in this study is based on the early empirical works, such as Schommer (1990) and Hofer and Pintrich (1997). The topic-specific epistemological questionnaire by Bråten, Strømsø and Samuelstuen (2007) is related to Hofer and Pintrich's (1997) Discipline-Focused Epistemological Beliefs Questionnaire (DFEBQ), though it is adapted to suit the topic of climate change. This section of the questionnaire contains 49 statements on knowledge and knowing that candidates assess on the basis of a 10-point Likert-type scale (10 = agree strongly, 1 = strongly disagree). Higher scores represented more sophisticated epistemological beliefs, although the wording of some questions meant that the opposite was true, and for these questions candidates' scores had to be reversed before their views on the dimensions of personal epistemology were quantified. The questions are specifically designed to assess beliefs about knowledge and knowing on climate change; more specifically, the simplicity of knowledge on climate change (specifically assessed by 12 of the 49 items), the certainty of knowledge on climate change (12 items), the source of knowledge on climate change (12 items) and justification for knowing about climate change (13 items). As before, these dimensions corresponded with those in the DFEBQ (Bråten et al, *ibid*), with earlier factor analyses showing that questions loaded on four factors corresponding to Hofer and Pintrich's dimensions (Strømsø et al, *in press*). As Strømsø et al underline, while several researchers have developed questionnaires to measure personal epistemology at a domain-specific level, very few researchers have attempted to carry out an assessment of personal epistemology at a topic-specific level.

In order to increase the reliability of the questionnaire, a number of items were deleted for the purposes of empirical investigations into correlations between questions on epistemological beliefs and the components of epistemology. This resulted in a total of six items being assigned to the certainty component of personal epistemology. High scores on this section suggest a sophisticated view on the certainty of knowledge on climate change. It was also the case that six items could be

shown to represent a reliable measure of participants' views on the simplicity of knowledge, whilst justification for knowing was measured with seven questions, and source with five. The following examples of questions appertaining to the four dimensions of personal epistemology are taken from the questionnaire (my translation): "The only thing that is certain on the topic of climate change is that nothing is certain" (refers to certainty of knowledge dimension); "I try to evaluate what I read on climate change in order to check its reliability," (refers to justification for knowing); "my perceptions on problems within the area of climate change are worth little in relation to what I can learn from textbooks and articles" (refers to source of knowledge, also an example of a question where the candidate's response score had to be reversed in order to give a representation of their epistemological perception); and "Knowledge on climate change consists of closely related concepts, rather than a collection of facts" (a statement that refers to simplicity of knowledge). The items that were chosen are those that are shown to measure the specific components of epistemology most reliably on the basis of their Cronbach Alpha scores. The reliability estimate for the component appertaining to the certainty of knowledge was .80; scores for items appertaining to the simplicity of knowledge on climate change resulted in a reliability estimate of .57; the reliability estimate for the scores on the source component was .78; and the estimate for the items linked to justification for knowing was .72. Aron et al inform that a Cronbach's alpha of "at least .60, and preferably closer to .90" is considered a "good measure" in psychology (Aron et al, 2006:603).

The final section of questions in the file was designed to assess comprehension of multiple texts, and lies out-with the remit of this essay.

3.5 Procedure

The questionnaire was administered by one professor of education, one PhD student and three trained research assistants that were familiar with the research project. Students were given short verbal instructions as to the nature of the experiment and who the researchers were. They were informed that all responses would be confidential and that they should work their way through the folder in the order that it was presented (Questionnaire 1: previous knowledge, topic interest and epistemology; 2) texts (which could be read in any order); and finally 3) questionnaire appertaining to comprehension of multiple texts). Participants were allotted two academic hours to complete the questionnaires, which was sufficient for the vast majority of students that participated in the experiment.

3.6 Analyses

The goal of the analyses is to examine whether the chosen predictors (independent variables) can be shown to be related to the specified dimensions of epistemology (dependent variables). In order to do this I will investigate correlations between the proposed predictors and the various dimensions of personal epistemology. It is important to reiterate that correlation between two or more factors does not constitute causation. I will also investigate the proportion of the variance in students' measured epistemological beliefs that may be uniquely attributed to the named predictors, by performing multiple regression analyses. Multiple regression refers to statistical analysis that "analyses the relation between multiple independent variables and one dependent variable" (Lund, 2002:276). The calculation allows the researcher to show how much of an identified variation can be explained by a specific predictor when other factors are controlled for (Aron et al, 2006). The standardised regression coefficient is called standardised beta (β). It "has the same value as the correlation coefficient (r) between the two variables" (Aron et al, 2006:515).

4. Chapter 4: Results

The following information, represented in tabular and written forms, illustrates the group's composition, questionnaire results and the results of regression analyses. The purpose of these analyses is to test my hypotheses that 1) gender is a predictor of views on certainty of knowledge, and 2) topic knowledge and topic interest are predictors of justification for knowing. In order to do this I investigated correlations between the independent variables and dimensions of epistemology and then used multiple regression analyses to check whether 1) gender has a unique prediction effect for certainty of knowledge and 2) topic knowledge and topic interest predict justification for knowing when other factors are controlled for.

Table 1: Descriptive Statistics

		Statistic	Statistic	Statistic	Statistic
	N	Minimum	Maximum	Mean	SD
Age	49	21	47	24.49	5.995

Table 1 shows the demographic make-up of the sample group relating to age. The arithmetic average age of the 49 participants was 24.49 years. The youngest participant was 21 years old and the eldest was 47 years at the time of the study.

Table 2: Gender (N=49)

Male	10	20.4%
Female	39	79.6%

Table 2 shows that 20 percent of the participants in this survey were male and 80% were female. Although the gender divide is unevenly distributed, 10 males is a relatively large group. The distribution of gender in this study furthermore mirrors

that of the larger study by Bråten et al (2007), where 81.3% of the group were female and 18.7% were male.

Table 3: Descriptive Statistics for justification beliefs, simplicity beliefs, certainty beliefs, source beliefs, topic interest and topic knowledge.

	N	Minimum	Maximum	Mean	Std. Deviation
Justification	49	4.11	9.67	7.26	1.22
Simplicity	49	4.44	8.89	6.81	0.92
Certainty	49	4.45	10.00	6.99	1.33
Source	49	4.18	9.82	6.44	1.25
Topic interest	49	1.00	9.58	5.69	1.85
Topic knowledge	49	2.00	15.00	8.20	2.69

The 4 epistemological dimensions are scored on a Likert-type scale, from 1 to 10. Each dimension has a possible average score from 1-10. All of the average scores for dimensions of epistemology range from 6.44 to 7.26, which is indicative of fairly advanced epistemological beliefs. Source of knowledge has the lowest average score (6.44) and justification yields the highest average score (7.26). One noteworthy result from this table is that one candidate scored 10 on certainty of knowledge, which indicates a belief in tentative, evolving knowledge in the area of climate change. This candidate was male. The larger international study by Bråten et al (2007), where 225 Norwegian and 217 Spanish students of psychology and education were tested using the same questionnaire, the corresponding averages were somewhat lower, with justification beliefs averaging at 6.75, simplicity beliefs at 6.56, certainty at 6.73 and source averaging at 5.95. This may suggest that the sample group has, on average,

somewhat more sophisticated epistemological beliefs. There are a number of factors that may explain this, which will be taken up in the next chapter.

Topic interest and topic knowledge are scored out of a possible 12 and 16 points respectively. The average score for topic interest was 5.69, which is relatively low (but higher than the comparison group), and 8.20 for topic knowledge. The maximum score for topic knowledge in this sample was 15 points out of a possible of 16, which is a remarkable score. In the study mentioned above, the corresponding scores were, again; generally lower than in the sample of law students. Topic interest averaged at 4.89 and topic knowledge at 7.24 (topic knowledge score is out of a possible 17 in this case).

Table 4: Correlations between selected factors for study and dimensions of personal epistemology

Variable	1	2	3	4	5	6	7
1. Gender	-						
2. Topic knowledge	.00 1	-					
3. Topic interest	.06 9	.438** *	-				
4. Certainty of knowledge	.15 9	.082	.022	-			
5. Justification for knowing	.16 1	.267*	.369** *	.322* *	-		
6. Simplicity of knowledge	.03 9	.261	.248	.362* *	.148	-	

7. Source of knowledge	.03	.212	.109	.222	.388**	.10	-
	7				*	0	

*Correlation significant at 0.10 level (2-tailed) ** Correlation significant at 0.05 level (2-tailed) *** Correlation significant at 0.01 level (2-tailed)

Significant correlations can be observed between topic information and topic knowledge; topic knowledge and justification; topic interest and justification; certainty and justification; certainty and simplicity; and justification and source. Due to the size of the sample group ($N = 49$) correlations that are significant at $p < .10$ level are also considered. These data suggest that an individual that is interested in a topic has more knowledge about it, which is in line with previous research (for example Kintsch in Boscolo and Mason, 2003). It also suggests that individuals who have sophisticated epistemological views on one dimension of epistemology are likely to hold similarly sophisticated views on other dimensions, which may be related to Hofer's work on epistemological theories as dimensions that are coherent and internally consistent (Hofer, 2000). Based on the results of these analyses there is no statistical evidence that there is a relation between gender and certainty of knowledge, though there is a possibility a relation would have existed given a larger sample group. The question of gender and a relation to certainty of knowledge beliefs will be revisited in the discussion chapter.

Results of multiple regression analyses for variables that may affect personal epistemology

Tables 5-8 show each of the dimensions of epistemology and the unique prediction of scores on each dimension by gender, topic interest and topic knowledge.

Table 5: Justification for knowing

Predictors	B
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Gender	.140
Topic Interest	.301*
Topic Knowledge	.135

*Significant at 0.10 level **Significant at 0.05 level *** Significant at 0.01 level

Regression analysis showed that the three predictors together explained a significant proportion of the variance in students' beliefs about justification for knowing, $F(3, 45) = 3.064$, $p < .05$, $R^2 = .17$. Moreover, there was a significant relation between justification for knowing and topic interest, $\beta = 0.301$, $p < 0.1$. In line with my previously stated hypothesis, this suggests that students that were interested in a topic were also likely to have more sophisticated beliefs on justification for knowing.

Table 6: Simplicity of knowledge

Predictors	B
Gender	-.051
Topic Interest	.170
Topic Knowledge	.187

For simplicity of knowledge the three variables together failed to predict a significant proportion of the variance in students' beliefs, $F(3, 45) = 1.533$, non-significant, $R^2 = 0.093$. None of the individual predictors were significantly related to students' beliefs on simplicity of knowledge.

Table 7: Certainty of knowledge

Predictors	B
Gender	.161
Topic Interest	-.031
Topic Knowledge	.096

Contrary to my hypothesis on the matter, the three predictors together also failed to explain a significant proportion of the variance in students' beliefs about certainty of knowledge, $F(3, 45) = .506$, non-significant, $R^2 = .033$. None of the predictors were significantly related to certainty of knowledge either.

Table 8: Source of knowledge

Predictors	B
Gender	-.039
Topic Interest	.023
Topic Knowledge	.202

For source of knowledge the three variables also failed to predict a significant proportion of variance in students' beliefs. $F(3, 45) = .738$, non-significant, $R^2 = .047$. Again, none of the three predictors were significantly related to source of knowledge beliefs.

The low number of cases of statistical significance for correlations and beta values in this study may be a result of the size of the sample group. In addition to this uncertainty surrounding the methodology, use of sample group and research design

mean that results from empirical studies must always be viewed with some scepticism (Lund, 2002).

5. Chapter 5: Discussion

The purpose of this study was to investigate relations between possible predictors and dimensions of personal epistemology: More specifically, to investigate hypotheses regarding relations between gender and certainty of knowledge; and between topic knowledge, topic interest and beliefs about justification for knowing. Empirical investigation based on a sample of 49 second year law students at the University of Oslo did not support the first hypothesis. Evidence was found to support the second hypothesis. In this chapter I will firstly discuss possible reasons for the lack of empirical evidence of a link between gender and certainty of knowledge, in light of previous research and the nature of the sample group. I will then discuss the justification for knowing dimension of epistemology in relation to the findings. Finally, I will discuss the concept of epistemology and its importance in an educational setting on the basis of considerations made during the course of this essay.

5.1 Gender and certainty of knowledge

Researchers have previously reported findings that suggest gender-related patterns in epistemological beliefs (Baxter Magolda, 1992) and relations between gender and development of epistemological beliefs (Mason et al, 2006; Hofer, 2000). These findings, in conjunction with reports from related areas of educational-psychology, such as consistent findings of gender differences in self-perceptions of ability in motivational studies (Eccles & Wigfield, in Pintrich & Schunk, 2002) led to the development of my hypothesis that it would be possible to observe a relation between gender and personal epistemology. It was my belief that this relation would be observable in the certainty of knowledge dimension, due to the more careful, less

bombastic way that females might regard knowledge. This section shall focus on possible reasons for the lack of empirical evidence to support the hypothesis.

There is a possibility that the group's views on certainty of knowledge are affected by the nature of the study of law and that this has led to the depletion of any initial differences that may have existed between males and females in the group. Although laws and conventions are certain in that they are written and binding, laws are also constantly evolving in the form of new interpretations and rulings. This means that these students may have become more aware of the tentative and changing nature of knowledge in their area of study. Furthermore, it is possible that this sophisticated view on the certainty of knowledge dimension regarding the subject of law may affect students' views on knowledge in general (Buehl & Alexander, 2001). In the event that this suggestion contains any truth then males who study law may have more sophisticated beliefs about the certainty of knowledge than their male peers that are enrolled in other studies, which would make it difficult to observe any gender based differences.

Another possible reason for the lack of empirical evidence to support the hypothesis on gender and certainty of knowledge is also related to the typicality of the males and females included in the study. Participation in the experiment was voluntary and a minority of law students at this level chose to complete the questionnaire. The fact that the majority of students opted not to take part can be attributed to the highly competitive nature of the study and that these students work under pressure and must therefore exercise discretion when choosing how they dispose of their time. Those who chose not to participate may have felt that completing a questionnaire for an educational research project was of little academic benefit for them, and therefore time wasted. The vast majority of males decided not to partake in the experiment, which is also something that could be expected, based on gender stereotypes.

Females are generally considered to be most conscientious (Baxter Magolda, 2004; Belenky et al, 1986). It may, therefore, be the case that the 10 males that participated

were similarly conscientious or as interested in climate change as the females that participated. If this is true then it may also be the case that these males shared other views (e.g. on knowledge) with females and did not exhibit “typical” views on knowledge held by other males.

One final related possibility is that females that study a subject such as law, that has traditionally been dominated by men, have a somewhat different view of knowledge than other females. These epistemological views may be reflected in other areas of cognition and in self-perception. Differences in self-perception between males and females are reportedly “moderated by...how much the individual student endorses the cultural stereotype” (Eccles & Wigfield in Pintrich & Schunk, 2002:82). There is a possibility that females that study law are not inclined to *endorse cultural stereotypes*, hence their decision to embark on a traditionally male area of study. If it is possible to show a link between individuals’ views of themselves (self-perception) and their views on knowledge and knowing, then this may support the suggestion that female law students do not hold gender-typical views on knowledge. In this case a positive and certain self-perception may induce one to view knowledge as something that is also certain and comes from a source of authority. A number of theorists have linked epistemological beliefs to other areas of cognition including self-efficacy and motivation (Muis, 2007; Hofer, 2000). Such links would seem to increase the likelihood that an individual’s perceptions of herself and her abilities affect her considerations of what knowledge is and what one must do in order to attain knowledge. It is also possible that their epistemic views may have been altered by nature of the study, since previous research has revealed that epistemological views are not stable over time (Baxter Magolda, 1992; Perry, 1970). These suggestions would, however, be contrary to the findings that the law students, as a group had fairly sophisticated beliefs about certainty of knowledge and that the study of law is likely to help students develop more sophisticated certainty of knowledge beliefs, and is therefore unlikely.

In light of Bråten et al's (2007) findings on the specificity of epistemological views, a likely explanation for the results for the study is that candidates' views on knowledge are representative only in relation to knowledge about climate change (Bråten et al, 2007; Hofer, 2002). If this topic is one that evokes beliefs that knowledge is more uncertain than other areas, and thus more sophisticated beliefs; then results from this study do not preclude a link between gender and certainty of knowledge regarding other topics. Since this is a somewhat new topic that has been brought to the public's attention over the last years and there are a number of conflicting views regarding what is certain, then this may be the case. It is a topic that is *evolving*, in that new information is constantly being discovered. Although this is true of many/ most topics (depending on one's personal epistemological views), this evolution is more apparent due to the constant media attention the topic receives and may therefore have a stronger impact on individuals' beliefs.

Previous research that supports differences in males and females views about knowledge and knowing has been based on alternative concepts of personal epistemology that may not have been captured in this study (Mason et al, 2006; Baxter Magolda, 1992). This is supported by the facts that the researchers employ different definitions of epistemology and the studies make use of different tools to measure epistemological views. For example, Bråten et al (2007) refer to beliefs about knowledge and knowing with respect to particular topics within a domain and the researchers have a background in educational psychology. Baxter Magolda refers to epistemological *reflection* as "assumptions about the nature, limits, and certainty of knowledge" (2004) and belongs more to the developmental school of thought on epistemology. It may be that the epistemological reflections measured in the Baxter Magolda study were not captured by the topic specific epistemological questionnaire developed by Bråten et al, or in their definitions of the concept of epistemology or certainty beliefs. This raises questions in relation to the validity of the constructs used

in the various studies, and the possibility to compare the findings of the named studies, since it seems that they are investigating different aspects of epistemology, and as a result, may be studying slightly different concepts. It may then be that different patterns would have been observed in this group if, for example, Baxter Magolda's method of investigation had been employed.

Finally, size of sample group also merits discussion in this section. The disadvantage associated with use of such a small sample is that it is unlikely that correlations will be discovered, and the chances of them being significant are even less. Aron et al (2006) suggest therefore that small correlations should be taken into consideration when empirical research is based upon small sample groups. In this case correlation studies revealed a non-significant correlation between gender and certainty of knowledge at the .159 level ($p \leq .277$), which means that the correlation may have been significant in a larger group. In this case, however, presence of a positive significant correlation would have suggested that the females in the sample group were more likely to see knowledge as more certain. This does not support my hypothesis or the results of previous research that have already been discussed. It may, however, correspond with some of the arguments appertaining to the nature of this group's beliefs that are suggested above.

5.2 Justification for knowing

As predicted, correlations were found between topic interest and justification for knowing; topic knowledge and justification for knowing; and topic knowledge and topic interest. Furthermore, multiple regression analyses show that topic knowledge, topic interest and gender together explain 17% of the variance in students' scores on justification for knowing. Possible contributing factors for the link between these variables have already been explained in chapter 3. I will therefore use the majority

of this section to discuss the sample group's relatively sophisticated views on justification for knowing. The average score for justification for knowing was 7.26, which is relatively high in comparison to the average score of 6.75 in Bråten et al's study. The difference between these two scores is the largest of all the differences on each of the dimensions of personal epistemology between this group and Bråten et al's findings. Topic interest is not particularly high in either of the sample groups (5.69 vs. 4.89 out of a possible 12), yet topic knowledge varies somewhat (8.2 out of a possible 16, and 7.24 out of 17. This translates to 51.25% and 42.58% correct respectively). The finding that higher scores on topic knowledge and topic interest lead to a higher score on justification for knowing is in line with the hypothesis. This turns the focus of the question to what it is that can be contributing to these higher scores. The sophistication of this group's epistemological beliefs is also evident in measures of other dimensions of personal epistemology. This may be in line with Hofer's (2002) argumentation that personal epistemology consists of a system of related beliefs.

Firstly, regarding topic knowledge and topic interest, it is difficult to say with certainty why these students should have higher scores than the other group. The average age of the participants in Bråten et al's study was 22.9 (SD=5.6) and in my study 24.49 (SD=6). The average age difference of a little over one year between this group and Bråten et al's group may be enough to make the law students more interested in world issues and current affairs. It may also be the case that elder students are more engaged in topics that concern the future, which may have contributed to an overall higher score on topic interest for this group. It may also be the case that law students are generally a conscientious group on the matter of keeping abreast world news.

Regarding justification for knowing, it follows that a higher score on topic interest and topic knowledge relates to a more sophisticated view of justification for knowing. Age is a factor that has also been shown to affect the development of personal epistemologies (King & Kitchener, 2004; Perry, 1970). Other reasons for sophisticated views may include the nature of the subject of law, and accordingly how law students view knowledge in other areas. The study of law includes use of multiple sources of information. It is an analytical subject that requires students to discuss the merits of various sources and to justify their conclusions based on argumentation. A combination of these and other factors may mean that law students' views on their subject that include sophisticated views on justification of knowledge may spread into other areas of their thinking. Furthermore, critical thinking, which is a sign of sophisticated epistemological beliefs, and helps develop techniques associated with sophisticated beliefs about justification for knowing, is encouraged and developed through the study of law. This hypothesis may furthermore be supported by the findings of Mason et al (2006), who found that students enrolled in a scientific branch of high school showed more absolutistic views about knowledge than students following a technical-commercial discipline. Science is a subject that is often presented in more absolutistic terms at high school level, whereas there may be more room for discussion and evaluation of knowledge in technical-commercial subjects at this level. This may support my suggestion that the way knowledge is presented in students' area of study affects their epistemological beliefs in other areas.

5.3 The concept of personal epistemology reconsidered

With reference to Hofer's (2002) question as to whether "we [can] fully capture individual epistemology when we impose meaning through the questions we ask?" (2002:10); I underline the importance of the concept of objectivity when investigating personal epistemology. It may be that researchers' own concepts of

knowledge subconsciously affect their work and how they formulate questionnaires and classify different epistemological beliefs. This may create problems for construct validity, and as Hofer asks the problem of whether we are "...eliciting...a reasonable approximation of what we are trying to understand?" (Hofer, 2002:10). As suggested earlier, this may also create complications when comparing research results. This problem can, however, be minimised by co-operation in the research community, in the form of researchers from different backgrounds critically examining each others' work and questionnaires, or by making use of questionnaires that have been validated by previous studies.

The currently accepted definition of what epistemology entails and how it is measured is built on the presumption of a concept of epistemology that is both domain-general and domain-specific. But research by Bråten et al (2007) has shown the distinct possibility for the existence of a topic-specific concept of epistemology. This may not only affect what methods are needed to measure epistemology, but also the different aspects that make up this topic-specific notion of epistemology. This may have a number of ramifications for the concept of personal epistemology as it exists. It may be the case that the four aspects of epistemology (certainty, justification, simplicity and source) may be present in varying degrees depending on the topic in question. Justification for knowing, for example, may feature as a high proportion of an individual's epistemological beliefs in one area of history, for example on the topic of the Vikings, which is a historical epoch from which no one is longer in existence, and there are few original sources of information; whereas this dimension of epistemology may make up a smaller proportion of the same individual's beliefs when considering World War II as a topic, since this is an event that has occurred in the recent past upon which much was written at the time and is still available.

Dimensions of personal epistemologies vary from subject to subject and topic to topic, and from one individual to the next. It is, therefore, possible to imagine a concept of personal epistemology that is as specific as Bandura's concept of self-efficacy, which is related to one's beliefs about one's ability down to *task* level. In this case one's perception of the task at hand in relation to own ability would affect views for each task. Further investigation is also needed into the dimensionality of personal epistemology. It is possible that future researchers will discover other dimensions of personal epistemology than those that are currently accepted and it may be naïve to believe that the current construct is the ultimate one (Bendixen and Rule, 2004). Future research may also be able to answer questions regarding the proposed independent nature of the dimensions of epistemology. There is a possibility that certain dimensions are linked and may vary in accordance with each other for a certain domain or topic. It is also possible that the dimensions of epistemology become closer to one another, or more interlinked when studied at a topic-specific level rather than a general level, where thoughts and beliefs about knowledge may be more diffuse.

5.3.1 Sophisticated and naïve views

It is now widely accepted that each dimension of epistemology consists of a continuum of possible views, with sophisticated views at one end and naïve at the other and any number of intervening views in between (Hofer & Pintrich, 1997; Schommer, 1990). These two terms may, however, be somewhat misleading in some circumstances. The term "sophisticated", for example, may change meaning in relation to an individual's level of expertise and knowledge within a specific domain or topic. In relation to certain knowledge, a usual sophisticated response would be that knowledge is tentative and evolving, as opposed to fixed and certain. A researcher with a high level of expertise in the field of medicine may respond to a question on certainty of knowledge with an answer that lies fairly close to the

“certain” end on the continuum of beliefs. Based on currently employed methods for measuring personal epistemology his responses on his beliefs about the certainty of knowledge may resemble those of an “unsophisticated” thinker. It may, however, be the case that this person is in a position where he/she is able to ascertain that knowledge on this specific topic is relatively *certain*, in light of what we know today. It would, therefore, be *naïve* of him/her to hold any other epistemological view.

Intelligence is not a good predictor of epistemology. Research has shown that experts are as likely as novices to have predominantly absolutist (naïve) views on knowledge (Mason et al, 2006; Kuhn, 2002). Though, in light of the foregone argumentation, it may be that this is due to the way in which naïve and sophisticated views are measured. Some views that have traditionally been known as naïve also have merits in relation to other views that are supposedly more sophisticated. Clinchy (2002) explains that although received knowing is classified as a fairly unsophisticated level of epistemology in Belenky et al’s model (1986); individuals that are of this mindset are more receptive to knowledge and are less likely to be arrogant when considering different points of view. As a merit of this these thinkers are able to “appreciate expertise and make use of it” (Clinchy, 2002:67), and may therefore be more eager and able to learn more from external sources in comparison with, for example subjectivists or procedural knowers (to use the terminology of Belenky et al, 1986) that will be occupied with making their own images of how things are and perhaps not so receptive to external stimuli. Being receptive to new information will be particularly beneficial in complex situations where one knows little from before. This is possibly most important at a topic specific level where it will be more difficult to incorporate knowledge from other areas to find solutions, so that it will be more important to be open to knowledge from experts.

5.4 Personal epistemology and other aspects of learning

A number of recent articles have called for investigation into links between epistemology and other aspects of learning, for example, Hofer and Pintrich (1997): “More work is needed to better understand how epistemological theories may hinder or enhance academic performance in their effect on strategy choice and student motivation” (1997: 128). It is important to understand how knowledge about personal epistemology can be used in an educational setting for the benefit of the student. If, as recent research suggests, personal epistemology is a construct that can be applied at a topic-specific level (Bråten et al, 2007), then it is also conceivable that it is a task-specific construct. It is also possible, therefore, that epistemological beliefs can be linked to other constructs such as self-efficacy, self-regulated learning, learning strategies and motivation. The relation between epistemology and these other factors may also be a reciprocal one. As Hofer (2000) surmises, “[b]eliefs about the nature of knowledge may influence comprehension, cognitive processing, and conceptual change learning...Conversely education also appears to influence epistemological development, fostering one’s competency to critically evaluate information, resolve competing claims; and coordinate theory and evidence” (2000:1). Another possibility is that the effects of personal epistemology are mediated through one construct to influence another, for example, self-regulated learning to affect motivation (Muis, 2007; Hofer & Pintrich, 1997).

Kuhn (1999) explains the importance of epistemological thinking for development of critical thinking, which she claims is a main goal of education. In its simplest form critical thinking can be viewed as the evaluation of assertions (Olson & Astington in Kuhn, 1999), a skill that is necessary for participation in a democratic society (Kuhn, 1999). Kuhn underlines the influence of epistemological beliefs regarding students’ ability to think critically when faced with assertions in an educational setting. “If knowledge is [viewed by the student as something that is] entirely objective, certain, and simply accumulates, unconnected to the human minds that do this knowing – as

the absolutist conceives – or if knowledge is entirely subjective, subject only to the tastes and wishes of the knower – as the multiplist conceives – critical thinking and judgement are superfluous. People must see the point in thinking if they are to engage in it” (Kuhn, 1999:23). If a student believes that assertions are mere duplications of knowledge then they will not see the need to evaluate these knowledge claims, and may fail to develop the necessary skills in critical thinking. Kuhn explains how sophisticated epistemological beliefs correspond with the ability to critically evaluate assertions: “Evaluative epistemologists have reconciled the idea that people have a right to views with the understanding that some views can nonetheless be more right than others. They see the weighing of alternative claims in a process of reasoned debate as the path to informed opinion, and they understand that arguments can be evaluated and compared based on their merit” (Kuhn 1991, in Kuhn 1999:22).

In response to Pintrich’s (2002) “call to advance theoretical specifications of relations between epistemic beliefs and self-regulated learning” (in Muis, 2007:174), Muis sets out to present a theoretical model that integrates personal epistemology and other elements of cognition, including self-regulated learning. Her work embodies four logically bound propositions: “(a) epistemic beliefs are one component of the cognitive and affective conditions of a task, (b) epistemic beliefs influence the standards students set when goals are produced, (c) epistemic beliefs translate into epistemological standards that serve as inputs to metacognition, and (d) self-regulated learning may play a role in the development of epistemic beliefs” (Muis, 2007:174). She presents a summary of works that support her belief that epistemological beliefs are responsible for how students “approach learning tasks, monitor comprehension, plan for solving problems and carry out those plans” (Muis, 2007:173). Furthermore, she claims that epistemological beliefs “are theorized to directly and indirectly affect achievement” (Muis, 2007:173). Muis’ work demonstrates how one’s beliefs about knowledge and knowing affect the standards one sets for one’s self and the techniques one employs to achieve these standards.

Furthermore, Muis' incorporates Kuhn's theories on *epistemological meta-knowing*, the third level of cognition, which entail "monitoring one's understanding of the complexity of problems, the certainty and limits of knowledge and the evaluation of evidence" (Kuhn in Muis, 2007:182); and Kitchener's *epistemological knowing*, which describes the monitoring of the epistemic nature of problem solving. Both of these concepts and Muis' model clearly demonstrate the interconnected nature of epistemology and self-regulated learning. Their reciprocal relation is further demonstrated in Muis' four step model of epistemic beliefs and self-regulated learning, which is an extension of earlier models of self-regulated learning. The main difference is the incorporation of epistemic beliefs in the task definition phase, and the corresponding epistemological standards that are then involved in phase two, planning and goal setting. To surmise; Phase 1 involves task definition, which includes cognitive and affective conditions, such as motivational and affective factors, and other cognitive factors and epistemic beliefs; Phase 2: Planning and goal setting, depends on the individual's standards, such as time on task, epistemological standards, comprehension standards, and goal standards. Phase 3: Enactment, involves enabling tactics and strategies to create products. And finally, phase 4: Evaluation, where metacognition is taken in use to monitor, control and evaluate outcome in relation to standards and to attribute for success or failure. Muis explains the way in which one's beliefs about what knowledge is and what it is to know affects the level of motivation, effort and cognitive resources required for each task. Furthermore, she informs that constructivist views about knowledge are related in high levels of motivation, including mastery goals and self-efficacy. These findings underline the importance of a conscious effort in educational establishments to enhance the development of sophisticated epistemological beliefs.

In another study Muis (in press, referred to here in Muis 2007) found that students' epistemic profiles correlated with their approaches to problem solving. She concludes

“epistemic profiles are activated during the task definition phase of self-regulated learning, which influence subsequent phases such as selection of the types of strategies students use to solve problems” (2007:179). In practice this can mean that a student who believes that a subject, for example mathematics, is rational will be more likely to use rational information to solve the problems (Muis, 2007). This suggests that the marrying of epistemological views with a subject with a similar epistemological make-up is optimal for self-regulated learning: “if students’ epistemic beliefs about mathematics are consistent with the epistemic nature of mathematics knowledge, then the students’ epistemic beliefs should facilitate their self-regulated learning” (2007:180). On the other hand, any “inconsistencies between students’ epistemic beliefs and the epistemic nature of a domain may lead to a constraint on self-regulated learning” (2007:180). For example “[i]f students believe that there is only one path to solution, then they may be more likely to give up more quickly or engage less effort if their first attempt is not successful” (2007:180). Muis (2007) asserts that this relation holds for all domains of knowledge and for each domain of epistemological beliefs.

On the basis of the foregone discussion as to the extent to which the concept of personal epistemology may be a topic-specific one, it is possible that Muis’ model could also be applied at a topic-specific level. By incorporating beliefs about knowledge at topic-specific level, it may be possible to shed more light on motivational differences for different topics within the same subject area. Students’ ability to link epistemological beliefs to the nature of a subject, or a specific task, may also help explain motivational and strategic differences at a task-level.

5.5 Personal epistemology in an educational setting

Based on the above findings, the logical question is how can we support development of epistemological beliefs in an educational setting? Kuhn and Weinstock (2002) suggest practice via exposure to situations that promote the development of sophisticated views. In light of results from this study that suggests that a group of law students have relatively sophisticated epistemological beliefs, one suggestion may be to use the study of law as a model for developing epistemological beliefs. This need not include a study of the subject itself, but of the principles of beliefs about knowledge that are important in the subject, for example, focusing on the evolving nature of complex knowledge and using a variety of sources to justify claims. Muis (2007) also refers to studies by Higgins and Verschaffel et al that show that explicit training in cognitive and metacognitive strategies can aid students in developing more constructivist epistemological views. These findings support Muis' hypothesis that "training students to engage in more metacognitive activity and to use deeper approaches to learning fosters epistemological development" (Muis, 2007:184). If these techniques are taken in use then it is important that students understand the value of the techniques they are learning. Since, as Kuhn comments, "practice does not make perfect in the absence of understanding" (1999:24).

On the matter of teaching students about more advanced epistemological beliefs and critical thinking, Kuhn proposes a combination of bottom-up and top-down approaches. By "work[ing] from both ends at once", Kuhn claims these skills will be "anchor[ed] in regular practice of what is being preached" and "exercised, strengthened, and consolidated", at the same time "fostering...understanding and intellectual values that play a major role in whether these skills will be used" (1999:24). Kuhn also refers to Brown's argument for the importance of children attaining "flexible learning and inquiry strategies of wide applicability" (1999:17). It would then seem important that students are able to understand and consider the epistemological constitution of a subject so that they are able to apply optimal

strategies in order to be able to critically evaluate what they are learning. She suggests “the successful wedding of thinking-skill development to subject matter instruction...depends on the explicit definitions of thinking skills argued for here, making them readily identifiable within varied subject matter” (Kuhn, 1999:24).

In accordance with Pintrich and Schommer, Muis states that “students need to be responsible for guiding and controlling their own learning activities, and to sustain those activities is dependent on their ability to engage in metacognitive processes. Accordingly, cognitive and metacognitive strategy training is key, not only for developing good self-regulated learning skills but also, it appears, to develop students’ epistemic beliefs” (Muis, 2007:185). Muis suggests teaching students methods of elaboration and integration and how to incorporate prior knowledge in a specific context that they can test out in a controlled environment, before testing it in groups, and eventually alone. This is in accordance with Vygotsky’s theory on learning and the zone of proximal development; and Brown’s community of learners, where “reflective activities become internalized as self-reflective practices” (Kuhn, 1999:181). Moreover, it is important that students are met with a certain degree of challenge in order to activate self-regulation skills and development of epistemological beliefs (Muis, 2007). It is equally important then, that students are not being taught strategies that may hinder their epistemological development, such as memorisation and rote learning.

6. Chapter 6: Summary and conclusions

Personal epistemology refers to beliefs about the “nature of knowledge and justification of human knowledge” (Hofer & Pintrich, 1997). The earliest research from a psychological perspective was rooted in cognitive development psychology. Perry’s investigations into the way in which college students interpreted their educational experiences resulted in identification of developmental positions that reflect individuals’ views on knowledge. The positions can be sub-divided into categories of dualism, multiplism, relativism and commitment to knowledge. This description of the general pattern of development in epistemological beliefs has been reflected in later research in the cognitive development tradition (King & Kitchener, 2004; Belenky et al, 1992). Epistemological views progress from a view of knowledge as being either right or wrong, where individuals rely on observation as a source of truth and knowledge is something that is handed down from authority; to a multiplistic stance, where all views are of equal importance. Such beliefs are the result of experience with conflicting views and the realisation that even experts disagree with one another. A common response to this realisation is that if experts cannot reach agreement on what is true then no opinion is correct, and all opinions must be of equal value. Many individuals remain at this level of thinking. Those who progress to the next developmental stage are concerned with comparing different sources of knowledge. They discover that whilst everyone has a right to their own opinions, not every opinion is equally right (Kuhn, 1999) and that knowledge is complex and consists of interwoven theories rather than separate, certain facts. The final and most advanced stage of epistemological beliefs is reached when individuals take responsibility for their beliefs about knowledge.

Educational psychologists have been concerned with the structure of epistemology

and how it can be related to other aspects of learning (Hofer & Pintrich, 1997; Schommer, 1990). There has also been investigation into the factors that predict views on knowledge (Muis et al 2007; Mason et al, 2006; Belenky et al, 1992) and the degree to which epistemology is a concept that can be connected to specific areas of knowledge rather than consisting of general views about abstract knowledge. On the basis of works by Schommer (1990) and Hofer and Pintrich (1997) that identify dimensions of personal epistemology relating to certainty of knowledge, source of knowledge, simplicity of knowledge and justification for knowing; as well as the works of Buehl and Alexander (2001) and Bråten et al (2007) showing how beliefs about knowledge are related to domains of knowledge or to specific topics; I chose to investigate some variables that I believed could affect a group of students' epistemological beliefs on the topic of climate change.

Using data from a group of law students collected in connection with the project *Learning in a Knowledge Society: Constructing Meaning from Multiple Information Sources*, I investigated the hypotheses that gender acts as a predictor of beliefs about certainty of knowledge on climate change; and that topic interest and topic knowledge predict what beliefs individuals hold about justification for knowing. More specifically, I predicted that females would be more likely to view knowledge in this area as more tentative and evolving; and that high levels of topic interest and topic knowledge would be related to sophisticated views on justification for knowing. The first hypothesis was not supported by empirical analyses. Results suggested, on the contrary, that females were more likely to view knowledge as certain and fixed (these results were not, however, significant, which may have been caused by use of a small sample group). I have attempted to explain the reason for this unexpected result through looking at the specific nature of the sample group. The second hypothesis was supported by positive correlations between topic knowledge, topic interest and justification for knowing; and by multiple regression analyses showing that 17% of the variance in the sample group's responses was explained by the three selected

variables. These findings may be attributed to a relation between being interested in a topic and a concern with finding out more about that topic (thus increasing their knowledge about the topic); and that those who are knowledgeable about a topic are more likely to have ambitions of creating their own ideas about knowledge in that area, they may be more engaged in checking different sources in order to gain the most accurate picture of the topic.

On the basis of findings supporting the existence of a topic-specific concept of personal epistemology (Bråten et al, 2007) and Muis' (2007) findings that it is possible to incorporate epistemological beliefs and standards into models of learning; it seems that more research is needed in these areas in order to present a model that can accommodate topic-specific beliefs (or even more specific) about knowledge and aspects of learning. For example, future work may be able to identify a task-specific construct of personal epistemology that could then be incorporated into Bandura's model of self-efficacy. Due to research showing the benefits of marrying the epistemological make-up of a subject and the student's beliefs about knowledge in the subject (Muis, 2007), it is also important that the relative merits of the different ways of viewing knowledge are considered for each subject and that students are made more aware about their beliefs about knowledge in each area. Kuhn's (1999) suggestion that instruction in epistemological beliefs and critical thinking are of mutual benefit to one another also suggests that there may be a need for more attention to the topic of personal epistemology in educational establishments.

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